Assessing the impact of work integrated learning and its practices on the education of engineering technicians and technologists in relation to the Higher Education Qualification Sub-Framework (HEQSF) document in South Africa

by

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DECLARATION

I declare that, **ASSESSING THE IMPACT OF WORK INTEGARTED LEARNING AND ITS PRACTICES ON THE EDUCATION OF ENGINEERING TECHNICIANS AND TECHNOLOGISTS IN RELATION TO HIGHER EDUCATION QUALIFICATION SUB-FRAMEWORK (HEQSF) DOCUMENT IN SOUTH AFRICA**, is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

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SIGNATURE DATE

(F R Samadi)

ABSTRACT

Work integrated learning (WIL) for the training of engineering technicians and technologists combines the theoretical learning of the fundamentals with their practical application in a real-world situation and environment. The activities in WIL are intended to provide students with specific learning outcomes in each engineering field of study, as well as with the general skills that are necessary for engineers in any field. The WIL learning outcomes are very specific and provide the student with the opportunity to practise and apply the fundamentals in an actual workplace.

WIL includes various modalities such as problem-based learning, project-based learning and workplace learning. In this thesis, work integrated learning is referred to specifically as a period of work placement for engineering students. The other modalities of learning are usually included in all engineering qualifications.

Thirty percent of the curriculum for the National Diploma engineering qualification in South Africa consists of work integrated learning, which translates into approximately 120 credits. WIL provides a valuable context for learning. However, there has been debate about the offering, placement, quality and supervision of it. This thesis investigates the various factors that may affect the offering of this component of learning in addition to ascertaining the importance of WIL in the training of technicians and technologists. This research comprises a survey conducted among engineering students as well as interviews with lecturers and supervisors directly involved in the implementation of the WIL component.

The study investigates the format of WIL and its duration, the presence or absence of supervisors, mentors, a syllabus and clear guidance within the context of the Higher Education Qualification Frameworks. Quantitative data was collected from Engineering National Diploma and B-Tech students in two universities in Gauteng and then captured and processed. Statistical analysis such as factor analysis, analysis of variance, Cronbach's Alpha coefficient, Pearson chi-squared, the Bartlet test and others were carried out, using various standard tests.

The study reveals the extent to which both students and lecturers appreciate WIL. The study also offers recommendations for the unique and on-going collaboration between industry and academic institutions for the purpose of the training of future technicians. In addition, it provides reasons for the possibility of a shorter work placement period provided certain preparations are made by the universities prior to placement. It highlights the need for clarity on the responsibilities of the role players involved and on assessment methods, and for the provision of a more specific, yet flexible, curriculum, while also recommending regular reflection on this component of learning. All of these points are discussed within the context of the Higher Education Qualification Framework in South Africa. This framework recommends that higher education institutions accept responsibility for WIL placement and for ensuring that programmes are properly structured and supervised.

Keywords: Higher Education Qualification Sub-framework, National Diploma curriculum, technician, technologist, work integrated learning, work placement.

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INTRODUCTION

1.1 Background of the Study

The demand for engineering student graduates is increasing. This is as a result of the need for more technology and engineering oriented individuals who are self-starters and do not require long-term mentorships. At the same time, the pace of the work and pressure in engineering environments are increasing and, thus, there is not much time available for long-term mentorships. Accordingly, firms and industry, among others, are looking for individuals with relevant knowledge of the engineering discipline and communication skills, who are work ready and who possess “hands on” industry expertise.

In addition, the cost of higher education is increasing and there is pressure on universities to produce graduates who are employable and could succeed in completing their education within the time required. According to Orrell (2004), employability has a major influence on university reputations, retention rates and course demand. According to him, the education market is extremely competitive and it is, thus, essential that students are equipped with knowledge as well as the necessary transferable skills. Internationally, there is a demand for higher education institutions to account for success in the employment of their graduates (Eraut, 1994).

With these two strong forces pressurising universities to produce employable students within the given period, there is definitely a need to test all aspects of engineering education and to conduct thorough research to ascertain how these goals may be achieved. In addition, the modern engineering profession exerts an additional demand on engineering graduates. This demand originates mainly from the engineering profession’s clients, government, environmental groups and the general public, which have competing (and sometimes conflicting) demands (Mills & Treagust, 2003). These groups require that engineering graduates possess skills in terms of human relations, as well as technical competence, and believe that engineers should be able to cope with technological, organisational and cultural changes within their work environment. The engineering graduates are also required to be familiar with the legal requirements in each country and also with the commercial realities that are changing continuously.

However, despite these challenges it is important to refer back to certain basic fundamental questions which arise in any kind of research. For example: What are our expectations of engineering technicians and technologists after their graduation? Do we expect them to know the basic mathematical, scientific and engineering principles, to be able to analyse the engineering problems in their field of study and apply their knowledge to solve well-defined and broad-based engineering problems? They are expected to know how to communicate their results, how to present their findings, how to collaborate with others, how to experiment and test their findings in a pilot project, how to use the recent technologies in an appropriate way and how to apply and implement these in an actual situation. Within an engineering environment, they are required to work with others and be able to manage the human and environmental circumstances. In addition, they also need to be aware of recent environmental, economic, managerial, legal and ethical issues.

The engineering programmes in many parts of the world reveal the tension between two main objectives of engineering education, namely, the need to educate students to be specialists in a certain field of study and to develop them as generalists in personal, interpersonal, product, process and system building skills (Crawley, Malmqvist, Östlund, & Brodeur, 2007). This tension may, in fact, be considered as a tension between technical abilities and their actual application within a real-world situation.

Crawley et al. (2007) indicate in their book - Rethinking engineering education: The CDIO approach that

> "… *in* the past ten years, leaders in engineering industries have identified specific knowledge, skills, and attitudes required of their workforce if they want to be

> innovative and competitive in a global marketplace. Engineering education programmes have kept pace with emerging disciplinary knowledge, research and technologies, but have been less successful in ensuring that their graduates acquire the knowledge, skills, and attitudes desired by industry. Evaluation by accreditation agencies and professional associations in the United States, Canada, the United Kingdom, Sweden, Denmark, South Africa, and other countries moved toward an outcomes-based approach. These groups have specified outcomes for graduating engineers among their evaluative criteria. Their lists of skills overlap with those generated by engineering industries. Our book describes an approach to engineering education that integrates a comprehensive set of personal and interpersonal skills, and process, product, and system building skills with disciplinary knowledge."

In another research work, Mills and Treagust (2003) indicate that in recent years the engineering profession and the bodies responsible for accrediting engineering programmes have called for change. In their paper they discussed the application of problem-based and project-based learning to engineering education and examined the difference between them. They showed that studies that have been conducted in many parts of the world have indicated the technical and personal abilities required of engineers in today's society (Henshaw, 1991). These studies have indicated certain key concerns. One of these concerns is the lack of strong communication and teamwork skills in our present-day engineers, while another concern is the lack of a broad perspective of social, environmental and economic issues. Finally, a major concern is the lack of "know-how" as regards using fundamental engineering science and computer literacy within a practical situation.

These studies have asked for reviews of engineering education in several countries and have had a major influence on the revision of national accreditation criteria for engineering programmes in some countries, including the United States of America Accreditation Board for Engineering and Technology(ABET) (2001), the United Kingdom Standard Routes to Registration (SARTOR) (2000) and Institution of Engineers Australia (1999). These studies recommended that the new accreditation approach shift the emphasis away from "what is being taught" to "what is being learned" (Koehn, 1999). It is also deemed essential that the engineering programmes demonstrate a certain set of outcomes and show the industrial relevance of these programmes. It is possible for many of the outcomes mentioned in the above studies to be learnt in the university environment and surroundings, although others require practical experience. This practical experience would best be acquired within an industrial and consulting environment, depending on the field of engineering study.

The process of curriculum development gradually evolved and exit level outcomes, learning outcomes and associated assessment criteria became the norm in terms of the qualification offered. The Engineering Council of South Africa (ECSA) has specifically encouraged universities of technology and universities to indicate exit level outcomes for each qualification they offer and they have stated generic Exit Level outcomes for different qualifications in South Africa. Some of these exit level outcomes require hands-on experience that may be acquired either by work placement or practical laboratory work. The Higher Education Framework (HEQF, 2007), in extremely broad terms, indicated the purpose and characteristics of each of the nine qualification types that were identified in the document. For example, it indicated that the diploma qualification should have, typically, provided experience as regards the application of knowledge in a workplace context.

The philosophy underlying work integrated learning (WIL) is in agreement with the notion expressed by Dewey (1938) that “all genuine education comes through experience”. WIL has the potential to provide students with the opportunity of gaining experience during the placement and applying the theory they have learnt in practice. In addition, it also provides an opportunity for students to interact with other people in the workplace, to learn from their experiences and to develop their own skills.

The Council on Higher Education (CHE) in South Africa published a document, entitled *HE Monitor (2011)*. This document is a good practice guide for WIL. It describes the various types of WIL that may be used in developing a WIL curricular. These modalities include work-directed theoretical learning, problem-based learning, project-based learning and workplace learning. The majority of engineering programmes offered by universities of technology include the different types of WIL based on the above guide. However, in terms of some of the engineering programmes, there is a need for a specific period of workplace training.

WIL represents one of the practical methods of learning. This research work will concentrate only on this aspect of engineering learning, which is a form of practical education in jobs that are related to the students' field of study. The study refers specifically to WIL as a period of work placement only, and not to the other modalities of learning which are usually included in engineering qualifications.

WIL is an activity that combines the theoretical learning of the fundamentals with the practical application of these fundamentals in a real-world situation and environment. These activities are supposed to provide students with both specific learning outcomes in each field of study and with the general skills that are required by all engineers in any field of study. These outcomes are extremely specific and provide the student with the opportunity to practise and apply the fundamentals in an actual workplace.

WIL provides a valuable context for learning. From their first work placement, students engage in a different form of learning, one that is informed by their understanding of the workplace and of their role in the workplace. They learn to appreciate the critical importance of generic skills such as teamwork and communication, skills which they may have previously perceived as being peripheral or "soft" (Jancauskas, Atchinson, Murphy, & Rose, 1999). They indicate in their paper that, during the WIL period, students use their skills and knowledge to complete work tasks and, as a result, they develop a deeper understanding of the abstract theory.

Research has shown that active learners learn by trying things out and working with others (Katsioloudis & Fantz, 2012). Accordingly, by means of constant application, WIL students develop an understanding and mastery of abstract theories and learn to work with others in the work environment with its tight timelines and commercial interests.

WIL is a powerful method of learning. It is a proven fact that students learn best when their education is complemented by experiments or hands-on training (Kumar & Hsiao, 2007). In this thesis, WIL refers to the practical component of cooperative education, which is conducted under the auspices of a suitable and approved employer. This training provides the students with an opportunity to apply their technical knowledge to relevant problem situations in industry. It is understood that the best way in which to learn and to comprehend engineering theory is to determine whether the individual concerned is able to apply the relevant theory to solving engineering problems (Fleming, 2001). By complementing and enhancing traditional coursework and laboratory work with WIL, students are better prepared to enter their profession upon graduation (Canale & Duwart 1999). This training also enables the student to be exposed to aspects of typical organisational culture, human relations and working conditions and this, in turn, further develops the student's confidence and soft skills.

In South Africa, there have been repeated calls for higher education to be more responsive, accountable, relevant and accessible (Forbes, 2003). According to Forbes (2003), discussion documents and debates on a human resource development strategy, together with the South African Qualification Authority (SAQA) Act of 1995 and the South African Skills Development Act of 1998, will create opportunities to focus on WIL as a cooperative education model for applied learning.

In WIL programmes there are three partners who participate in developing and introducing effective education and training programmes and in adapting to technological advancements within a short period of time. These partners are the learner, the employer and the university. They all cooperate equally by acknowledging certain responsibilities. The effectiveness of the training provided depends on the role and responsibilities of the academic supervisors and the mentors from industry. The guidance to the learners must be regular and constant and, thus, it is essential that both mentors and supervisors possess the necessary knowledge and the experience required to be able to offer appropriate guidance (Liodakis et al., 2006).

The role of universities involves equipping learners with the theoretical skills and technical knowledge required to solve problems in industry and commerce. On the other hand, the employer provides learners with an opportunity to apply their technical knowledge to real-world problem situations, while exposing learners to typical organisational culture, human relations and work conditions. With suitable guidance and supervision, the learner will be taught to work independently and to develop an awareness of the ethics and requirements of industry. The learners must commit themselves to share in the partnership by making full use of opportunities to develop themselves as responsible citizens of the country by contributing to the wellbeing of society.

At present the National Diploma programme in South Africa requires 360 credit hours and consists of three years of study. Two years of the programme are theoretical while one year is dedicated to WIL. Accordingly, 30% of the curriculum for the National Diploma qualification in South Africa at present consists of WIL (NATED Report 151, 2004). This component translates into approximately 120 credits. It is believed that this component can provide students with a valuable learning experience.

WIL is industry based and involves a specific curriculum and programme for each discipline. Accreditation of the WIL year by the ECSA is rigorous (ECSA policy, 2012). Each student must have a mentor in the industry. This mentor must be either a professional engineer or a professional technologist or, at the very least, a candidate who may be registered with the ECSA. The student must also have a supervisor who provides him/her with guidance, visits him/her in their workplace, and evaluates the work. This is a thorough process and has the potential to provide a useful and practical learning experience for students.

One aspect of WIL is the practise of the fundamentals in a working environment. Another aspect of the learning experience is “project and design”. In these projects, the students identify a problematic area in the industry, use their knowledge of the fundamentals to find a solution, and recommend the solution to the industry. These students are working in industrial environments and, therefore, they gain a great deal of insight into their field of study.

At present the curriculum for the National Diploma in Engineering consists of two modules of 60 credits each. The first module is offered in the first year of study or in the subsequent years. The second module usually happens in the last year of study. There is usually a fixed curriculum for this programme and it takes one year to complete. The assessment of WIL is varied, based on the curriculum and placement of students, but usually it includes a logbook and final report. In this regard, there is collaboration between the universities of technology, industry and the students. Students are either placed by the universities or they find their own placement. In order to appreciate the role of WIL in the training of engineering technicians and technologists, it is essential to acknowledge that 33% of the time spent in training technicians and 25% of the time spent in training technologists involves work placement in different work environments. This part of study is either not subsidised or it is insufficiently subsidised by government.

In 2007, the Council for Higher Education (CHE) stated that: “Work Based [or integrated] learning forms an essential part of many professional and vocational programmes” (HEQF, 2007). The Higher Education Qualification Sub-framework (HEQSF, 2013) further states that it is the responsibility of those institutions offering programmes of WIL to place students in industry and provide opportunities for them. This has increased the pressure on universities to find placements for all of their students.

There are multiple assumptions and perceptions among institutions and higher education practitioners regarding the offering of WIL. This study investigated the effect of different variables on WIL offered through two universities in South Africa, which are representative of other universities offering the National Diploma, one being a university of technology and the other a comprehensive university.

As stated above, the National Diploma programme in South Africa at present requires 360 credit hours and three years of full-time study. Two years of the programme are theoretical and one year is dedicated to Work Integrated Learning, which is industry-based (NATED Report, 2004). However, the number of applicants for Work Integrated Learning in South Africa far exceeds the number of placement opportunities in the industry.

1.2 Statement of the Problem

There are a number of challenges relating to the offering of WIL. This includes lack of a subsidy, lack of sufficient placements for all students and lack of sufficient manpower at the universities of technology to deal with the placement of students. As Harvey, Geall and Moon (1998) states the quality of the work experience is tied to its relevance, structure, and organization. Accordingly, this study intends to investigate the effects of different variables on the WIL experience of engineering technology students in South Africa.

Engineering technology students in South Africa receive a variety of packages from different universities and industries for their WIL module. Some industries have a very organized programme for WIL students; others consider it as nothing but a burden. As a result, students receive widely varying training experiences. Considering that WIL forms one-third of the total credit value for the National Diploma qualification, we wish to investigate the impact of the variety of variables on the Work Integrated Learning and find out if these variables have any effect on the training of students. These variables include the present format of WIL, placement of students, collaboration between universities, student and industry, period of WIL, guidance and supervision, syllabus of work integrated learning and attitude of the students..

1.3 Research Questions

The study will examine two aspects of WIL, namely, its importance in the training of technicians and technologists and the effect of the above-mentioned variables on its management. The study will concentrate on the responses of students who have completed their WIL, as well as the mentors and supervisors who offered the WIL component, in order to assess the effect of certain factors on the WIL offering.

The specific focus areas include the following:

Focus 1 – Investigation of those issues that would be considered relevant factors as regards the satisfactory offering of WIL, including syllabus, collaborations, time period, clear guidance and attitude of learners.

Focus 2 – Investigation of the effect of WIL period on the training of technicians

Focus 3 – Based on the results from the focus points no 1 and 2, the study will investigate the HEQSF document and compare the research outcomes with the changes recommended in the document.

The following is the main research question in this investigation:

"Does the present format, placement, collaboration, time period, guidance and syllabus of work integrated learning (WIL) and the attitude of the students directly affect the practical experience gained through WIL and, eventually, the training of engineering technicians; and what learning can be gained from the present practices for the future restructuring of these modules in light of the HEQF document?"

The research question was selected based on the variables that may be affecting the operation of WIL.

The sub-questions are as follows:

RQ1 Does appropriate placement for WIL make any difference in the training of technicians?

RQ2 Does the duration of WIL have any effect on the training of technicians and what should be the minimum required duration for effective WIL placement.

RQ3 Does a strict syllabus for WIL have any effect on the training received?

RQ4 Is the presence of a mentor or supervisor an important aspect of WIL?

RQ5 Does WIL require clear guidelines for effective training?

RQ6 Is on-going contact between the institutions of higher learning, students, and industry crucial to WIL training?

RQ7 Does the attitude of a student have any effect on his/her practical learning during the WIL period?

RQ8 Does WIL constitute an important part of the syllabus for the training of technicians and technologists?

RQ9 What are the WIL requirements contained in the new HEQSF document?

RQ10 Does the current structure of the WIL programme require an amendment in order to make it more effective in the light of the HEQF and its recent revision, the HEQSF document.

1.4 Significance of the Study

In South Africa, WIL is part of the National Diploma and BTech qualifications in engineering fields of study. At present this component forms one-third of the total credit values for the National Diploma qualification and 25% of the credit values for the BTech and it is an extremely important aspect of the professional programme accreditation.

The Higher Education Qualification Framework (HEQF, 2007) and its most recent revision (HEQSF, 2013) recommend certain changes to the structure and the period of the Work Integrated Learning as currently offered in South Africa. The documents recommend the inclusion of WIL in diploma and advanced diploma qualifications and perhaps even in the higher certificate. It also assigns responsibility for the provision of the WIL placement to the institutions of higher learning. All new programmes submitted for accreditation have to satisfy these requirements, while existing programmes will be afforded a period of time to align with the new requirements.

It is thus appropriate to conduct this specific research study at this point in order to learn from past experiences and to use this learning in the future restructuring of the WIL modules in the light of the HEQSF document. The study aims to find out whether the present format, placement, collaboration, time period, guidance, syllabus of WIL and the attitude of the students directly affect the practical experience gained through WIL component in South Africa and, as a consequence, the quality of the training of newly-qualified engineering technicians. By identifying some of these factors and challenges, the research provides basis for future studies, and informs recommendations for improvement of the WIL module for Diploma programme in engineering in South Africa.

The results of the investigation will indicate whether these challenges are perceptions or realities. The study will provide feedback from students and lecturers on the duration of WIL which is required for the completion of curriculum and its effect on the training of technicians and technologists. It will clarify the type of relationships that should exist between supervisors, industry and students. It will provide feedback from participants on the type of supervisors and mentors required, the curriculum and guidance for this component, and finally whether the students have the requisite attitudes to participate effectively in the WIL module.

1.5 Assumptions of the Study

The following assumptions are important for this study:

1. Combining quantitative and qualitative methods provides the researcher with a better understanding of the research problem than the use of one of these methods only (Creswell and Clark, 2007).
2. The respondents to both the questionnaire and the interview answered the questions with honesty and to the best of their ability.
3. The researcher possessed sufficient prior knowledge and experience in the field to enable her conduct the research.

1.6 Limitations of the Study

The study was limited to National Diploma and BTech graduates from two universities of technology in Gauteng, South Africa. The study assessed the impact of work integrated learning on the training of technicians and technologists in these two institutions. Some factors that could affect its implementation were investigated. There was a relatively good response to the questionnaire. Many other universities of technology follow similar processes and procedures. Nevertheless, caution should be exercised in generalising the findings of the study.

1.7 Definition of Some Keywords

Work integrated learning (WIL) - This is the term used to describe the educational activities that integrate theoretical learning with its application in the workplace. In this study the term refers to the formal module of study for the training of engineering technicians that comprises placement in the industry.

Technician - The term “engineering technicians” in this study refers to those individuals who have completed certain curricula, such as the National Diploma, Diploma or equivalent certificates and have some work experience. Engineering technicians assist engineers and scientists, particularly in research, development, sales, control, construction, maintenance, and process engineering.

Technologists - A technologist is a specialist who is trained to perform work in a field of technology. In some countries their roles are clearly defined in law and only individuals who have graduated in an accredited curriculum in technology and also possess a significant amount of work experience in their special field will be considered as technologists.

Higher Education Qualifications Sub-framework (HEQF) - This document proposes a single qualifications framework for a single coordinated higher education sector in South Africa. It provided a basis for integration of all higher education systems into the National Qualifications Framework (CHE, 2013)

Higher Education Qualifications Sub-framework (HEQSF) - This document proposes a single qualifications framework for a single coordinated higher education sector in South

Africa. It is the revised form of HEQF. It "improves the coherence of the higher education system and facilitates the articulation of qualificaions" (CHE, 2013)

National Qualification Framework (NQF) - This is the national education and training system in South Africa. It is an integrated system for registration, classifications and articulation of quality assured qualifications. It provides mobility and progression within the education system.

Cooperative education (co-op) - This is a structured method of combining classroom-based education with practical work experience. It provides academic credit for structured job experience.

Experiential learning - The process of making meaning from direct experience; in other words, it is learning through reflection on doing.

Work based learning - Any formal higher education learning that is based wholly or predominantly in a work setting. The HEQC (2004- p26) defines work-based learning in a broad way that is closer to work-related learning.

> *Work-based learning*: A component of a learning programme that focuses on the application of theory in an authentic, work-based context. It addresses specific competences identified for the acquisition of a qualification, which relate to the development of skills that will make the learner employable and will assist in developing his/her personal skills.

CHAPTER 2

REVIEW OF RELATED LITERATURE

2.1 Introduction

In many parts of the world, undergraduate employability is becoming an important aspect of degree programmes within and beyond the engineering discipline, and work-integrated learning (WIL) is being considered to improve graduate employability. According to Jackson (2013), such programmes build student confidence, add to their appreciation of the importance of employability skills and provide an introduction to the workplace.

Work integrated learning refers to activities that combine theory with practice. These activities could take place in the workplace or take the form of on-campus training. WIL may include work placement, project-based learning, problem-based learning, community service and internship. This type of learning usually represents a collaborative effort between industry and higher education in order to facilitate learning applying theory to real-life practice (Bates, 2011, York 2011). This type of learning is becoming important in many fields in higher education, beyond the traditional discipline areas of nursing, medicine, education and engineering (Billet 2011).

Billet (2011) argues that different types of WIL activities lead to different outcomes. In some professions such as Education, Engineering and Health Sciences, WIL is required for professional accreditation. In others, for example, business and management, it confers status or standing in the discipline (Council for Excellence in Management and Leadership, 2002).

In this section we will review the literature shaping the conceptual framework of the study, including the definition and assessment of WIL, the various forms of WIL, the importance of WIL for training of engineering technicians and technologists, WIL organisation and partnerships in South Africa, and different types of WIL.

2.2 Conceptual Framework of the Study

In South Africa, for the purpose of national quality assurance, the Higher Education Quality Committee (HEQC) has established projects on various topics. One of these projects was on WIL and resulted in a publication entitled *Work integrated learning: A guide for higher education institutions (HE Monitor, 2011)*. This publication prompts academics who are involved in teaching the WIL module to consider the purpose and role of this component in teaching and learning, as well as its theoretical foundations.

According to the HE Monitor (2011), every professional discipline in South Africa consists of three fields: (1) the academic; (2) the educational; and (3) the professional practice. The academic field provides the scientific background for the profession, while within the educational field, curricula, teaching and learning strategies are developed and assessment is implemented. Students subsequently move into the field of professional practice after graduation or in the final year of study. These three fields have different foci but all operate within the knowledge system of the discipline. The publication specifies that "programmes that do not provide students with insights into both the academic and the professional dimensions of their chosen field do not adequately prepare students for professional practice".

WIL programmes in university courses are not new. In vocationally oriented degrees that lead to professional accreditation, such as the National Diploma in Engineering, which provides accreditation for technicians, this component has been widely used. However, attempts are being made internationally to increase the usage of WIL, either by making it a degree requirement or an elective in more general programmes. Recent research in Australia, the United States (US) and the United Kingdom (UK) shows that those students who had undertaken a WIL experience or other forms of skill development during their study were more likely to find employment in their chosen field and have positive experiences of their studies (Harvey, Moon, Geall & Bower, 1997).

The inclusion of WIL as part of the Engineering curricula in university programmes in Australia and other parts of the world is becoming increasingly common in the higher education sector (Abeysekera, 2006; Smith, Mackay, Challis, & Holt, 2006). Higher education providers are under pressure to produce more ‘employable’, or ‘work ready’ graduates, with skills that are a good match for what employers are seeking in university graduates. WIL can support to create a better ‘fit’ between graduates and the kinds of work they seek after graduation (Smith & Simbag, 2009).

The Central Queensland University in Australia offers a Diploma of Professional Practice. This is a compulsory element of the co-op education programme and prepares students by equipping them with the skills, knowledge and attributes that are required for professional practice. A feature of this diploma is its integration with a period of placement in a professional environment. Courses are offered before and after work placement which provide preparation for both work placement and its review afterwards. After the placement a reflection process takes place, which provides an opportunity for the implicit learning from the work to become explicit learning which is assessable (Howard & Devenish, 2008).

The Diploma of Professional Practice is integrated in the Project Based Learning Bachelor of Engineering. This combined programme has intellectual, social and professional development aspects (JGFEPS, 2004a) and, ultimately, provides a dual award known as Bachelor of Engineering (Coop)/Diploma of Professional Practice.

The Australian engineering accrediting body, Engineers Australia Accreditation Board (2006), states: “Exposure to professional engineering practice is a key element in differentiating a professional engineering degree from an applied science degree.” All Australian professional engineering degree programmes require a minimum period of professional practice, which entails a “semester-in-industry” in the first semester of the final year. During this period the student works on a joint industry–university supervised project.

In its strategic plan, Griffith University in Australia promotes the integration of WIL in its programmes, stating that, by 2010, 70% of its programmes will offer this component as a distinctive feature (Griffith University, 2007). Flinders University has paid particular attention to the quality of its WIL provision since 1996. Five key issues have been identified in this endeavour: (1) management; (2) teaching and supervision; (3) assessment; (4) legal and ethical matters; and (5) partnerships with host organisations (Orrell, 2004).

In the light of evidence of a lack of "employment readiness", which entails a gap between educational and practical work, a professional development programme (PDP) was developed by Griffith Business School at Griffith University, Australia, to expose students in undergraduate commerce degrees to industry in order to develop professional skills and awareness (Freudenberg, Brimble, &Cameron, 2008). As reported by the industry, professional body and institution involved, the initial stages of the PDP projects have been very successful, having had a positive impact on both students and industry, and raising their impression of the university.

The University of Surrey, which is one of the oldest universities in the UK, offers professional training (WIL), and boosts its success on the offering of this programme. Most of its undergraduate programmes offer a one-year placement in industry or a professional environment, usually in year 3 of the four-year degree programmes. Willis (2008) has followed the development of the programme since 2003 and states that when it comes to employability, Surrey graduates have a very high track record of career success.

The professional training at the University of Surrey was defined as "a set of achievements, *understandings* and *personal attributes* that make individuals more likely to *gain employment* and be *successful in their chosen occupations"* (Yorke & Knight, 2003). Moreland (2006) recognised the need "to facilitate the development of degree-level learning through an associated emphasis upon the *reflective learning processes*". Barnett (2000) believed that in the 21stcentury, universities have to prepare graduates for a life of work and leisure, as well as, instilling the ability to cope with changes.

From the above literature, we can conclude that universities are working on the integration of theory and practice using different methods and approaches. These approaches include cooperative education, experiential learning, inquiry learning, simulated learning, problem-based learning, and project-based learning, among others.

2.3 Training of Engineering Technicians and Technologists

The profession of engineering has always had a bit of a "wild frontier" reputation (Lee, 2009). Hollywood, through some of its movies such as *Star Trek* and *Apollo 13*, has added to this romantic view. These days, we are reminded of this romantic view of the engineering world every day. Creative developments in different fields of engineering are amazing. All these amazing developments are done by the engineering team which plays a vital and creative role in providing society with the products and services that it needs, such as water, housing, transport, electricity, communication, manufacturing, entertainment, medical equipment and so forth and, in a creative way, provides facilities that could not have been imagined in the past. In other words, the engineering team creates products that are against nature and its present limitations.

Wikipedia (2010) defines engineering as

> … the discipline, art and profession of acquiring and applying technical, scientific and mathematical knowledge to design and implement materials, structures, machines, devices, systems, and processes that safely realise a desired objective or inventions. One who practices engineering is called an engineer, and those licensed to do so may have more formal designations such as Professional Engineer, Chartered Engineer, Incorporated Engineer, European Engineer, etc. The broad discipline of engineering encompasses a range of more specialised sub disciplines, each with a more specific emphasis on certain fields of application and particular areas of technology.

An *engineering technician* is

> … a person who has relatively practical understanding of the general theoretical principles of the specific branch of engineering in which they work. It also specifies that engineering technicians solve technical problems. Some help engineers and scientists do research and development. They build or set up equipment. They do experiments. They collect data and calculate results. They might also help to make a model of new equipment. Some technicians work in quality control. They check products, conduct tests, and collect data. In manufacturing, they help to design and develop products. They also find ways to produce things efficiently. They may also be persons who produce technical drawings or engineering drawings (Wikipedia, 2010).

An *engineering technologist*, on the other hand, is a specialist "who is trained to perform work in a field of technology. In some countries there is a clear distinction defined in law and only individuals who have graduated from an accredited curriculum in technology, and have a significant amount of work experience in their field may become registered technologists" (Wikipedia, 2010).

Depending on the country, a technician and technologist's recognition may be in the form of a certificate or a professional registration. The Sydney Accord and the Engineering Technologists Mobility Forum (ETMF) are two international efforts to improve cross-border recognition for technologists.

There are three agreements covering mutual recognition in respect of tertiary-level qualifications in engineering. These are the following:

- *The Washington Accord* signed in 1989 was the first such agreement. It recognises substantial equivalence in the accreditation of qualifications in professional engineering, usually of four years' duration. The signatories as of 2007 are Australia, Canada, the Republic of Ireland, Hong Kong, Japan, New Zealand, Singapore, South Africa, South Korea, Taiwan, the United Kingdom and the United States.

The following are the signatory accreditation bodies of the Washington Accord, their respective countries and territories, and their year of admission:

- Accreditation Board for Engineering and Technology (United States; 1989)
- Canadian Council of Professional Engineers (Canada; 1989)
- Engineering Council UK (United Kingdom; 1989)
- Institution of Engineers Australia (Australia; 1989)
- Institution of Engineers of Ireland (Republic of Ireland; 1989)
- Institution of Professional Engineers New Zealand (New Zealand; 1989)
- Hong Kong Institution of Engineers (Hong Kong; 1995)
- Engineering Council of South Africa (South Africa; 1999)
- Japan Accreditation Board for Engineering Education (Japan; 2005)
- Institution of Engineers Singapore (Singapore; 2006)
- Accreditation Board for Engineering Education of Korea (South Korea; 2007)
- Institute of Engineering Education Taiwan (Taiwan; 2007)
- Board of Engineers, Malaysia (Malaysia; 2009)

- *The Sydney Accord* commenced in 2001 and recognises substantial equivalence in the accreditation of qualifications in engineering technology, usually of three years' duration. The signatory countries/territories of the Sydney Accord are Australia, Canada, the Republic of Ireland, Hong Kong, New Zealand, South Africa, the United Kingdom, and the United States.

- *The Dublin Accord* is an agreement for substantial equivalence in the accreditation of tertiary qualifications in technician engineering, usually of two years' duration. It commenced in 2002. The signatories to this accord are the United Kingdom, Republic of Ireland, South Africa and Canada. Two other countries have attained provisional membership and are working toward signatory status. These are New Zealand and the United States.

In South Africa, the professional registration of technicians, technologists and engineers is done by the Engineering Council of South Africa (ECSA), which is a statutory body established in terms of the Engineering Profession Act46 of 2000, from which it derives its powers and responsibilities. The ECSA is a signatory to the three accords mentioned and therefore South African graduates in the engineering field have the mobility to move from one country to another, provided the country is a signatory to the accords.

In South Africa, engineering technicians are people who receive their education and training at a tertiary institution, usually a university of technology or a comprehensive university. Apart from the theory and instruction in the fundamentals of mathematics, science and engineering, the syllabus includes instruction in laboratory/measurement techniques, drawing work, workshop practice where applicable, small projects, and so forth. Many engineering technicians assist in design work, therefore creativity is desirable. Good communication skills and the ability to work well with others are also important because engineering technicians form part of an engineering team.

A major part of the engineering diploma awarded by a tertiary institution is the WIL, in terms of which students spend a period of six to 12 months in industry. During this period they are given an opportunity to apply the theoretical knowledge obtained in the classroom to solving engineering problems allocated to them. Technicians possess a high degree of skills but they also have scientific and engineering knowledge for the application of the skills.

Engineering technologists are also educated and trained in tertiary institutions such as universities of technology or comprehensive universities. They solve broadly defined engineering problems, and design new processes, equipment, structures, and so on. They also have responsibility for the work done under their supervision. Their academic training is based on a core of applied mathematics and engineering/science fundamentals which provide a firm base in a specific field of engineering. This training is supplemented by laboratory, project and design experience.

2.4 Definition of Work Integrated Learning

WIL is the practice of fundamentals in a working environment. One component of this learning experience is ‘projects and design’. In these projects, the student identifies a problematic area in the industry, uses knowledge of the fundamentals to find a solution, and recommends this solution to the industry. Therefore, by working in an industrial environment students gain a great deal of insight into their field of study.

There are different definitions for WIL in the literature. Reeders (2000) defines it as “student learning for credit designed to occur either in the workplace or within a campus setting that emulates key aspects of the workplace”, while Katula and Threnhauser (1999) define it as “the insight gained through the conscious or unconscious internalisation of our own or observed interactions which build upon our past experiences and knowledge”. However, according to Abeysekera (2006), these definitions exclude the educational institution.

In its “Good Practice Guide’ (HE Monitor, 2011), the Council on Higher Education (CHE) uses “WIL as an umbrella term to describe curricular, pedagogic and assessment practices, across a range of academic disciplines that integrate formal learning and work place concerns”. It has indicated that this integration can occur through a range of WIL activities.

Although there may be different definitions of workplace learning, it would appear that these are centred on a number of key concepts (Eraut, 2000; Raelin, 2000; Evans, Hodkinson, & Unwin, 2002). Clarke (2004) defines the key concepts in WIL “as:

- concerned with reflection on and learning from experience;
- a result of the former being significantly based on real-life problem-solving;
- acknowledges that much learning is also a function of a collective activity situated within a specific social context.”

Work-based learning, therefore, recognises learning from both socio-cultural and individual perspectives. It does not exclude more formal learning methods such as self-reflectivity, examining theories in action (Pedler, 1991; Eraut, 2000) and so forth.

Franz (2008) provides the context for describing WIL as a programme which is integrative and cooperative and has action-based methodology and pedagogy, which are concerned with improving professional practice and employability. Hunt (2006) explains that "[t]he continuing use of work-based learning by universities may be explained by its value as a learning tool. However, like any other teaching and learning tool, work-based learning is not in itself valuable. The full potential of work-based learning is only realised by the pedagogy that informs its application" and "by the operational and support infrastructure put in place at the organisational level" (Orrell, 2004; Hunt, 2006). Overall, Franz (2008) considers "practice", "pedagogy", and "partnership" as inclusive concepts which are central to employability and professional education relevance.

Hunt (2006) describes WIL as a pedagogy incorporating elements of experiential learning, problem-based learning, flexible learning, situated learning, and action learning. It also includes cooperative learning and reflective learning. Work placement also provides an opportunity to learn academic and procedural knowledge, but this happens within a context that necessitates other forms of learning that are not available in an academic environment (Orrell, 2007). Orrell also describes academic knowledge as "predictable, intentional, replicable, prolonged and student-focused", and professional practice knowledge as "unpredictable, immediate, unique, and transient".

It is becoming clear that the values underpinning WIL have changed. In the early years, WIL entailed the development of practical knowledge for a professional role but later on it developed into the facilitation of propositional knowledge (Eraut, 1994). According to Willis (2008), "[w]e have moved away from notions of learning *at* work (Seagraves et al., 1996), to those of *for* work and *through* work (Barnett, 1995) in order to *be* in the world".

A WIL programme is an attempt to establish a relationship between tacit and explicit knowledge. Wikipedia defines tacit knowledge as that knowledge which people carry in their mind and is difficult to transfer to another person by means of writing it down or verbalising it. It also explains that explicit knowledge is knowledge that has been or can be articulated, codified, and stored in certain media. It can be readily transmitted to others.

Tactic knowledge is considered valuable because it provides context for people, places, ideas, and experiences. Explicit knowledge is relatively easy to capture and store in databases and documents and is usually shared with a high degree of accuracy.

Sanchez (2004) identifies two approaches to knowledge management, a tacit knowledge approach and an explicit knowledge approach. The

> … *tacit knowledge* approach emphasizes that the knowledge that is available in and to the organization will largely consist of *the knowledge* that remains in the heads of individuals in the organization and that the dissemination of knowledge can be accomplished by the transfer of people as "knowledge carriers" from one part of an organization to another.

In terms of this approach individuals are carriers of knowledge.

In contrast to the tacit knowledge approach, the *explicit knowledge* approach holds that knowledge is something that can be explained by individuals with some help from those who can articulate the knowledge. In this approach the knowledge of individuals in an organisation can be articulated and made explicit (Sanchez, 2004). Accordingly, knowledge assets can be created by helping individuals to articulate their knowledge which can then be disseminated throughout the organisation by means of documents, drawings, standard procedure, manuals, and so on.

These two methods of knowledge management are used in many firms. The majority of these firms in Western nations tend to think that useful knowledge can be quantifiable and codified, while firms in Eastern nations, such as Japan, believe that knowledge creation takes place by tapping into the tacit knowledge, insights and intuitions of employees (Nonaka, 1991). Nonaka, Toyama and Konno (2000) hold a similar view. Subsequently, firms in the West are increasingly making use of this approach (Brown & Duguid, 2000). We can therefore conclude that tacit and explicit knowledge are complementary.

Reflection on practice in an organisation can help us to distinguish between the definitions of explicit and tactic knowledge (Rigano & Edwards, 1998). Explicit knowledge is codified and made formally available in an organisation, while tacit knowledge is deeply rooted within the social and cultural context of the organisation. Research in this area has concentrated on understanding how tacit knowledge may be converted into explicit knowledge so that the organisation can benefit from it (Nonaka, 1994; Eraut, 2000).

Raelin's (1998) conceptual model shows how tacit knowledge and explicit knowledge can be merged in a WIL programme. The model is based on the simple idea that learning can be acquired in the midst of practice. It merges theory with practice and shows how to bridge and establish relationships between explicit and tacit forms of knowing. Raelin indicates that in work-based learning, one seeks not only the explicit instructions and guidelines which are available in the workplace, but also the tacit process as the members of the organisation personally and collectively work through the problems of daily management and learn by themselves and from others. According to Raelin's model, tacit knowledge comprises experimentation and practical learning in an academic setting, and gaining experience and practice in an industry setting. Explicit knowledge comprises the learning of theory in an academic setting and reflection in an industry setting.

Raelin (1998) indicates that there are two levels of activity in which to learn through work. On an individual level, one may learn as the knowledge forms challenge personal frames of action. When learning collectively, there is a need for learning to be extended to colleagues and co-workers. Wenger (1998) maintains that knowledge could be transferred and presented to students in a classroom situation if we believe that knowledge is something that can be stored in a library or a brain. However, if we believe knowledge is acquired as a result of everyday interactions in life and work, then we have to expand our conventional method of classroom teaching and consider the workplace as a suitable place of learning.

Training, therefore, should be holistic, rather than task focused, and students are encouraged to develop new ideas by exploring their subject matter in the actual workplace. In the workplace, they are involved in a range of activities– developing teamwork, communication and interpersonal skills as well as experiencing a range of skills (Raelin, 1998). Students are regarded as value-added workers in the workplace and the above activities should be considered when developing the curricula for WIL.

2.5 Types of Work Integrated Learning: A World Perspective

WIL programmes which are more common in some engineering programmes than others, are becoming popular with students, government, employers and universities. A major benefit of a WIL programme is the increased employability of students. WIL builds employability skills in terms of engineering programme curricula (Fallows &Steven, 2000). There are different types of WIL, each of which has its own advantages and disadvantages. We will discuss the different types based on the exposition by Abeysekera (2006).

The first type of WIL is an ad hoc approach; everything is possible and depends on the contingencies of the situation. In terms of this approach students may find or are found a work placement. The programme may have a flexible content or a very fixed curriculum. The only thing that is fixed in this regard is that the student acquires knowledge and skills in a classroom and university setting and then applies them in practice in a WIL environment (Reeders, 2000).

The second type of WIL is cooperative education, which provides academic credit for structured job experience. This means that the time spent in the workplace is part of an academic programme and is generally a contractual arrangement between the faculty and outside agencies such as firms, industry, and so on. A recruitment agency might also be used for this purpose. The cooperative education office has full-time staff that help students with their needs throughout their time in the programme (Katula & Threnhauser, 1999). A cooperative programme usually begins after certain units in the core course of the programme have been completed or the programme alternates between work and study.

The third type of WIL is work-based programmes for organisations. These learning degrees are developed by the organisations themselves and are in the beginning stages of development. Work-based learning was introduced to meet the needs of industrial staff that were interested in personal development but were unable to attend a programme of study at a university. In this type of work-place programme, culture, structure, management and systems are central to the nature and scope of learning that occurs (Kirkpatrick & Garrick, 2001).

This form of education is based on the completion of a series of learning outcomes which have been agreed between the student, the university and the employer and that will benefit all involved. Trigwell and Reid (1998) argue that work-based learning is a form of flexible learning, as it has both flexibility of entry and exit into the course and flexibility in terms of the nature and scope of assessment. Barnett (1997) shows how a work-based learning degree indicates a shift in emphasis from theoretical knowledge to problem-based ‘know-how’. Universities have to become ready to accommodate this kind of programme otherwise this may create tension between organisations and universities.

The fourth type of WIL is workplace learning (WPL) (Rose, McKee, Temple, Harrison, & Kirkwood, 2001). In this type of programme, the degree is taught at the workplace. This method has evolved from traditional off-campus teaching but has been customised to the needs and expertise of the host company. This method entails fewer contact hours and, as a result, degree programmes are fast-tracked (Wojtas, 2000) compared to those delivered at university. This could be because of independent learning by students, more relevant teaching materials and what is already known by students through their experience. However, this is a very costly exercise because the degree has to be customised for each industry or company, and general administration, travelling costs and evaluation of the workplace have to be considered. The Department of Engineering at Glasgow Caledonian University has operated WPL in association with British Aerospace, Motorola Cellular (Chisholm & Burns, 1999) and the Post Office (Glasgow Caledonian University, 1999).

The fifth type of WIL is the internship programme. In this type of programme, the work is carefully monitored and students are given learning goals that must be achieved within a certain period of time. Students learn the organisational structure of the work environment and develop professionally (Katula & Threnhauser, 1999). This is a good model for the professional development of engineers. However, it is difficult to provide an intentional uniform learning agenda for all students in different firms.

The sixth type of WIL programme is service learning or community service, which is done in the university setting. According to this method, service experience is monitored and intentional learning goals are formulated in the same way as the internship model. During this process students gain critical thinking skills through participation in public service work which also has the potential to develop into research activity.

Therefore, WIL is a broad term that encompasses different types of programme or activity, such as internships, WPL, cooperative education, industry-based learning, community-based learning, experiential learning, and so on. The foundation of all of them is learning through work but the definition and type of WIL indicates the methodology used in each case. In all cases, workplace application must be intentional and organised and it has to be acceptable by the institution and/or by the accredited body.

In South Africa, the Council on Higher Education (CHE) has published a *Good Practice Guide for WIL* (HE Monitor, 2011) which identifies four modalities for WIL. These are work-directed theoretical learning (WDTL), problem-based learning (PBL), project-based learning (PJBL) and workplace learning (WPL). While all four types of modalities could be found in engineering programmes, in this study we are specifically concerned with workplace learning.

2.6 Organisation of Work Integrated Learning for Engineering Students in South Africa

In October 2007, the South African Minister of Education published *The Higher Education Qualifications Framework* in terms of section 3 of the Higher Education Act (Act No. 101 of 1997). In this framework, she emphasised that "separate and parallel qualifications structures for universities have hindered the articulation of programmes and transfer of students between programmes and higher education institutions". She also stated that

> … this new qualifications framework has been designed to meet demanding challenges facing the higher education system in the 21st century. It will guide higher education institutions in the development of programmes and qualifications that provide graduates with intellectual capabilities and skills that can both enrich society and empower themselves and enhance economic and social development.

In this document (HEQF, 2007), the context of the new framework is explained, as is the fact that it replaced the following policy documents:

- *A Qualification Structure for Universities in South Africa* – NATED Report 116 (99/02)

- *General Policy for Technikon Instructional Programmes*– I\JATED Report 150 (97/01)

- Formal Technikon Instructional Programmes in the RSA – NATED Report 151 (99/01)

- Revised Qualifications Framework for Educators in Schooling, in *Norms and Standards for Educators* (*Government Gazette* No. 20844, February, 2000). In addition, the Criteria for the Recognition and Evaluation of Qualifications for Employment in Education will be amended to ensure consistency with this policy.

The Higher Education Qualification Framework was later revised and was replaced by the *Higher Education Qualification Sub-Framework* (HEQSF, 2013). The policy provides an opportunity for the integration of all higher education qualifications into a national framework. It also facilitates the articulation of qualifications and enables students to move from one programme to another with ease and efficiency.

The revised framework (HEQSF, 2013) "recognizes three broad qualification progression routes", namely, vocational, professional and general routes and introduces two qualification types in addition to the existing nine types. Based on this framework, "WIL is characteristic of vocational and professionally-oriented qualifications, and may be incorporated into programmes at all levels of the HEQSF. In the HEQSF, WIL may take various forms including simulated learning, work-directed theoretical learning, problem-based learning, project-based learning and workplace-based learning". For workplace-based learning, responsibility for the placement of students into WIL programmes now lies on the shoulders of the institutions.

The framework has eleven qualification types mapped onto the ten levels of the NQF. The framework comprises the following qualification types:

Undergraduate

- Higher certificate
- Advanced certificate
- Diploma
- Advanced diploma
- Bachelor's degree

Postgraduate

- Postgraduate diploma
- Bachelor honours degree
- Master's degree
- Professional master's degree
- Doctoral degree

- Professional doctorate

These qualifications accommodate all the current higher education qualifications. A WIL component is recommended for qualifications which are vocational or industry oriented, such as 360-credit diplomas, advanced certificates and higher certificates. There is also a possibility of including such a component in professional bachelor degrees. If the WIL component is in the form of workplace-based learning, then it must "be appropriately structured, properly supervised and assessed" (HEQSF, 2013).

The HEQSF document indicates that vocational qualifications have a strong orientation towards specific contexts of application and are "designed around the practical knowledge that is required to perform more defined vocational roles together with some applied theory", while professional qualifications prepare students for professional practice "through an appropriate balance between pure and applied theory and practical experience".

Completion of a 240-credit diploma which is mainly based on the theoretical and educational aspects of training should require a successful completion of WIL component by a provider or recognition of prior learning for those who are working in engineering environments related to the diploma.

The purpose of the professional bachelor's degree, according to the HEQSF document, is

> … to prepare students for professional training, post-graduate studies or professional practice in a wide range of careers. Therefore it emphasises general principles and theory in conjunction with procedural knowledge in order to provide students with a thorough grounding in the knowledge, theory, principles and skills of the profession or career concerned and the ability to apply these to professional or career contexts.

For that reason, the degree programme allows for a WIL component.

WIL has, in various formats, been a feature of many professional qualifications. Some professional bodies such as the ECSA and the HPCSA have special training requirements in the form of work placement, in addition to other forms of WIL such as project-based learning and problem-based learning.

In South Africa at present, WIL forms a part of the National Diploma in engineering fields of study. The ECSA, which is empowered by the Engineering Profession Act, 2000 (Act 46 of 2000), conducts "accreditation investigations" (visits) at educational institutions and places a lot of importance on the WIL component of the National Diploma and the methods by which WIL is implemented.

In the past, students and universities were responsible for finding placements in industry for the WIL component, while universities would encourage industry members to visit their institutions and interview students for this purpose. However, in the light of the HEQSF document, this practice has to change in South Africa, as according to this document, responsibility for finding work placements for students rests solely with the provider institution.

2.7 Partnership in Work Integrated Learning

Partnership is a very important aspect of effective work integrated programmes. It involves partnerships among diverse groups such as students, employers, academic staff, higher education, professional bodies, the placement or co-op office, and so forth. Partnership is used here to describe different types of relationship. The relationships between partners are based on mutual cooperation, in terms of which the contribution of each party and the attainment of mutual benefit for all participants have to be recognised. Otherwise the partnership will cease to be effective (Harvey et al., 1997). According to Benson and Harkavy (2001), good partnerships are based on mutual respect, trust and benefit for both sides, good communication, process improvement and the sharing of resources. However long-term, sustained partnerships are based on personal relationships. These start and develop between some individuals and are sustained by the same people.

The service-learning partnership is very similar to personal friendships in terms of their form and patterns. The closer and more committed the relationship; the stronger will be the partnership (Bringle & Hatcher, 2002). Therefore, partnerships have to be built between the different role players. There is wide acknowledgment that the success of WIL at universities hinges on a close partnership with industry (Wright, 2008).

According to Mintz and Hesser (1996), ideally, a good quality partnership is supported by three legs, that is, collaboration, reciprocity and diversity. The issue of diversity is mentioned here because students come from different backgrounds and have different perspectives of cultural appropriateness, respect, and related issues, which can sometimes become a hindrance to learning. However, if diversity is used properly, it could build a long lasting relationship that is necessary for a year of service (Worrall, 2009).

According to Abeysekera (2006), there are several stakeholders that contribute to the success of the WIL programme. These are the faculty, academics, employers, professional bodies and the government. Each stakeholder wants to benefit from this collaboration. However, there are issues that need to be addressed with regard to each beneficiary. For faculty, the issues that need to be resolved include curriculum alignment, the selection of a WIL programme, the selection of students (if required) and the logistics involved in the planning.

In general, there are three main partners in developing and introducing effective education/ training programmes and in adapting to technological advancements within a short period of time. These partners are the student, his employer, and the university. These partners collaborate as equal partners by acknowledging certain responsibilities. However, the effectiveness of the training depends on the role and responsibilities of the academic supervisors and the mentors from industry. The guidance that students are given has to be regular and constant and both mentors and supervisors need to have the necessary knowledge and experience required to give appropriate guidance (Liodakis, Manitis, Vardiambasis, Makris, Antonidakis &Tatarakis, 2006).

According to Jancauskas, Atchinson, Murphy and Rose (1999), a key element of WIL is that each student should have both an academic supervisor and an industry mentor and both of these must be well trained for their job. The “necessity of supervision is accepted in practice, and although challenged from time to time, it continues to be an integral part of professional preparation and practice" (Brashears, 1995). Industry supervisors or mentors should work closely with the learners. They are "teachers of ethical values and decision-making" (Ayling, 2004) and should delegate work, so that the student learns by doing and at the same time receives feedback and guidance from the supervisor.

Guidance and supervision at work are done by a mentor, who is more than a workplace supervisor, who provides students with project or day-to-day supervision. This means accepting the student as a member of the work team, providing customised learning for each student and providing personal and professional development opportunities for the student (Murray, 1991). Murray indicates that good mentors facilitate and empower students to come to their own suggestions and conclusions and he considers challenge and support as the two key factors in a supervisor's work.

A key element of WIL is its supervision component. Without such supervision by academic and industry supervisors, WIL will be just work experience (Jancauskas et al., 1999). Studies have shown that these academic supervisors and industry mentors have very little or no preparation for their role. Although a few have been trained in core supervision skills the majority are poorly trained for the job. We, therefore, need some sort of training for supervisors.

The other partner in the WIL programme is the student. A student learns by observing and participating. Boud, Keogh and Walker (1985) were interested in what turns experience into learning. They recommend self-assessment as one of the instruments that is very important in this learning, as it makes students self-confident and enables them to judge their work rather than being dependent on the learning of their mentors. Baxter's (2001) concept of "self-authorship" and "self in the world" is actually self-reflection, which allows students to form their own opinions and make their own decisions about different matters.

As Fischer (1999) notes, "the new millennium is marked by the changing of mindsets: the teacher evolving from 'sage on the stage' to 'guide on the side'". The student is no more a dependent, passive individual, but rather a self-directed, discovery-oriented individual. These comments are also applicable to supervisors and mentors.

We could therefore conclude that the effectiveness of WIL depends to a major extent on the role of the academic and industry supervisors. Accordingly, the quality of supervision directly affects the quality of WIL programmes. The training of the supervisors who are involved in WIL is therefore of strategic importance and we cannot offer a quality WIL programme without properly trained supervisors.

Bates (2003) explains that learning is continual and each experience is influenced by its own social and cultural context. Boud (1993) defines experience as the foundation for learning and recommends a model with three stages, that is, preparation, experience and reflection.

Preparation

Each of the partners in WIL plays a role in the preparation stage. In order to define accurately the roles of the academic and industry supervisors, Sarah Pollock and Janine Rizzetti from the Research and Curriculum Unit in the Faculty of Business at Royal Melbourne Institute of Technology (RMIT) University (Jancauskas, 1999) carried out research titled ‘Job Needs Analysis’. The outcomes of the research identified five broad areas of activity for these supervisors:

- Building and maintaining relationships
- Designing the learning experience
- Mentoring the student
- Monitoring and evaluating the placement
- Assessing learning against objectives

Shaw (1992) recommends that “appropriate in-service training” be made available to all supervisors, while MacFarlane (1996) concluded that “there is a lack of tools for the professional development of coordinators to ensure that they have the skills to successfully deal with critical situations they may encounter”. The manuals that most universities provide for industry supervisors are not sufficient for their supervisory work. Moreover, academic supervisors are either academics with technical knowledge who lack other skills, or they are supervisors without technical knowledge. In this partnership the role of the student is identified as committing himself to the training, and making full use of the opportunities available, as well as developing himself as a responsible citizen of the country, and contributing to the wellbeing of society.

The academic staff members who were interviewed in the WIL Report (Patrick, Peach, Pocknee, Webb, Fletcher, & Pretto, 2008) identified adequate preparation for placement and appropriate supervision and mentoring as crucial components of effective placement strategies. The research recommends that adequate supervision has to be integrated into both the design and the implementation of curricula. In the preparation process it must be ensured that adequate resources and opportunities are available to implement WIL programmes. Preparations should also include clearly defining the expectations of all stakeholders (students, supervisors and employers/placement providers). They should share the same understanding of expectations and have the same vision of the outcomes. Harvey et al. (1998) points out that a "prior briefing or period of familiarisation is essential to ensure that all parties are clear [regarding] what is expected of them, and the objectives of the work experience, so that students are not just 'thrown in at the deep end".

Experience in Australia has shown that few supervisors in industry have been trained in core skills such as performance management and conflict resolution and that only a few have been exposed to both academic and industry environments. The research work by Jancauskas et al. (1999) recognises the skills required of WIL supervisors and recommends staff development programmes in any Australian university that uses WIL.

Work Integrated Placement

In order to gain appropriate experience, an effective WIL placement programme is required with three essential aspects: organisation, communication and documentation (Long, Larsen, Hussey & Travis, 2001). Quality placement for students is a real concern because many of the placements are 'token placements' and not 'quality placements'. As Harvey et al. (1998) state, ultimately work experience must be a 'quality' process. The quality of the work experience is tied to its relevance, structure and organisation.

A major national study in New Zealand has examined the approaches used for the integration of knowledge and its impact on students' learning (Coll, Eames, Paku, & Lay, 2008). In this study, the pedagogical approaches that were used by WIL practitioners, and the integration of academic and workplace learnings, were investigated and their effects on students' learning were studied. One of the research groups comprised students with a science and engineering background. They stated that they learnt "theory" on campus and more "practical work" on placement. Although they had received a variety of information on campus, practical laboratory work at the university was limited and did not give them the confidence required in the workplace. Consequently, it was the co-op that gave them the privilege of using scientific equipment as well as giving them the sense, in the words of one participant, of being "like a real scientist".

When students enter the workplace, it is important to make sure that the workplace is educative and enhances the learning experience. The issue of collaboration, therefore, becomes a challenging task (Reeders, 2000). The role of universities is to provide learners with the necessary theoretical skills and technical knowledge to be able to solve problems in industry and commerce. The employer, on the other hand, must provide the learner with an opportunity to apply his/her technical knowledge to real-world problem situations, and expose him/her to typical organisational cultures, human relations and work conditions. With suitable guidance and supervision, the learner will be taught to work independently and to develop an awareness of the ethics and requirements of industry.

Reflection

Another area that needs attention is reflection on the methodologies and assessment methods used and the success rate of students. In order to enable these reflections we need collaboration between researchers in engineering education and educational research (Olds, Mosakal, & Miller, 2005). In WIL, educators are interested to know how students can take what they learn on campus into the workplace and how they can take what they learn in the workplace and relate it to their learning on the campus (Coll et al., 2008). It is this integration aspect of WIL that separates WIL from workplace learning (Boud & Falchikov, 2006). This could be one of the points of reflection on the methodologies used.

It has been shown that there is an indirect integration of 'on campus' and 'workplace' learning but students are not conscious of this process. Therefore, reflection and review are required for this purpose so that lifelong learning is encouraged. Studies recommend the development of an explicit mechanism for integrating learning as part of cooperative learning (Coll et al., 2008).

2.8 Assessment of Learning

Rogers and Sandos (1996) have defined assessment and clarified three associated terms. They define *assessment* as the act of collecting data or evidence, and *assessment methods* as the procedures used to support the data collection process and *evaluation* as the interpretations that are made of the evidence collected about a given question. Researchers have also recognised the central role that assessment plays specifically in engineering education.

Concepts of learning are differentiated as either formal or informal. Both types of learning occur either at the individual or organisational level (Clarke, 2004). These different approaches suggest that assessment of learning for each target group and each category may differ. This also highlights the assumptions and practices that form the foundation for any assessment learning. Work learning can be either organised for the development of staff members in an organisation or it could be in the form of the WIL for students who are studying at tertiary institutions and require hands-on experiences. These two aspects are discussed in sections 2.7.1 and 2.7.2.

2.8.1 Assessment of Work Learning in an Organisation

The majority of studies on student approaches to learning have been conducted in social science and in medical faculties (e.g. Lonka & Lindblom-Ylänne, 1996), with few research studies in engineering education. The research done by Päivitynjälä, Salminen, Nuutinen, and Pitkänen (2005) showed that "study approaches or orientations are formed in the interaction between individuals and their environment". They present a model of student learning which has three components; namely, background variables, learning processes, and learning outcomes. They indicate that there is a relationship between learning outcomes and factors related to learning processes and that the learning environment can indirectly influence learning. Another research study shows that students' *perceptions and conceptions* of their learning environment have more influence on learning than the environment itself (Vermunt &Verloop, 1999). Students' conceptions of themselves as learners are also important (Pintrich 1999).

In real-life situations informal and formal learning interact in important ways and can be used to assess different features of the tasks in the workplace. Although it might be difficult to link informal learning directly to outcomes, some links can be identified and assessed. Informal learning is not new. Apprentices learnt their craft at the feet of masters but they were fewer in number. Today at work people are more knowledgeable and technology has made knowledge more accessible than before. Moreover, interest in informal learning is increasing. Some people believe that informal learning is hard to standardise, systemise, and assess because its hallmark is its naturalness. In a research review, Dale and Bell (1999) identified many benefits and drawbacks of informal learning at work. They mention the benefits as flexibility, employability, adaptability of learning to context, rapid transfer to practice, and resolution of work-related problems through the regular review of work practices and performance. They identified the drawbacks as its narrow, contextual focus; and learning bad habits or wrong lessons in some situations.

The assessment of either formal or informal types of learning is influenced by differing elements of the training and development system. In organisations in the past, most of the activities were in the form of off-the-job methods such as seminars, training courses, and so on. However, today one of the most significant developments shows the increasing focus on work-based learning, or informal learning as it is referred to in some areas (Boud & Garrick, 1999; Tjepkema, Stewart, Sambrook, Mulder, TerHoerst, & Scheerens., 2002). This is in response to the limitations of formal learning. Some critics have specified that off-the-job learning can be removed from the actual realities of the workplace and often lacks relevance to the learner's need (Bryans & Smith, 2000; Raelin, 2000). On-the-job learning, which is usually informal and forms part of workplace learning or development, includes methods such as mentoring, coaching, job rotation and special projects (Marsick, & Watkins, 1997; Gray, 2001), and even routine work which is trial and error learning. Active participation in our everyday life and work is also viewed as knowledge and is considered as the most important learning within an organisation (Coffield, 2000). Such learnings are becoming more prevalent (Raper, Ashton, Felstead, & Storey 1997).

Assessing learning in the workplace is critical because it adds to our understanding of how people learn in differing contexts (Elkjaer, 2000). The learning outcomes of both formal and informal learning must be assessed, although the mechanisms for doing so might differ. Workplace learning requires a flexible approach to assessment. The literature indicates that, in practice, the evaluation and assessment of learning are very difficult (Woodall, 2000).

Another critical question is the quality of learning at the workplace. Kirkpatrick and Garrick (2001) argue that "the 'hard-nosed' corporate financial arrangements may expect their trainees to be assessed favourably. If the firm becomes the curriculum for students' learning, then the activities, etc. that take place in the workplace becomes the standard by which students' performance can be judged". In that case, then, the power relationship might shift from academics to the employers. This could be justified on the basis of the relevance of the learning to the outcome of the degree.

Research by Grove and Ostroff (1990) in the United States identified five key barriers that could explain why the assessment of training is not very effective in organisations. These key barriers include:

1. Senior management often does not insist on or request information on the impact of the training that was provided.
2. Lack of expertise among HRD professionals regarding how to carry out training evaluations.
3. Lack of clear training objectives attached to training programmes so that actually knowing what to evaluate against is difficult if not impossible.
4. The limited budgets available to training departments means that resources are preferred to be devoted to training provision rather than training evaluation.
5. The risks associated with evaluation may be too great given that the evaluation data might reveal that the training had little impact.

A survey research by the Industrial Society showed that a lack of knowledge of evaluation techniques and time constraints in organisations are the major reasons for poor evaluation practices (The Industrial Society, 1994). Further research indicates that many of the evaluations are for the main purpose of improving the instruction rather than the evaluation of its effect on individual performance (Brandenburg, 1982).

Research done on the manager's job task (McCauley, Eastman, & Ohlott, 1995) revealed that four key characteristics related to this task are associated with providing opportunities for on-the-job learning. These characteristics include:

1. Transitions (e.g. a new function, unusual responsibilities or proving oneself)
2. Task-related characteristics (e.g. creating change, high level of responsibility or non-authority relationships)
3. Obstacles (e.g. difficult organisational environment, lack of management support, lack of personal support or a difficult boss)
4. Support (e.g. a supportive boss).

McCauley (1994) showed that the selection decisions for managerial jobs have to incorporate developmental considerations. He developed a 15-item Developmental Challenge Profile questionnaire based on the four managerial characteristics listed above. The 15 items were clustered into five broad categories: Transitions, Creating Change, High Levels of Responsibility, Non-authority Relationships, and Obstacles. These challenging situations provide the manager with opportunity and motivation to learn. He called these challenging situations *developmental components.*

Ohlott, Ruderman and McCauley (1994) indicated that one of the reasons for not promoting women to senior positions is the rare opportunities given to them for further development and training during their career. Researchers and management practitioners alike have documented how difficult it is for women to break corporate ‘glass ceilings’. A glass ceiling is an apparent barrier to advancement to the highest level of an organisation (Morrison, White, & Van Velsor, 1987)

Friedman's (1986) survey of succession planning practices noted that some organisations are looking at developmental experiences for a position. “The succession event then becomes more than just filling a slot with someone who can do the job, but an opportunity for someone to learn from his or her experience in it”. Ruderman and Ohlott (1994) found that 31% of the executive promotion decisions that they studied were developmental promotions; that is, the potential of the individual and his preparedness for development was considered, and not his abilities at the present time.

This indicates that many social and organisational problems can be addressed by means of training and developmental opportunities. Nonetheless, measuring learning capacities for workplace learning is in itself not sufficient because some of these points of learning are not necessarily effective or valuable. Research has shown that inaccuracies can occur in learning from experience as a result of human biases and distortions (Feldman, 1986).

We need to find out ways of improving informal learning and explore ways in which organisations could benefit from this informal learning. Marsick, Watkins, Callahan, and

Volpe (2008) believe that individuals seem to be more self-motivated and self-directed in setting and reaching goals, and finding opportunities for learning. However, the context of organisations – culture, structure, processes and practices – plays a key role in enabling or inhibiting the motivation for learning (Marsick et al., 2008).

The assessment of the learning programmes in any organisation is recognised as a key component of the human resource development practitioner's role (Wexley & Latham, 2002). WIL for employed staff and learners who are placed in an organisation has to be assessed because this could further the performance of the organisation. However, based on some of the research done, it would seem that such an evaluation is given very little priority within an organisation (Phillips, 1997).

In multinational organisations it is becoming important to allow students and graduates to move from one country to another through collaboration programmes and the international accreditation of programmes. Universities such as McMaster are providing opportunities for students to obtain global experience by doing their WIL programme in other countries.

According to Clarke (2004), there are two deficiencies in the research studies that have been done. Firstly, there is little information about the factors that drive the assessment of learning in organisations and, secondly, we are unaware of the effect the conceptualising of learning as either formal or informal has on effective assessment, although there is increasing reliance on different forms of workplace learning.

These studies demonstrate the need for a close alignment between curriculum outcomes and assessment, a hallmark of constructive alignment theories of teaching and learning. According to Shuell (1986), "[i]f students are to learn the desired outcomes in a reasonable effective manner, then the teacher's fundamental task is to get students to engage in learning activities that are likely to result in achieving those outcomes".

2.8.2 Assessment of Work Integrated Learning

Coll (2009), in one of the work integrated forums, mentions that assessment of WIL is highly problematic. He indicates that some academics think that their own assessment methods are rigorous so they frustrate any attempt to provide rigour in the assessment of workplace learning. According to him, the assessment of WIL has to be subjective because we are making a judgement about what people have done through their presentation or written reports. Therefore we have to come up with a method of assessment that is reliable and not administrative or bureaucratic in nature.

Industries are becoming more creative and innovative in their work approaches. They have become more flexible and are not following solely traditional methods (Dewey, 1916). The economic revolution has created knowledge-based economics and industries are turning to academics for solutions to their problems in industry. Work has offered greater intellectual content and demands that universities disseminate such information to students and provide industrial cultural possibilities for students through vocational programmes such as WIL (Dewey, 1916).

WIL should include assessed activities, which are available to all students in the programme. "These educational activities should provide *a meaningful experience of the workplace application* that is *intentional*, *organised and recognised* by the institution", in order to secure transferable and applied learning outcomes for the student (Griffith University, 2006).

In work placements, learning therefore needs to become deliberate and intentional. This must be supported by the induction of students, supervisors and mentors and the development of appropriate assessment methods for these programmes. The quality of the learning outcomes has to be monitored in order to ensure the maintenance of high standards. This must be followed up by reflection and debriefing on the work by all parties (Washbourn, 1996).

In WIL programmes different types of assessment practices are used, and there is an awareness of the need for innovative assessment (Bryan & Clegg, 2006). However, we have to make sure that the assessment methods used in these programmes encourage reflection and the integration of theory and practice (Jorgensen, & Howard, 2005).The effective implementation of WIL requires appropriate assessment methods, which in turn requires resourcing and employer commitment and involvement. The choice of methods is greatly affected by the availability of the university staff and the engagement of the employer.

Despite the fact that assessing the WIL experience is a challenging issue, one way of assessing it is to consider it as a course unit with credit points based on certain criteria (Abeysekera, 2006). Assessment of these criteria might require the students to submit assignments about their learning, attend workshops, present a paper, maintain a portfolio or journal to support their reflections, and might also include student peer group reviews, and reports from workplace supervisors (Bates, 2003; Johnson, 2000). There has to be more than one assessment method in order to accommodate different learning (Billett, 2001).Another factor that affects the assessment of a WIL programme is the amount of time and effort that the workplace allocates to student employees during WIL (Abeysekera, 2006)

In order to assess the workplace learning, there must be a curriculum for it. Moore (2004) examines educators' definition of curriculum, explores the features of curriculum as a naturally occurring workplace phenomenon, and identifies the factors that shape the curriculum of work experience and the extent to which participants are expected to use the various forms of knowledge. He discusses the dynamics that influence what kinds of learning people engage in during productive organised activities and base all these on some of the theories of cognition and learning. According to Edström, Törnevik, Engström, and Wiklund (2003), it is the assessment that shapes the curriculum and not curriculum that shapes assessment.

According to Moore (2004), a curriculum at work must be dynamic, emergent and experiential, but it is not haphazard or random. He refutes the idea that some experiential educators claim that anyone can learn anything anywhere. Vygotsky (1978) emphasises that the curriculum of experience is “planful and systematic” and the use of knowledge in a particular setting is orderly and accountable. Better quality environments provide better and more structured opportunities.

Broadly speaking, industry representatives are satisfied with the technical or discipline-specific skills of graduates, but for some there is a perception that employability skills are underdeveloped. Some employers believe that universities are providing students with a strong knowledge base but without the ability to apply that knowledge intelligently in the work setting. This is backed up by international research (Cleary, Flynn, Thomasson, Alexnder, & McDonald, 2007).

In conclusion, it can be stated that a trained teaching force for WIL is required. Industrial supervisors should be given the opportunity to keep in touch with new developments and have the chance to improve their career paths via various remote learning systems. Many of the studies presented here make a strong case for drawing on multiple theoretical methods in integrating the individual, social and organisational dimensions of workplace learning. At the core of all these is learning from and through experience (Okamoto,Cristea, & Kayama, 2005).

Research has been conducted on various assessment areas for engineering. We will concentrate on a few of them here.

Outcome-based Criteria and their Assessment

In the past the engineering criteria in many countries were based on inputs such as number of credit hours and staff with PhDs, rather than ‘outcomes’ (what students know and are able to do). The new outcome-based engineering criteria check the achievement of the outcomes through the assessment and evaluation that are in place (Olds et al., 2005).Particularly challenging for engineering institutions seeking accreditation has been Criterion 3 of the Accreditation Board for Engineering and Technology **(**ABET, 2001), which indicates “engineering programmes must demonstrate that their graduates have:

- an ability to apply knowledge of mathematics, science, and engineering;
- an ability to design and conduct experiments, as well as to analyze and Interpret data;
- an ability to design a system, component, or process to meet desired needs;
- an ability to function on multidisciplinary teams;
- an ability to identify, formulate, and solve engineering problems;
- an understanding of professional and ethical responsibility;
- an ability to communicate effectively;
- the broad education necessary to understand the impact of engineering solutions in a global and societal context;
- a recognition of the need for, and ability to engage in, lifelong learning;
- a knowledge of contemporary issues;
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice."

Use of Technology as an Assessment Method

Some research studies on assessment methods in engineering education have shown the positive effects of technology use on student learning, including the greater knowledge gains that have resulted from the multimedia version of the tutorial (Ellis, 2004), the comparison of the effectiveness of using Web-based delivery in a unit on ultrasound imaging to that of a traditional lecture (Nguyen &Paschal, 2002) and the comparison of the impact of computer tutorials on student learning with that of lecture style instruction (Merino &Abel, 2003). Ellis (2004) compared the effectiveness of a text-based tutorial to an online multimedia tutorial.

Technology could be used as a method of learning in WIL as well as for its assessment. For example, simulations could easily be used for learning and experimentation. Recent progress in information technology and the internet has opened new ways of assessment for many fields including engineering. These developments have helped bring about an important shift from a teaching paradigm to a learning paradigm (Okamoto et al., 2001) because of the movement of the educational field toward the World Wide Web, which provides free and accessible education at anyplace, anywhere, at any time. Synnes, Parnes, Widen, and Schefstroem (1999) indicate that “[i]f the Internet is the next industrial revolution, then net based learning may be the next educational revolution”. In the United States “Colleges and Universities have embraced distance learning, doubling the number of courses offered and enrolment in them” (Blair, 2000). Other countries are also following the distance education and wired teaching learning path (Meissner, 1999). In South Africa, the University of South Africa (UNISA), which is a distance education university, makes use of different kinds of technology in its teaching and learning methods and has initiated online teaching. Many other institutions are embracing online teaching and learning as well.

Effective Learning in WIL Programme

It is necessary to monitor the nature and relevance of work offered to students by workplaces participating in the WIL programme and in the research activities in this field. Therefore, we need to carry outresearch on our assessment methods and learn from it in order to improve our offerings. Jiusto and DiBasio (2007) state “[a]cademics teach their research but don’t research their teaching”. Informal learning, by its very nature, is highly contextual and must use other areas of practice and discipline (Marsick et al., 2008).

Attempts should be made to determine the actual effect of work-based learning and informal learning. We also need to evaluate their effect on the performance of employees and those in training (Clarke, 2004). In order to assess learning, qualitative approaches might be more appropriate than other methods. A great deal of research on training has already been carried out on the identification of individuals, jobs and organisational conditions that could maximise learning through training on the job (Baldwin &Ford, 1988; Noe, 1999). Putting the lessons learnt into practice comes with its own complexities, however. For example learning will lead to better performance only when the knowledge obtained is accurate (Tsang, 1997). All these arguments suggest that there should be attempts to reflect on the impact of WIL, whether from strictly a learning point of view or from a performance orientation side.

Feedback on learning is also important in curriculum development. Formal feedback could be included in stakeholder pre- and post-surveys, evaluation forms and interviews; informal feedback is gathered mostly from stakeholder feedback. Willis (2008) reported that, at the University of Surrey in the United Kingdom, a reflection questionnaire is used for obtaining feedback from students who are returning from a WIL placement. This questionnaire has shifted from a quantitative indicator of quality assurance to qualitative feedback for reflective learning. The questionnaire is used as an additional tool for critical reflection on the preparedness of students for the dynamic world of the 21st century. A more formal analysis of data is then carried out and the findings are circulated widely. Subsequently, faculties are requested to put in place actions in response to the findings.

Self-assessment is also recommended by Boud, Keogh and Walker (1985) as one of the instruments that could turn experience into learning. They believe that in this process students can judge their own learning rather than becoming dependent on their instructors. Bates (2003) mentions that "[a]ll learning is ultimately learning about the self" and "without the opportunity to continue building self-confidence and self-esteem there is little to no learning".

Collaborative Assessment

Rainsbury and Hodges (1998) conducted research on a work-based cooperative education course forming part of a Bachelor of Business Studies (BBS) degree programme. An important aspect of this method was the joint process used for assessment, in terms of which the three collaborators, namely, the student, the employer and the employee collaborated to assess the projects done on site. The course consisted of a written report and the project and the project was subsequently assessed by all collaborators who met after the completion of the project to negotiate the final grade. The research involved, firstly, the assessment of the work-based project and, secondly, determining what should be assessed, how it should be assessed and who should carry out the assessment.

What to Assess

According to Rainsbury and Hodges (1998), the technical development of the candidates and their learning through workplace projects should be assessed. Moreover, the personal, interpersonal and intellectual competencies of the student should form part of the assessment.

Hodges, Barrow, Rainbury and Sutherland (1996) developed a model that included the three competencies mentioned. The application of knowledge to business situations and the integration of personal capabilities with professional practice is another aspect that was considered.

A media publication in Australia showed that "the employers seek eight key attributes in their student-employees in addition to the relevant technical knowledge that is required. These are communication, teamwork, problem-solving, self-management, planning and organizing, technology, learning, initiative, and enterprise" (Abeysekera, 2006).

How to Assess

According to Rainsbury and Hodges's (1998) research, each of the four categories mentioned (technical, personal, interpersonal and intellectual) have a number of capabilities that students have to develop and that should be assessed during the WIL period. A weight is assigned to each category and, during the assessment, grades are awarded.

Who should Assess?

Rainsbury and Hodges (1998) recommend that there should be three assessors in the collaborative assessment process –the student, the employer and the academic supervisor. Each of these assessors determines his or her grade for the four categories, before a meeting is held at which the final grade for the student is negotiated. The inclusion of the student in this assessment process was based on Boud's (1995), Brown and Knight's (1994) and Heron's (1989) support for student self-assessment. These researchers believed that critically reviewing one's performance is a transferable skill for their future workplace performance and professional practices. The employer representative who is the mentor in this case, has been included in this model because they work closely with the student and is in a better position to obtain evidence from various people in the organisation. Another reason for the involvement of employers is the variation in their expectations of students' performance. Accordingly, clear assessment criteria and grade descriptors are required to narrow the gap between assessments of the three collaborators.

2.9 Professional Degrees and Research in Engineering Education Field

Tertiary education is a strategic tool for healthy economic growth in any country. The doctoral degree is the ultimate crown in the higher education system. Traditionally, doctoral students used to work within their own unit and show very little flexibility with respect to social, economic and cultural considerations around them (McAlpine & Norton, 2006). Recently, this traditional training has been affected by changes around it and has had to adapt to the needs of industry (Altbach, 2004, Pearson, 2005). Today there is great pressure for applied research and joint intellectual property arrangements (Stewart & Chen, 2009). New fields of study and research are opening up for doctoral students such as biotechnology, nano-technology, and so forth. Consequently, there is pressure for more flexibility in their training and research work, considering a wider range of jobs and fields.

In today’s world we need innovative engineers, who can go beyond technical specialty in order to explore the broader implications of the technology they are developing (Akay, 2008). That means engineers with doctoral degrees must understand not only the technology aspects of the work, but also the business, education and social aspects of it. There has been rapid diversification in terms of the doctoral degrees offered, which now encompass a range of activities (Boud & Tennant, 2006). In addition to a normal PhD awarded for original research (Wright & Cochrane, 2000), there is a trend toward professional doctorates which bring together academy and workplace with an emphasis on professional practice in areas such as management studies, education, law and engineering.

Australians have recently developed the work-integrated research higher degree programme (WIRHD) in response to the needs of linking higher quality research studies with urgent needs such as the globalised economy (Abanteriba, 2008) and sustainable engineering innovation (Schäfer & Richards, 2007). WIRHD projects are a form of applied research, establishing a dialogue between academics and relevant industry supervisors as a first step in the process. In this programme, industry appoints a partner from its side to the project team who has a strong appreciation for research, preferably someone holding a doctoral qualification. Together, the team develops innovative research ideas and a doctoral student will be involved in carrying out the research. Ultimately, the team is able to publish high quality research in journals as well as to produce a successful PhD graduate. This kind of PhD programme commenced in 2001 and, according to Kolmos, Kofoed, and Du (2009), is functioning well.

Stewart and Chen (2009) studied the framework for WIRHD studies in an Australian engineering context and developed a well-structured partnering approach for facilitating enhanced communication and cooperation between the university department and the industry partners. The authors hoped that this formalisation of infrastructure would support university and industry partners to work more efficiently and effectively and develop stronger partnerships. This would effectively increase the number of opportunities for the university to develop more jointly funded research projects.

WIL practitioners have the opportunity to research and publish on topics related to WIL. At the 11thBiennial World Association for Cooperative Education (WACE) conference held in Washington in July 1999, Coll and Chapman (2000) highlighted the importance of research for WIL practitioners. It is claimed that research in this area is very scarce (Rowe, Ricks, &Varty, 1999). A number of reasons were given for the lack of research in this area (Ricks & Mark, 1997):

- Lack of time for WIL practitioners
- Some practitioners are placement coordinators and administrators rather than academics
- Lack of access to funding
- Lack of access to graduate students in this field
- Lack of support structure
- Not equating inquiries with research

- Lack of confidence and skills in research and as a result lack of publications.

A lot has changed since then. A number of conferences have been organised by WACE in order to encourage research in this area. However, there are still many areas that have not been explored.

The key enabler in this process is that both industry and academic supervisors recognise the value of cooperative research and appreciate the partner’s viewpoints. Ideally both should have academic and industrial experience. Equally important is the role of the academic supervisor who must be able to appreciate the applied research objectives of the company and be able to structure the research in such a way that can provide the necessary deliverables (Stewart & Le, 2009). One of the challenges of this type of programme is the individualised nature of the study and the great responsibility and creativity that is required of the student (Gardner, 2008). The other challenges in this process are the lack of supervision, isolation and financial stress (Haksever & Manisali, 2000; Gardner, 2008).

Research outputs from academic and scholarly practices support academics in meeting their research and career development goals. Similarly, WIL could reach its full potential if academics were to experience a shift in their thinking and recognise that practice-based research can also support them in meeting their research and developmental goals (Reeders, 2000). In Australia, there is a growing shift in the source of knowledge from academic areas by offering professional doctorates (Wright & Cochrane 2000). These programmes produce ‘scholar professionals’ who can reflect critically on their professional roles and experiences (Maxwell, 2003), rather than professional researchers. Lee, Green, and Brennan (2000) describe the programme as a ‘hybrid curriculum’ where the university, the candidate’s profession and the workplace meet in specific and local ways to address a certain kind of problem.

Much of the reflection on WIL so far has been done by academic staff as the driving force because engineers are usually trained in high consensus traditional engineering fields and could become frustrated moving into areas in which agreement is still being developed

(Borrego, 2007). Although engineers are used to implicit standards, it would nevertheless be valuable for them to enter fields such as scientific research in education (Shavelson & Towne, 2002*;* Diamond &Adam, 1993). The research in these areas would help other practitioners to judge the results and decide whether to apply them in their classroom.

Educational research work in the engineering field is gradually shifting from focusing on course and curriculum to areas such as assessment and institutionalisation. For example, a model by Streveler, Smit and Miller (2005) links teaching and assessment, as levels of inquiry that has increasing levels of rigour. Another publication researched the general education and technical education literature and indicated that in reality better teaching methods exists for the facilitation of learning instead of the traditional single-discipline lecturing approach (Felder, Sheppard, & Smith, 2005). Gradually, consensus on important topics and acceptable research methods is increasing and certain standards of rigour have been attained. As a result, journal acceptance rates are rising.

Issues in educational engineering research, such as methodology, measurement, evaluation, assessment, and so on, call for a closer collaboration between engineers and educational researchers. The results that have already been obtained in education could provide a theoretical basis that engineering educationists could adapt to guide their own assessment and evaluation practices (Olds, Mosakal, & Miller, 2005). The use of experts as partners in educational research offers the opportunity for rapid developments in this area. For example, researchers have already recognised the central role played by assessment in engineering education (Olds et al., 2005). According to Felder, Sheppard and Smith (2005)'s communication with Olds on 23 November 2003: "Research, by its nature, requires effective assessment. The infusion of accepted principles and practices of educational assessment are having a significant impact on the development of engineering curricula and the evaluation in terms of student performance". This already indicates a very important area for collaboration.

In recent years some of the deficiencies in engineering education have been highlighted. Commissions, industry and accreditation boards for engineering and technology education are emphasising the coverage of fundamentals, ‘real-world’ engineering design and operations and expect coverage of more materials in the frontier areas of engineering, better oral and written communication skills, better team work, creative thinking and problem-solving abilities with high engineering ethics. Felder, Woods and Stice (2000) discuss a wide variety of teaching methods that are effective in engineering education.

In his address in Pretoria in Feb 2010, Dr Blade Nzimande, the Minister of Higher Education in South Africa, mentioned that

> … “too little research has been done on workplace learning, and its theoretical underpinnings. The Quality Council for Trades and Occupations (QCTO) must help to reverse this shortcoming and deepen our understanding of this important dimension of learning. It must also find ways to afford recognition to the skills of those adults in the workplace who have worked for years and learnt a great deal whilst working” He also mentioned that education and training must integrate and, “In this way the QCTO becomes the gateway in ensuring workplace learning gets its proper credentials and that the lives of ordinary workers are revolutionised.”

In summary, the professional doctorate and professional master’s degrees have been introduced in South Africa by the HEQSF (2013). Future studies will assess their effect on the further training of engineers and their influence on publications and research output. Research on workplace activities and on WIL can also improve the quality of these offerings and produce opportunities for reflection.

2.10 WIL Curriculum Content

One of the aims of a university is to develop graduates who combine knowledge and skills so that they become valuable employees in the workforce (Esposto & Meagher, 2009). In turn, employers expect graduates who come with knowledge and skills that are relevant to their field of expertise and that allow them to transition into the work environment (Frawley & Litchfield, 2009). “WIL helps students to engage in workplace learning and provide direction for career choices, an understanding of workplace culture, and a relevance that drives deeper learning" (Patrick et al., 2008).

The curriculum, the learning tasks and the facilitation approaches must be *embedded* and *embodied* in the cultural context of the workplace (Choy & Delahaye, 2009), if the benefits of WIL had to be realised. The learning would then become meaningful for both individuals and organisations. WIL is a component of learning that could facilitate this process; it is a socio-cultural experience which shapes knowledge formation and the interpretation of information. It would be difficult to provide the same experiences in any other environment because the work environment provides and facilitates a unique opportunity for this kind of learning (Symes & McIntyre, 2000).

Institutions of higher learning, in the face of increasing demands for graduates' employability, need to relook at the university learning curriculum so as to bring it increasingly in line with the real work tasks. Academics are challenged to produce new teaching and learning approaches for WIL. Since both industry and learners prefer the learning challenges to be based on the real work circumstances, a shift is needed from the traditional academic environment to a shared ecosystem of industry, worksites and learners (Choy & Delahaye, 2009). For universities, the challenge is more complex; they have to move beyond traditional offerings to a more proactive and complex approach in the management of learning.

At the University of Queensland, engineering students have the opportunity to undertake an engineering internship which is composed of a six-month programme in the fourth year of study. This internship consists of one semester of vacation work and one semester of Professional Engineering Placement Scholarship (PEPS). The PEPS programme is accredited and is composed of a research project and a professional development course (Doel, 2008).

The research project entails companies allocating students to projects that are vital to the company and have complexity and depth. These projects are intended to motivate and stretch students so that they become useful to the company. Consequently, students acquire technical skills and experience that cannot be gained in the lecture hall. Moreover, the professional course introduces reflective thinking. Van Gyn (1996) finds that reflective practice is a learnt skill and maintains that it will be more effective when combined with the experiential component of a curriculum

According to Coll and Eames (2004), reflective practices are crucial features of a WIL programme. For WIL to be effective, students must think about what they have learnt and analyse it. They also need feedback on the decisions that were made so that they learn from them for future applications. One of the examples of this kind of reflection is the programme offered at the University of Queensland, which includes two preparation courses before work placement and two review courses afterwards. Howard and Devenish (2008) indicate that the courses before replacement cover résumé writing, interview skills, ethics, health and safety, and industrial relations. After placement, the course contents include the documentation of actual work experience using a competency framework, the formal presentation of work experiences and shared reflection workshops.

Dilworth (1996) proposes that action learning be included in the curriculum to ensure that students get a deeper understanding of their work through action and reflection on their learning. Johnson (2000) suggests that students should be given an opportunity to solve a workplace problem or issue, and produce a solution. With increasing pressure on the employability of graduates, the community expects its university graduates to be people who ‘can do’, as well as ‘know how’ (Stephenson & Weil 1992).

To maximise the effectiveness of the WIL, employers must ensure the quality of the learning by designing it in such a way that “would provide job-related responsibilities, encourage dialogue and communication, and to spread new explicit knowledge by rotating students strategically” (Abeysekera, 2006).

Research has been conducted across the world in an attempt to identify the non-technical competencies required of graduates (Fleming, Zinn, &Ferkins, 2008). Common attributes, according to Martin and Hughes (2009), include the ability and willingness to learn; to prioritise tasks and organise effectively; to take responsibility and make decisions; to solve problems; to communicate interpersonally; and to work as a team.

Patrick et al. (2008) propose the simulation of the work environment in order to provide some aspects of the workplace within university environment. "Online experiential learning is an essential element in the move towards more situated and professional orientations and with the drive to providing students with real work working knowledge" (McLoughlin & Luca, 2002). This might help to reduce the pressure on placement opportunities which are limited. Online simulation of experiential learning could be included in the preparation for placement, thus reducing the period of WIL as indicated in this study.

A comprehensive study, entitled 'The WIL Report: The National Scoping Study' (WIL Report, 2009), was carried out in Australia. The main purpose of the project according to this report was "to identify issues and map a broad and growing picture of WIL across Australia and to identify ways of improving the student learning experience in relation to WIL". The report made a contribution to the understanding of challenges faced by stakeholders. It evaluated the work readiness of students, and highlighted the collaboration that is required with regard to curriculum and the assessment of WIL in Australia.

In summary, the content and curriculum for WIL has been researched by academics and some technical and non-technical contents have been identified and highlighted by these researchers. With increased demand for work readiness, the researchers identified the need for a shift from traditional offerings to a more complex approach which is innovative and proactive. In addition, online simulation of experiential learning was researched and is recommended for WIL in certain fields of study.

2.11 Summary of the Reviewed Related Literature

The area of cooperative education and WIL provides students in engineering with work placement. The practice has been successful in many ways but has had its share of challenges which could provide an interesting area for action research. This kind of research could provide solutions to challenges experienced in this area of study and provide innovative alternatives to the current methods used. According to Reason (1994), in action research practitioners would be concerned with their own actions and those of others, using self-reflection to improve, sometimes collaboratively and at other times individually, their educational practice and learning. More academics and industry mentors need to initiate action research based on their own learning in the workplace, subsequently discussing challenges and solutions and, as a result, enriching the generation, dissemination and application of knowledge in their respective fields.

Identifying a placement is just one aspect of the workload of academics involved in this endeavour. Prior to placement, they have to plan and guide the WIL process, manage the diversity of work opportunities and provide options and understanding right at the start (Patrick et al., 2008). They also need to encourage students to become involved in meaningful activities in the workplace and to do something specific rather than merely being an observer.

It has been acknowledged that for proper delivery of WIL, greater resources are required than have been allocated in the current financial and political climate. In addition, for proper supervision from industry additional recompense may be required for the supervision services of the staff involved. Greater administrative support is also required in this process.

Patrick et al. (2008) raise a number of resource issues which include workload and time constraints for university staff and employers, the financial cost of placements to employers, and the inflexibility of university timetables in enabling students to spend appropriate time in the workplace. These issues become more challenging as the number of students increases and more universities adopt WIL as a part of their programme. This also emphasises that the opportunities for student’s placement should be increased (O’Connor, 2008). This report provided an account of the first large-scale scoping study of WIL in Australian higher education. In this report some of the main challenges that are facing WIL were identified and summarised:

- Ensuring equity and access
- Managing expectations and competing demands
- Improving communication and coordination
- Ensuring worthwhile WIL placement experiences
- Adequately resourcing WIL

Similar research work is not available in South Africa and our research work has tried to address some of these issues.

In South Africa, academic staff members are usually extensively involved in WIL. Academics are required to prepare students, find placements for them (directly or via a co-op office) visit all students and to be in communication with them continuously. Mentoring and the recruitment of staff for mentoring are additional responsibilities that fall onto the shoulders of academic staff. The WIL module is allocated 120 credits for the National Diploma presently, covers a wide range of activities and it is a significant part of the entire degree.

There are many factors that affect the proper functioning of WIL in South Africa. Our study tried to address some of these issues for engineering technician and technologist training, in the light of the HEQSF. In this chapter, some experiences on the period of WIL, assessment methods and curriculum were discussed, as were the research results on collaboration and the mutual responsibilities of the role players. In addition, the importance of reflection on different aspects of WIL was reiterated.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

Based on the discussion in the literature review and the importance of work placement in the professional training of technicians and technologists, this research study has identified lacuna in the literature regarding WIL practices in South Africa. It has, therefore, articulated the research question and sub-questions based on areas where further study is required. These questions will now be investigated and discussed.

In this research, both quantitative and qualitative methods were used, because the nature of the research is such that more comprehensive source data was required for analysis. The use of a mixed method enabled the researcher to investigate the responses to the questions from the perspectives of both the students and the supervisors. The quantitative and qualitative methods worked in a complementary way and enabled a deeper understanding of the issues.

This chapter discusses the procedure that was used to carry out the study under the following sub-headings, namely, research design, population, sampling, data collection and data analysis.

3.2 Research Design

The study used descriptive survey research because the researcher was trying to account for what had already occurred and wished to analyse the information and draw conclusions. According to Best (1970), “at times, descriptive research is concerned with how “*what is* or *what exists”* is related to some preceding event that has influenced or affected a present condition or event”.

The study used survey research because the researcher wanted to obtain information from groups of people by using the questionnaire method (Ary, Jacobs, & Razavieh, 2002). Gall,

Gall and Borg (2003) state that "the purpose of a survey is to use questionnaires or interviews to collect data from a sample that has been selected to represent a population to which the findings of the data analysis can be generalized".

3.3 Population

The population in this study, for the quantitative component, comprised engineering National Diploma and BTech students from one university of technology and one comprehensive university in South Africa, who had *completed* their WIL placement. Graduates from these two qualifications have to complete their experiential learning before graduation. The population for the qualitative component of the research comprised supervisors for Work Integrated Learning (WIL) at the same two universities. Both universities are based in Gauteng province, a major metropolitan population centre where the majority of the universities of technology in South Africa are found. One university was residential while the other offered solely distance/online education. The offering of the engineering work placement is very similar in both residential and distance/online institutions.

3.4 Sampling

One university of technology and one comprehensive university were selected for this study. Both are currently accredited to offer the National Diploma and BTech qualification. In each university two disciplines were selected, Civil and Chemical Engineering. The total of 600 questionnaires were distributed and 254 students responded. The WIL supervisors, for each of these programs, at these two institutions were interviewed, comprising 7 participants.

The quantitative component of the study used cluster sampling by selecting the Chemical/Metallurgical Engineering and Civil Engineering students at Unisa and the Tshwane University of Technology. The survey was carried out in 2009. The information was collected from a sample within a predetermined population and at the same point in time. The final data did not differentiate the university concerned although it did indicate the discipline. The sample students were registered for either the National Diploma or BTech between 2005 and 2009. A total of 600 students received the questionnaire.

The qualitative component of the study used semi-structured interview for data collection. The same two universities of technology were selected for this purpose. The interviews were organised with WIL supervisors for the two disciplines of Civil and Chemical Engineering (including Metallurgical Engineering or Pulp and Paper supervisors within the Chemical Engineering Department) at the two institutions. A total of 7 supervisors were interviewed.

3.5 Data Collection

3.5.1 Questionnaire

The instrument used for data collection during the quantitative part of the study comprised a structured questionnaire, which was developed after a review of the related literature. The questionnaire used in the study consisted of two sections, namely, the biographical section and the WIL section. In the biographical section of the questionnaire, general questions were asked, such as gender, university attended, year of completion of study and whether employed or not. In the WIL section, WIL-related questions based on the research question and sub questions were asked. A copy of the questionnaire is contained in Appendix A.

The researcher included questions that would provide information relating to all the research questions cited in chapter 1. The style of the questionnaire is unique. The researcher had studied other work done in this field and, based on her own personal knowledge of the field and other previous research works, she developed a questionnaire which was then checked by experts in the field. After consultation with experts, some changes were made to the questionnaire, thus making it more user-friendly.

The questions included dichotomous answers such as “yes” and “no” options for questions 11, 12, 13, and 16. Some of the questions included tables while questions 19, 21 and 23 included five-point scales with response options such as “hardly ever”, “seldom”, “sometimes”, “often”, and “almost always”. Questions 24 to 29 referred to the responsibilities of the various role players and the respondents were given different options from which to choose. Other questions involved descriptive answers, or presented participants with a few answers from which to choose. There were also two open ended questions – questions 15 and 20.

Section B in the questionnaire included questions about the students’ overall satisfaction with WIL placement and its importance in their training. Questions were asked about the guidance, mentoring and supervision provided during the WIL period. There were also questions regarding the challenges faced during the WIL period, as well as questions which aimed at ascertaining the attitude of the students towards their placements. In addition, there were questions on the overall design of the WIL programme in different institutions.

Each questionnaire was accompanied by a covering letter, explaining the purpose of the research study, consent terms, voluntary participation, confidentiality and the anonymous nature of the work, as well as the telephone number and e-mail address of the researcher for further enquiries. Copies of the cover lettering for Unisa and Tshwane students are contained in Appendix B.

The final draft of the questionnaire was distributed among those students who had registered for WIL in either Civil or Chemical/Metallurgical Engineering. The questionnaire was distributed to the National Diploma and BTech students from 2005 to 2008 who had already completed their experiential learning. Approximately 400 questionnaires were distributed by mail – 200 for Chemical and 200 for Civil Engineering students – while a further 200 questionnaires were distributed in classrooms or during contact sessions. The details are reflected in Chapter 4.

The envelopes were addressed to each individual student and mailed to their home address. The questionnaire was identical for all the students and was accompanied by a covering lettering for each institution. The covering letter briefly explained the purpose of the survey, emphasised the confidentiality of the study, provided a postal address for the completed questionnaires and the contact details of the chief researcher. Large envelopes were used for the outgoing questionnaire while small envelopes were used for the returned questionnaires. The postal address of the researcher was indicated on the outgoing envelopes and, as a result, a few envelopes were returned as undelivered because of a change of address. Stamps were affixed to the return envelopes so that a lack of stamps would not constitute a problem. The questionnaires that were distributed in the classroom or during the contact sessions were collected at the end of the session by administrators. At the end of the survey, 254 responses to the questionnaire had been obtained – a response rate of 42% which may be deemed as satisfactory.

3.5.2 Interview

The interview was used as the data collection instrument in the qualitative component of the research project. Academic supervisors/academic lecturers from the two universities indicated above were interviewed and asked questions regarding their experiences, including questions on the advantages and disadvantages of the WIL component, challenges and learning, reflections on the programme and any similar questions that required a deep understanding of the challenges faced.

The semi-structured interview method was used during the interviews. Face-to-face interviews were arranged with all the supervisors/lecturers from the two academic institutions of the Unisa and the Tshwane University of Technology (TUT). An interview guide was prepared and, within the guidelines, more probing took place. A copy of the interview guide is contained in Appendix C. All the interviews were tape recorded, while detailed documentation of the comments was made and kept, without indicating the name of the individual. The purpose of these interviews was to obtain a deeper understanding of the situation and to acquire information regarding the quality of supervision, mentoring, guidelines given, and so forth. The results from the interviews were compared with the results of the questionnaire, which provided the views of the students.

Seven supervisors from the two identified institutions were interviewed, four of them from one institution and three from the other. All supervisors were supervising students for work placement in Chemical Engineering, Civil Engineering or closely related qualifications such as Metallurgical Engineering or Pulp and Paper. The interviews were based on a set of questions that had been prepared in advance. A copy of the questions is attached in Appendix C.

During the actual interviews the interviewers requested the consent of the interviewees. If they granted their consent they were asked to sign the consent form. The interviews took place in the supervisors' workplace. With the exception of one, all the interviews were face to face. The interviews were all tape recorded and text was also noted down in case the tapes were not clear. Each interview took between 30 minutes to an hour. The supervisors all provided their full support during the process. The majority of the supervisors were extremely open about their views and answered all the questions. A text of all the interviews and the tapes themselves are available.

3.5.3 Validity and Reliability of the Instrument

Validity

For the purposes of this research study, both face and content validity were established by a panel of experts (see list in Appendix A). In order to check the face and content validity of the questionnaire before its distribution, the questionnaire was given to three experts in the field in order to make sure that the questions were both appropriate and comprehensive. Comments were received and included in the final draft of the questionnaire. It was then given to the research and ethics representative in the Institute of Mathematics, Science and Technology Education and, eventually, to the Senate Research and Ethics Committee at the University of South Africa (Unisa) for final approval. All comments were included in the final draft and the set up of a couple of questions changed. The questionnaire was also sent to the Research and Ethics Committee of the Tshwane University of Technology and their specific comments regarding the questionnaire and the covering letter were attended to. A similar process was applied for the face and content validation of the interview guide. The panel of experts as well as the two research committees checked the interview questions.

Reliability

The questionnaire was pretested, as described under ‘Pilot Project’, to make sure that questions were understood properly and were not ambiguous.

During the main study, an internal consistency reliability estimation was used for different factors in each question. One of the instruments used for this purpose was Cronbach's alpha, which finds the correlation between all possible splits of questions. Ultimately, the programme generates one number for Cronbach's alpha. The closer the number is to one, the higher the reliability. The Cronbach’s alpha value for factors in question 19 were 0.8390 and 0.7091 respectively, and for the two factors in question 21 were 0.7765 and 0.6531 . Question 23 has the Cronbach value of 0.9031.

3.5.4 Pilot Project

In order to test the research instrument, a pilot study was performed. In other words, before distributing the questionnaire, it was *pretested*. The questionnaire was sent electronically to 24 Chemical Engineering students at Unisa who had been randomly selected from the class of 2009, but who were not participating in the study. These students had recently completed their experiential learning (part 2) in 2009. A covering letter and the questionnaire were sent to them electronically. They were asked to participate in the project, the importance of the research was explained to them and they were requested to send back the online survey.

The result provided a pretest regarding the content of the questionnaire, indicating any ambiguous questions or those that were not clear. Four students replied, thus indicating an extremely low response to the electronic method. This was one of the reasons why it was decided to use the mail method instead of the electronic method for the main study and provide contact opportunities for the distribution of the questionnaire. Small changes were made to the questionnaire after the pilot project.

3.6 Statistical Tests Used in The Data Analysis

Several statistical tests were carried out during the data analysis. The descriptive statistics recommended for this data analysis included mean for central tendency and standard deviation for variability. Additional data procedures included Pearson's r, the *t*-test, ANOVA and regression analysis, as well as Likert data analysis specifically for questions 19, 21 and 23. Our method of data analysis was not based on individual question analysis but rather on composite score from the series of questions that represented the attitudinal scale.

In our questionnaire we had both Likert scale and Likert-type data. Variations of the Likert response alternatives are extremely common in research. However, it is essential that care be taken in the proper usage of Likert scale data (Boone, & Boone, 2011). One problem area is related to the difference between the Likert scale and Likert-type questions. In terms of Likert-type questions, multiple questions are used in a research instrument but the scores are not combined. Likert-type items such as question 24-29 are ordinal and the measuring scales that was used include a mode or median for central tendency and frequency for variability. Additional analysis were chi-square measure of association, Kendall Tau B, and Kendall Tau C.

Factor analysis was used to find the composite scores in Likert scale questions. The main purpose of factor analysis was to reduce the number of variables, to find a relationship between variables and categorise them.

There are different methods for factor extraction and also different procedures for factor rotations and factor score calculations. The methods for factor extraction include principal components, generalised least squares, maximum likelihood, principal axis factoring, alpha factoring and image factoring, although the main two methods are principal component analysis and principal axis factoring. In factor analysis it is necessary to take into account the theoretical background as well as the empirical outcome. A summary of the tests carried out in this study are as follows:

Kaiser-Meyer-Olkin Measure of Sampling Adequacy (MSA) Test and Bartlett's Test of Sphericity were carried out on the Likert scale data. These are the standard test procedure for a factor analysis. As a rule of thumb, KMO should be 0.60 or higher in order to proceed with a factor analysis of sample adequacy tests. The *p*-value of Bartlett's test (represented by "Sig") must be below 0.05 to indicate that the correlation structure is significantly strong enough for performing a factor analysis on the items.

Eigenvalue was used to decide on the number of factors. Methods such as eigenvalues and scree plots were used for this purpose. An eigenvalue indicates how many factors should be extracted in the overall factor analysis. The Kaiser rule is to drop all components with an eigenvalue of under 1.0.

The *scree test* was used to plot the eigenvalue on the Y-axis and the components on the X-axis. As the x value increases, the eigenvalue decreases and, when the drop in eigenvalue was ceased, the curve made an elbow. None of the components after the drop (or elbow) were considered. The number of factors were selected from those components that were before the drop (elbow).

Graphical Interpretation were used after the extraction of the factors, each variable was shown as a vector. The coordinates in this figure are factors. Factor loading, which is the cosine of the angle between the factor and one variable, was then calculated. Factors are rotated in order to make them more readable.

Communalities Tables were presented which indicate the extent to which the variables may be explained by the factors. A value near 1 indicates an item that correlates highly with the rest of the items in a factor. Items with low communalities (near 0.2) were reconsidered.

Cronbach's Alpha Coefficient was used to determine the internal consistency or average correlation of items in a survey instrument. When the reliability was low, then the individual items within a scale was either changed completely or modified.

Pearson Chi-square Test was used in this study. This is a statistical test that is used to compare observed data with the expected data based on a hypothesis. The chi-square test is intended to test the likelihood that an observed distribution is due to chance. The Pearson chi-square value gives the *p*-value. If the *p*-value is smaller than 0.05, then a statistically significant association exists between different categories. This means that the results cannot be attributed to chance and that a real association exists between the variables.

Analysis of Variance (ANOVA) provides a statistical test of whether or not the means of several groups are all equal. This is useful when comparing two, three, or more means.

$$H_0 = \mu_1 = \mu_2 = \mu_3 = \ldots.. = \mu_k$$

Where μ is the group population and k is the number of groups. The one-way ANOVA which was calculated in each case compares the means between the groups and checks whether any of the means is significantly different from others, testing the null hypothesis. If the one-way ANOVA produced a significant result, then the alternative hypothesis was accepted. This means that there are at least two group means that are significantly different from each other, without it being possible to identify them. In order to determine the groups, it is necessary to conduct a post-hoc test.

Statistical Significance (p-value) - It is the probability that the observed relationship between items is as a result of either chance or luck and indicates that there is no relationship between the components. It also provides the decreasing index of reliability. The results where $p = 0.05$ are considered to be borderline. The p-value still has a high probability of 5%. Results where $p \leq 0.05$ are significant while results that are between 0.005 and 0.01 are highly significant. This number is an arbitrary selection based on experience and literature.

3.7 Ethics in this Research Work

Social research is usually carried out within cultural, legal, economic and political environments. However, this may become complicated if there are sponsors with a set of agendas or if the researchers have their own agenda and priorities. It is for this reason that it is essential that ethical considerations be strictly upheld. The three major scientific norms that should govern any research are beneficence, respect and justice.

In this study, the rights of the individuals were protected by keeping the information confidential and anonymous and also by ensuring that participation in the study was voluntary. The research framework and agenda were both objective and clear. The administration of the research was consistent with research principles, the purpose of the research was explained and research team was introduced in the covering letter. Every effort was made to be sensitive to cultural and social issues and no conflict of interests existed. Further, there were no sponsors with specific agendas. The methodology was explained to all respondents.

As regards the questionnaire, the Unisa and TUT ethical guidelines were strictly adhered to. The research and ethics committees of both Unisa and TUT approved the final draft of the questionnaire. All the participants were provided with a covering letter, indicating that their participation in the study was voluntary. During the interview the supervisors were also given a letter indicating that their participation was voluntary and they also signed a consent form.

In summary, this research study made use of both quantitative and qualitative methods. The use of a mixed method enabled the researcher to investigate the responses to the research questions from both the students and the supervisors. The quantitative and qualitative methods worked in a complementary way. The instrument used for data collection during the quantitative part of the study was a structured questionnaire, and the instrument for the qualitative part was a semi-structured interview. Several statistical tests were carried out for data analysis of the survey results..

CHAPTER 4
ANALYSIS OF DATA

In this section, the data collected from the survey was analysed by standard statistical tests, finding possible interconnections between different questions. Inputs from interviews were also analysed based on the research questions. Discussion of these results and their interconnection to the research questions are reserved for chapter 5, which is the discussion of results. The details of the analysis are described in the following sections.

4.1 Analysis of Data from the Quantitative Method (Questionnaire)

After all the questionnaires had been collected, the results were tabulated in an Excel spreadsheet table and then converted to a data sheet that could be used by statistical software such as SPSS. Various statistical procedures were carried out.

The next few sections present the research results and their interpretation while a short description of all the above methods may be found in section 3.6. Details of the calculations are presented in the appendices and discussion of results will be carried out in chapter 5.

After all the questionnaires had been collected, the results were tabulated in an Excel spreadsheet table and then converted to a data sheet that could be used by statistical software such as SPSS. The following statistical procedures were carried out:

- Frequency calculations
- factor analysis
- principal component analysis and plots
- Cronbach's α
- chi square (χ^2) approximation
- one-way ANOVA
- Wilcoxon/Kruskal-Wallis tests

- Welch’s test
- parametric and nonparametric tests
- tests such as Levene, Bartlett, O’Brien and two-sided F tests
- normal distribution

The next few sections present the research results and their interpretation while a short description of all the above methods may be found in section 3.6. Details of the calculations are presented in the appendices.

4.1.1 Frequencies Distribution for all the Questions

Frequency distribution of data was carried out. Their details are shown below:

Table 4.1

A: Frequency tables for questions 1-18

		Q1			
	Gender	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Male	187	73.62	73.62	73.62
	Female	67	26.38	26.38	100.0
	Total	254	100.0	100.0	

		Q2			
University where National Diploma Obtained		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
	Other	18	7.09	7.09	7.09
	Unisa	12	4.72	4.72	11.81
	TUT	172	67.72	67.72	79.53
Valid	UJ	25	9.84	9.84	89.37
	Vaal UoT	19	7.48	7.48	96.85
	CPUT	8	3.15	3.15	100.0
	Total		254	100.0	100.0

Q3					
Year WIL completed		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Before 2004	58	22.8	23.02	23.02
	2004-2005	25	9.8	9.92	32.94
	2006-2007	85	33.5	33.73	66.67
	2008-2009	84	33.1	33.33	100.0
	Total	252	99.2	100.0	
Missing	System	2	.8		
Total		254	100.0		

Q4					
Student's Discipline		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Other	1	.39	.39	.39
	Civil Engineering	178	70.08	70.08	70.47
	Chemical/metalurgical engineering	75	29.53	29.53	100.00
	Total	254	100.0	100.0	

Q5					
Highest Qualification of Students		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	National Diploma	239	94.09	94.47	94.47
	BTech	13	5.11	5.14	99.61
	MTech/MSc	1	.39	.40	100.0
	Total	253	99.59	100.0	
Missing	System	1	.39		
Total		254	100.0		

Q6 Students Employed/ Study		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes (employed)	57	22.44	22.53	22.53
	Yes (further study)	22	8.66	8.70	31.23
	No (no work and no further study)	3	1.18	1.19	32.42
	Yes (both work and further study)	171	67.32	67.59	100.0
	Total	253	99.6	100.0	
Missing	System	1	.39		
Total		254	100.0		

Q7 Place Students Employed /Study		Frequency	Percent	Valid Percent	Cumulative Percent
	Industry	48	18.89	20.78	20.78
	Consulting firm	93	36.61	40.27	61.05
	Construction field	32	12.60	13.85	74.90
	Company	16	6.29	6.93	81.83
	Government	36	14.17	15.58	97.41
	Have my own company	4	1.57	1.73	99.14
	Education (any type)	2	.79	.87	100.0
	Total	231	90.92	100.0	
	0thers	5	1.97		
Missing	System	18	7.09		
Total		254	100.0		

Q8					
WIL placement		Frequency	Percent	Valid Percent	Cumulative Percent
	Industry	60	23.62	24.19	24.19
	Consulting firm	89	35.03	35.89	60.08
	Construction field	41	16.14	16.53	76.61
	Company	16	6.29	6.45	83.06
	Government	39	15.35	15.73	98.79
	Have my own company	2	.79	.81	99.60
	Education (any type)	1	.39	.40	100.00
	Total	248	97.63	100	
	Others	3	1.20		
Missing	System	3	1.20		
Total		254	100.0		

Q9					
Type of employment		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Permanent employment	136	53.5	55.06	55.1
	Contract employment	61	24.0	24.70	79.76
	Experiential placement only	50	19.7	20.24	100.0
	Total	247	97.2	100.0	
Missing	System	7	2.8		
Total		254	100.0		

Q10.1

	To obtain	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	To obtain a future employment opportunity	166	65.4	65.4	100.0
Missing	System	88	34.6	34.6	
Total		254	100.0		

Q10.2

	To obtain	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	To obtain practical experience during the placement	201	79.1	79.1	79.1
Missing	System	53	20.9	20.9	100.0
Total		254	100.0		

Q10.3

	To obtain	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	To develop employment skills such as communication, team work and problem solving	183	72.0	72.0	72.0
Missing	System	71	28.0	28.0	100.0
Total		254	100.0		

Q10.4

	To obtain	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No expectation	1	.4	.4	.4
Missing	System	253	99.6	99.6	100.0
Total		254	100.0		

Q10.5					
To obtain		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	To pass the subject	61	24.0	24.0	24.0
Missing	System	193	76.0	76.0	100.0
Total		254	100.0		

Q10.6					
	To obtain	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Other reasons	2	.8	.8	.8
Missing	System	252	99.2	99.2	100.0
Total		254	100.0		

Q11					
Mentor in the work place		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	216	85.03	85.71	85.71
	No	36	14.17	14.29	100.0
	Total	252	99.20	100.0	
Missing	System	2	.79		
Total		254	100.0		

Q12					
Supervisor at the University		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	184	72.44	73.60	73.60
	No	66	25.98	26.40	100.0
	Total	250	98.42	100.0	
Missing	System	4	1.57		
Total		254	100.0		

Q13					
Curriculum for WIL		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	215	84.65	85.32	85.32
	No	37	14.57	14.68	100.0
	Total	252	99.22	100.0	
Missing	System	2	.78		
Total		254	100.0		

Q14.1					
Improvements for WIL		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	More appropriate work placement	71	28.0	28.0	28.0
Missing	System	183	72.0	72.0	100.0
Total		254	100.0		

Q14.2					
Improvements for WIL		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	More support from university	93	36.6	36.6	36.6
Missing	System	161	63.4	63.4	100.0
Total		254	100.0		

Q14.3					
Improvements for WIL		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	More support from industry	103	40.6	40.6	40.6
Missing	System	151	59.4	59.4	100.0
Total		254	100.0		

Q14.4

Improvements for WIL		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Better guidance from university	69	27.2	27.2	27.2
Missing	System	185	72.8	72.8	100.0
Total		254	100.0		

Q14.5

Improvements for WIL		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Better preparation such as induction course	48	18.9	18.9	18.9
Missing	System	206	81.1	81.1	100.0
Total		254	100.0		

Q14.6

Improvements for WIL		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Better theory course work at the university	43	16.9	16.9	16.9
Missing	System	211	83.1	83.1	100.0
Total		254	100.0		

Q14.7

Improvements for WIL		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Better liaison between university and industry	135	53.1	53.1	53.1
Missing	System	119	46.9	46.9	100.0
Total		254	100.0		

Q14.8					
	Improvements for WIL	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Others	6	2.4	2.4	2.4
Missing	System	248	97.6	97.6	100.0
Total		254	100.0		

Q16					
Would you choose WIL, if optional		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	218	85.83	87.90	87.90
	No	30	11.81	12.10	100.0
	Total	248	97.64	100.0	
Missing	System	6	2.36		
Total		254	100.0		

Q17					
	Duration of WIL	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	7 months to 1 year	220	86.61	88.71	88.71
	4 to 6 months	24	9.45	9.68	98.39
	3 months or less	4	1.57	1.61	100.0
	Total	248	97.63	100.0	
Missing	System	6	2.36		
Total		254	100.0		

Possibility of WIL at university		Q18 Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes, in the laboratory	21	8.26	8.37	8.37
	Not at all	143	56.30	56.97	65.34
	Yes, I could have received part of it at the university but not all	87	34.25	34.66	100.0
	Total	251	98.8	100.0	
Missing	System	3	1.18		
Total		254	100.0		

Table 14.1
B: Frequency Tables -Questions 19, 21 and 23

Q19 WIL period	Hardly ever	Seldom	Some times	Often	Almost always	Total
Q19.1- WIL important period	1.20	1.20	10.80	14.00	72.80	100
Q19.2- WIL valuable period	1.20	2.00	8.80	22.80	65.20	100
Q19.3- Excited about WIL	2.02	4.84	18.15	20.16	54.84	100
Q19.4- Satisfied with WIL	3.63	10.89	21.37	30.24	33.87	100
Q19.5- provided with enough guidance by university	7.69	18.22	24.70	28.74	20.65	100
Q19.6- Provided with enough guidance by industry	6.02	10.04	19.68	40.56	23.69	100
Q19.7- WIL met your expectation	4.05	4.05	23.48	38.87	29.55	100
Q19.8- Fixed curriculum necessary	4.78	6.77	13.94	22.31	52.19	100
Q19.9- Given responsibility during WIL	12.15	12.15	17.41	25.91	32.39	100
Q19.10- Given Hands on during WIL	2.85	3.66	20.33	28.04	45.12	100
Q19.11- Satisfied with supervisor support	8.13	10.98	23.98	32.11	24.80	100
Q19.12- Satisfied with mentor support	6.91	10.57	22.36	29.67	30.49	100
Q19.13- WIL experience based on your curriculum	3.29	5.76	17.28	38.68	34.98	100

Q21- Challenges	Hardly ever	Seldom	Some times	Often	Almost always	Total
Q21.1- obtain WIL in my discipline	8.79	16.32	28.45	27.20	19.25	100
Q21.2- insufficient university support finding WIL	9.62	15.06	25.94	25.94	23.43	100
Q21.3- insufficient university support after placement	8.82	16.39	29.83	25.63	19.33	100
Q21.4- insufficient industry support finding placement	6.72	16.81	34.03	28.99	13.45	100
Q21.5- insufficient industry support after placement	7.95	18.83	32.22	28.03	12.97	100
Q21.6- Transition from university to work	10.50	15.13	37.39	26.05	10.92	100
Q21.7- Applying theory to applied problems	8.75	19.58	32.50	26.67	12.50	100
Q21.8- Inappropriate WIL	10.08	23.11	35.71	20.17	10.92	100
Q21.9- Doing the same work	10.13	16.03	25.32	24.89	23.63	100
Q21.10- Not completed curriculum in WIL period	10.08	19.33	30.67	26.47	13.45	100
Q21.11- not knowing what was expected	9.70	23.21	31.22	18.14	17.72	100

Q23 –Attitudes and Skills	Hardly ever	Seldom	Some times	Often	Almost always	Total
23.1- Individual initiative	1.30	1.74	14.35	26.09	56.52	100
23.2- Ability and willingness to learn	0.43	1.72	5.17	10.78	81.90	100
23.3- Organisational skills	0.43	2.60	17.75	31.17	48.05	100
23.4- Personal planning	0.87	1.30	9.57	27.83	60.43	100
23.5- Good communication skills	1.29	1.72	6.90	19.83	70.26	100

23.6- Social skills	0.00	3.88	18.10	35.34	42.67	100
23.7- Team work ability	0.88	1.75	6.58	21.93	68.86	100
23.8- Perseverance at work	0.43	1.29	6.03	25.43	66.81	100
23.9- Understanding the work place culture	0.86	3.88	10.34	30.60	54.31	100
23.10- Emotional intelligence	0.86	3.45	10.78	33.62	51.29	100
23.11- Self confidence	0.86	2.59	3.45	19.40	73.71	100

Table 4.2: Frequency Tables for Individual Responses in Q24-Q29

Q24.1

Who initiate WIL		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Student	78	30.7	30.7	30.7
Missing	System	176	69.3	69.3	100.0
Total		254	100.0		

Q24.2

Who initiate WIL		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	WIL Convener	45	17.7	17.7	17.7
Missing	System	209	82.2	82.2	100.0
Total		254	100.0		

Q24.3

Who initiate WIL		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Academic Supervisor	72	28.3	28.3	28.3
Missing	System	182	71.7	71.7	100.0
Total		254	100.0	100.0	

Q24.4

Who initiate WIL		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Industry Mentor	50	19.7	19.7	19.7
Missing	System	204	80.3	80.3	100.0
Total		254	100.0	100.0	

Q24.5

Who initiate WIL		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Placement coordinator	27	10.6	10.6	10.6
Missing	System	227	89.3	89.3	100.0
Total		254	100.0	100.0	

Q25.1

Who does induction for WIL		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Student	20	7.9	7.9	7.9
Missing	System	234	92.1	92.1	100.0
Total		254	100.0		

Q25.2

Who does induction for WIL		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	WIL Convener	44	17.3	17.3	17.3
Missing	System	210	82.7	82.7	100.0
Total		254	100.0		

Q25.3

Who does induction for WIL		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Academic Supervisor	65	25.6	25.6	25.6
Missing	System	189	74.4	74.4	100.0
Total		254	100.0	100.0	

Q25.4

Who does induction for WIL		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Industry Mentor	96	37.8	37.8	37.8
Missing	System	158	62.2	62.2	100.0
Total		254	100.0	100.0	

Q25.5

Who does induction for WIL		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Placement coordinator	25	9.8	9.8	9.8
Missing	System	229	90.2	90.2	100.0
Total		254	100.0	100.0	

Q26.1

Who is responsible for supervision		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Student	5	2.0	2.0	2.0
Missing	System	249	98.0	98.0	100.0
Total		254	100.0	100.0	

Q26.2

Who is responsible for supervision		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	WIL Convener	25	9.8	9.8	9.8
Missing	System	229	90.2	90.2	100.0
Total		254	100.0	100.0	

Q26.3

Who is responsible for supervision		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Academic Supervisor	78	30.7	30.7	30.7
Missing	System	176	69.3	69.3	100.0
Total		254	100.0	100.0	

26.4

Who is responsible for supervision		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Industry Mentor	151	59.4	59.4	59.4
Missing	System	103	40.6	40.6	100.0
Total		254	100.0		

Q26.5

Who is responsible for supervision		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Placement coordinator	19	7.5	7.5	7.5
Missing	System	235	92.5	92.5	100.0
Total		254	100.0		

Q27.1

Who evaluates student performance		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Student	8	3.1	3.1	3.1
Missing	System	246	96.9	96.9	100.0
Total		254	100.0	100.0	

Q27.2

Who evaluates student performance		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	WIL Convener	29	11.4	11.4	11.4
Missing	System	225	88.6	88.6	100.0
Total		254	100.0	100.0	

Q27.3

Who evaluates student performance		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Academic Supervisor	108	57.5	57.5	57.5
Missing	System	146	42.5	42.5	100.0
Total		254	100.0	100.0	

Q27.4

Who evaluates student performance		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Industry Mentor	139	54.7	54.7	54.7
Missing	System	115	45.3	45.3	100.0
Total		254	100.0	100.0	

Q27.5

Who evaluates student performance		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Placement coordinator	19	7.5	7.5	7.5
Missing	System	235	92.5	92.5	100.0
Total		254	100.0	100.0	

Q28.1

Who is responsible for student management		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Student	44	17.3	17.3	17.3
Missing	System	210	82.7	82.7	100.0
Total		254	100.0	100.0	

Q28.2

Who is responsible for student management		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	WIL Convener	35	13.8	13.8	13.8
Missing	System	219	86.2	86.2	100.0
Total		254	100.0	100.0	

Q28.3

Who is responsible for student management		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Academic Supervisor	58	22.8	22.8	22.8
Missing	System	196	77.2	77.2	100.0
Total		254	100.0	100.0	

Q28.4

Who is responsible for student management		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Industry Mentor	120	47.2	47.2	47.2
Missing	System	134	52.8	52.8	100.0
Total		254	100.0	100.0	

Q28.5

Who is responsible for student management		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Placement coordinator	43	16.9	16.9	16.9
Missing	System	211	83.1	83.1	100.0
Total		254	100.0	100.0	

Q29.1

Who is responsible for student final report		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Student	21	8.3	8.3	8.3
Missing	System	233	91.7	91.7	100.0
Total		254	100.0	100.0	

Q29.2 Who is responsible for student final report		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	WIL Convener	31	12.2	12.2	12.2
Missing	System	223	87.8	87.8	100.0
Total		254	100.0	100.0	

Q29.3 Who is responsible for student final report		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Academic Supervisor	145	57.1	57.1	57.1
Missing	System	109	42.9	42.9	100.0
Total		254	100.0	100.0	

Q29.4 Who is responsible for student final report		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Industry Mentor	103	40.5	40.5	40.5
Missing	System	151	59.4	59.4	100.0
Total		254	100.0	100.0	

Q29.5 Who is responsible for student final report		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Placement coordinator	22	8.7	8.7	8.7
Missing	System	232	91.3	91.3	100.0
Total		254	100.0	100.0	

Analysing the frequency distribution for the biographical section of the questionnaire, we can conclude that 70% of the participants were male which is known feature of the current gender makeup of engineering programmes in South Africa. Sixty six percent of participants completed their WIL module between 2006-2009, and seventy percent of participants were from Civil Engineering discipline. It is interesting to note that around 90 percent of the participants had a National Diploma as their highest qualification but already 90 percent of them were employed, which is a very healthy employment rate.

The majority of the participants were employed in industry, consulting firms or companies which are engineering oriented and around 80 percent of them had either permanent or contract positions. Among the participants, 85 percent of them conducted their WIL module in industry or firms with only a small percentage doing their WIL module in government agencies - which could still be an engineering-oriented placement such as water affairs, waste management or road and transport section.

From question 10, it is clear that the majority of participant had the expectation of gaining practical experience, developing employment skills and finding employment opportunities. The majority of the participants had a supervisor and a mentor and some sort of guidance for WIL. However they believed that improvement in industry and university support was needed. Around 90 percent of the students would not replace WIL with any other option and sixty percent of them believe that WIL cannot be done at university.

Comparison of results in question 23 indicates that between 80 to 90 percent of all the answers fell between the “Often important” category and the “Almost always important” category. Thus, this reflects that all these skills and attitudes are deemed to be important during the training. However skills such as ‘good communication skills’ and attitudes such as “ability and willingness to learn’ and ‘self confidence’ stands out among all the factors.

Questions 19, 21 and 23 consist of tables with a number of related questions. The questions are included in each table because we want to find the inter-relation between them in the context of the research questions rather than as individual questions. It is for this reason that factor analysis and principal component analysis were used for these questions.

As regards the data for questions 24 to 29, the data indicate the percentage of “yes” responses for the item in question. For example, in question 24, 31% of the respondents selected the student as the initiator of WIL, while 18% chose the WIL convener, and so forth.

Overall, for each of these questions, a variety of answers were received. It was, thus, obvious that the students were not very clear about the responsibilities of the various role players during the WIL period. Even for questions such as "Who is responsible for the student's final/formal assessment?" the majority of students either replied "academic supervisor", or "industry mentor" or both. Similarly, for a question such as "Who is responsible for evaluating the student's performance during the WIL activity?" (Q27), the same process occurred. This clearly showed that the role and responsibilities of the academic supervisor, mentor and others had not been clearly defined.

4.1.2 Principal Components Analysis for Questions 19, 21 and 23

Based on the discussion in section 3.6, factor analysis and principal component analysis were carried out for questions 19, 21 and 23 – which are Likert scale questions – in order to check the possibility of reducing the number of variables and to detect any correlations between them. Factor analysis grouped together some questions as one construct which also made sense theoretically. The item analysis was carried out to make sure that there is a good reliability and the individual questions were measuring the construct reliably. Therefore a new variable was calculated which is the mean of the individual questions.
The result for each question is reported separately as follows:

Question 19

The following results were gathered from the statistical analysis, using the SPSS software.

KMO and Bartlett Test – Q19

Table 4.3 presents the results of the KMO and Bartlett's test of sphericity which were carried out. It is essential to examine the KMO value of 0.825 in this case. This is considered sufficient to conduct a factor analysis as any value above 0.6 is considered acceptable. The *p*-value of Bartlett's test (represented by "Sig"), which is below 0.05 is significant, thus indicating that the correlation structure is significant for performing a factor analysis on the items.

Table 4.3
KMO and Bartlett's test for Question 19

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.825
	Approx. Chi-Square	1064.301
Bartlett's Test of	Df	78
Sphericity	Sig.	.000

Principal Components Analysis for Question 19

The principal component analysis method was used to reduce the number of variables to a few principal components. This statistical test was run for Question 19 and the summary plots for principal components are depicted in Figure 4.1. The plot indicates the presence of three principal components with eigenvalues of greater than 1 (left figure). In the right figure, one may predict the variables that may be grouped together. In other words, this method made it possible to reduce the number of variables in Question 19 from 13 to 3.

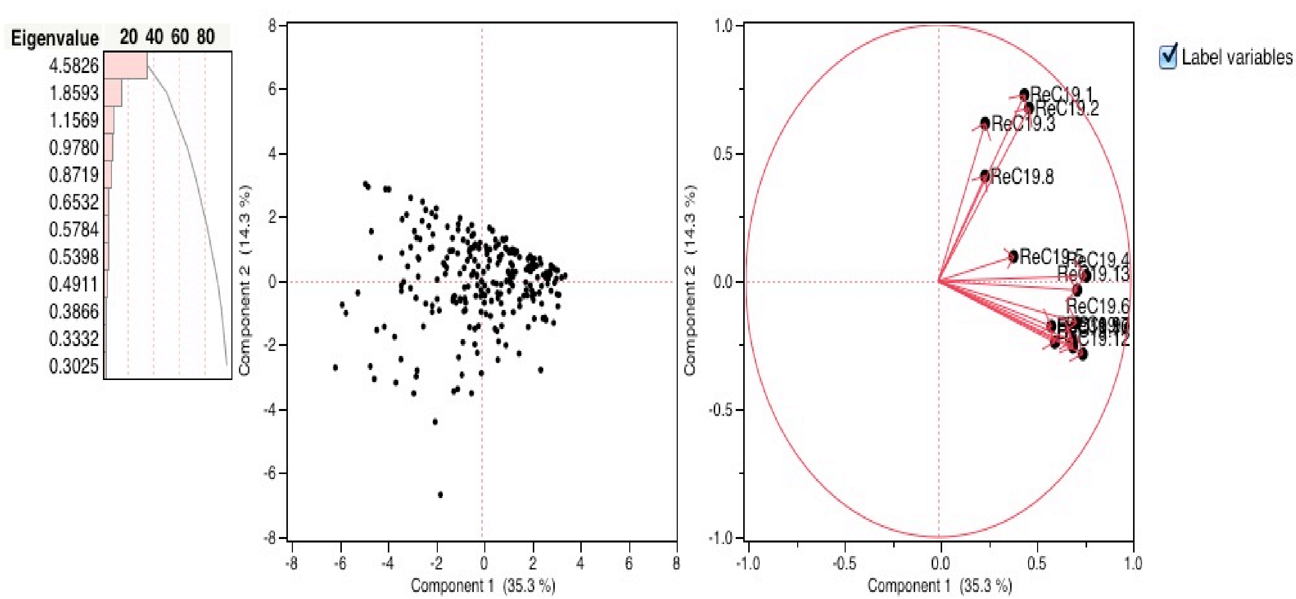


Figure 4.1: Principal component plots for Question 19

Table 4.4 contains the communalities, which indicate the extent to which these variables can be explained by the principal components (as explained in section 3.6). In this table, the variables with values near 1, for example, 19.1 with a value of 0.78398, correlate highly with the rest of the items while items with low values, for example, 19.8 with a value of 0.13639, should be reconsidered.

Table 4.4
Final communality estimates for Question 19

Estimates	Initial	Extraction
Q19.1	1.000	0.78398
Q19.2	1.000	0.56304
Q19.3	1.000	0.19106
Q19.4	1.000	0.61418
Q19.5	1.000	0.14501
Q19.6	1.000	0.59096
Q19.7	1.000	0.46546
Q19.8	1.000	0.13639
Q19.9	1.000	0.49495
Q19.10	1.000	0.64139
Q19.11	1.000	0.46295
Q19.12	1.000	0.61377
Q19.13	1.000	0.44790

Next, the total variance and eigenvalue were then calculated. According to the Kaiser rule, it is possible to drop all components with eigenvalues under 1.0. Therefore, in Table 4.5, it is clear that the three factors that were identified (components 1, 2 and 3) were the only three components with eigenvalues of above 1.0. They were called components 1, 2 and 3 and were given a title at a later stage. Table 4.6 was then constructed using the data in the last column of Table 4.5, which shows the cumulative total variance.

Table 4.5
Total variance for Question 19

Component	*Total Variance*			
	Total	*% of Variance*	*% of Variance*	*Cumulative %*
1	4.5826	35.251		35.251
2	1.8593	14.303		49.554
3	1.1569	8.899		58.453
4	0.9780	7.523		65.976
5	0.8719	6.707		72.683
6	0.6532	5.025		77.707
7	0.5784	4.449		82.157
8	0.5398	4.153		86.309
9	0.4911	3.778		90.087
10	0.3866	2.974		93.060
11	0.3332	2.563		95.623
12	0.3025	2.327		97.950
13	0.2665	2.050		100.000

Table 4.6 shows that component 1 covers 35.251% of the total variance, while factor 2 covers another 14.303%, thus giving a total variance of 49.554. The three factors together have a total cumulative percentage of 58.453%.

Table 4.6
Total variance explained by each factor for Question 19

Component	*Variance*		
	Variance	% of Variance	Cumulative %
1	4.5826	35.251	35.251
2	1.8593	14.303	49.554
3	1.1569	8.899	58.453

Once the three factors had been identified through total variance and eigenvalue calculations, the next step involved the rotated factor loading. This was calculated statistically and is reflected in Table 4.7. This process provided statistical values for the grouping of the variables. This table presents the factor loading for the three components extracted (variables for each factor are represented in bold). The loading of an item shows the extent to which an individual item "loads" onto a specific factor. All the highest values for a factor were examined and placed into a group. For example, factor 2 includes Q19.1, Q19.2 and Q19.3 because these were the factors with values close to each other and higher than 0.2. A value close to 1 indicates that the items load very highly onto a factor. A factor loading of less than 0.2 cannot be considered and must be omitted and the analysis recalculated. Factors with less than two items cannot be considered. Thus, although there was a potential for three factors, theoretically this table shows that there were two factors only with more than three items. Of the thirteen questions listed, factor 1 included Q19.4, Q19.5, Q19.6, Q19.7, Q19.11, Q19.12 and Q19.13. This fact can be called a potential factor – "Experience of WIL". The name of a factor is usually derived from the content of the questions. Factor 2 includes Q19.1, Q19.2 and Q19.3 and may be called the "Importance of WIL" in an academic institution. The third component has two factors only and could not be interpreted by the analysis.

Question 19 factor 1 is not an ordinal variable anymore but considered continuous. It is a new variable which is the mean of the individual questions in the factor 1. It includes questions (4, 5, 6, 7, 11, 12 and 13). That is why ANOVA was done (as well as T-test for two groups) because the variable was normally distributed (Appendix F).

Table 4.7
Total rotated factor loading for Question 19

	Component		
	1	2	3
Q19.1	0.180925	**0.866568**	-0.017410
Q19.2	0.215562	**0.717615**	0.039969
Q19.3	0.035841	**0.434247**	0.034751
Q19.4	**0.712264**	0.278128	0.171775
Q19.5	**0.364075**	0.110232	-0.017449
Q19.6	**0.749990**	0.090041	0.142721
Q19.7	**0.602946**	0.093068	0.305381
Q19.8	0.020917	0.344647	0.131052
Q19.9	0.241163	0.124968	**0.648977**

Q19.10	0.245087	0.082523	**0.757966**
Q19.11	**0.571914**	0.005715	0.368556
Q19.12	**0.703944**	-0.007494	0.343773
Q19.13	**0.522038**	0.216740	0.358327

The maximum likelihood extraction method was used in Tables 4.7 and 4.8. The rotation involved the Varimax orthogonal method, which indicates which variable loads on each factor after rotation.

Table 4.8
Rotated factor loading for Question 19 – arranged

	Component		
	1	2	3
Q19.4	**0.712264**	0.278128	0.171775
Q19.5	**0.364075**	0.110232	-0.017449
Q19.6	**0.749990**	0.090041	0.142721
Q19.7	**0.602946**	0.093068	0.305381
Q19.11	**0.571914**	0.005715	0.368556
Q19.12	**0.703944**	-0.007494	0.343773
Q19.13	**0.522038**	0.216740	0.358327
Q19.1	0.180925	**0.866568**	-0.017410
Q19.2	0.215562	**0.717615**	0.039969
Q19.3	0.035841	**0.434247**	0.034751
Q19.8	0.020917	0.344647	0.131052
Q19.9	0.241163	0.124968	**0.648977**
Q19.10	0.245087	0.082523	**0.757966**

Factor Analysis – Q21

Similar processes and tests were carried out for Question 21. KMO and Bartlett's tests were conducted. This showed that factor analysis could be carried out because the value was 0.788 which was greater than 0.6.

Table 4.9
KMO and Bartlett's test for Question 21

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.788
Bartlett's Test of Sphericity	Approx. Chi-Square	822.713
	df	55
	Sig.	.000

The principal component analysis results are shown below. These indicate the presence of three principal components with eigenvalues greater than 1. The vectors are also grouped as three principal components.

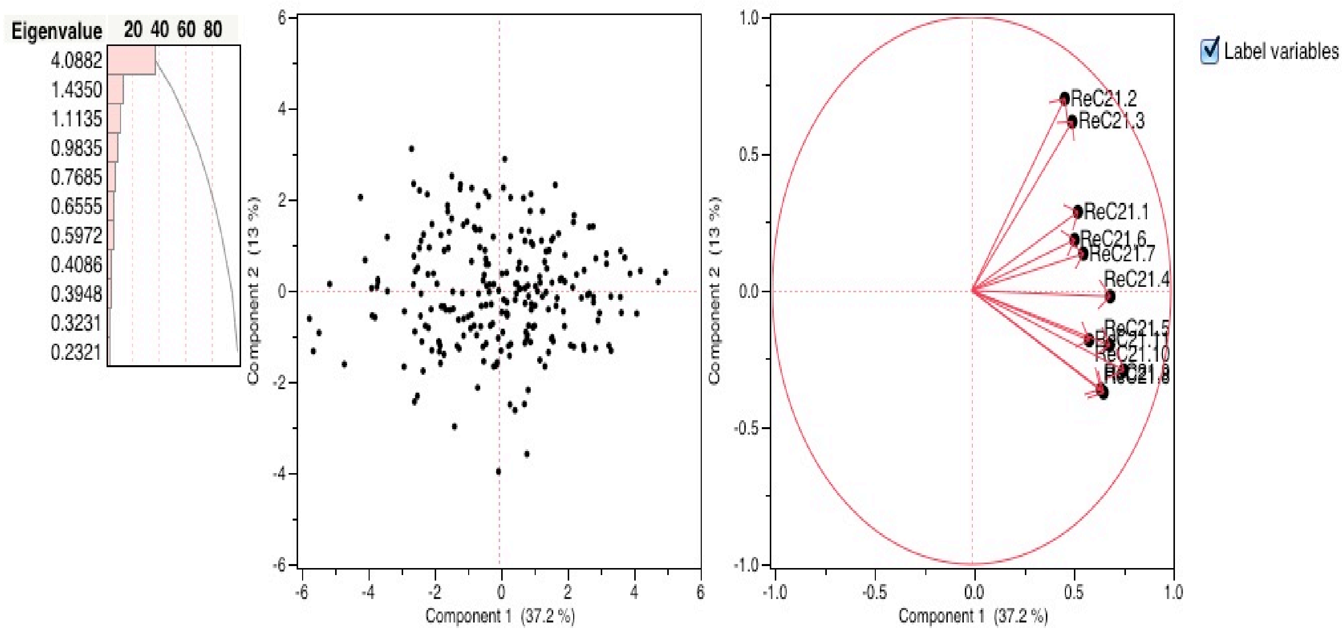


Figure 4.2: Principal component summary plots for Question 21

The communality estimates and eigenvalue data for Question 21 are presented in Tables 4.10 and 4.11 respectively. These tables show the extent to which these variables may be explained by the principal components as discussed in section 3.6. According to Table 4.10, the variables with values near to 1, for example, 21.2, 21.4, 21.5 and 21.10 correlate highly with the rest of the items. Items with low values (such as 21.6) should be reconsidered.

Table 4.10		
Communalities for Question 21		
	Initial	Extraction
Q21.1	1.000	0.25439
Q21.2	1.000	0.69356
Q21.3	1.000	0.45195
Q21.4	1.000	1.00000
Q21.5	1.000	0.60004
Q21.6	1.000	0.19880
Q21.7	1.000	0.25149
Q21.8	1.000	0.45503
Q21.9	1.000	0.50316
Q21.10	1.000	0.69127
Q21.11	1.000	0.31930

Table 4.11

Total variance for Question 21

Component		*Total Variance*		
	Total	*% of Variance*	*% of Variance*	*Cumulative %*
1	4.0882	37.166		37.166
2	1.4350	13.046		50.212
3	1.1135	10.123		60.334
4	0.9835	8.941		69.275
5	0.7685	6.986		76.261
6	0.6555	5.959		82.220
7	0.5972	5.429		87.649
8	0.4086	3.715		91.364
9	0.3948	3.589		94.953
10	0.3231	2.937		97.890
11	0.2321	2.110		100.000

Based on the previous explanation, there are three components with eigenvalues greater than 1 for Question 21 – see Table 4.11. As shown in Table 4.12, the three factors have a total cumulative percentage of 60.334%.

Table 4.12: Total variance explained by each factor for Question 21

Component	*Variance*		
	Variance	% of Variance	Cumulative %
1	4.0882	37.166	37.166
2	1.4350	13.046	50.212
3	1.1135	10.123	60.334

Table 4.13 depicts the total rotated factor for question 21. The rotated factor loading calculation shows the variables represented by the three components. However, one of the factors has only two items (less than three). This is not acceptable statistically, although theoretically correct. The acceptable components were called components 1 and 2.

Table 4.13
Total rotated factor loading for Question 21

	Component		
	1	2	3
Q21.1	0.2118551	0.2636680	**0.3741496**
Q21.2	0.0775775	0.0420525	**0.8281124**
Q21.3	0.1412881	0.1551572	**0.6386845**
Q21.4	0.2040630	**0.9514818**	0.2303056
Q21.5	0.3739357	**0.6694711**	0.1096521
Q21.6	0.3478849	0.0751776	0.2685598
Q21.7	**0.3894004**	0.0920180	0.3023094
Q21.8	**0.6479803**	0.1839413	0.0362817
Q21.9	**0.6759977**	0.1948207	0.0907238
Q21.10	**0.7837376**	0.2291876	0.1565124
Q21.11	**0.5123047**	0.1406265	0.1925399

Table 4.14
Total rotated factor loading for Question 21 -arranged

	Component		
	1	2	3
Q21.7	**0.3894004**	0.0920180	0.3023094
Q21.8	**0.6479803**	0.1839413	0.0362817
Q21.9	**0.6759977**	0.1948207	0.0907238
Q21.10	**0.7837376**	0.2291876	0.1565124
Q21.11	**0.5123047**	0.1406265	0.1925399
Q21.1	0.2118551	0.2636680	**0.3741496**
Q21.2	0.0775775	0.0420525	**0.8281124**
Q21.3	0.1412881	0.1551572	**0.6386845**
Q21.4	0.2040630	**0.9514818**	0.2303056
Q21.5	0.3739357	**0.6694711**	0.1096521
Q21.6	0.3478849	0.0751776	0.2685598

There are two main factors. Factor 1 includes components 21.7, 21.8, 21.9, 21.10 and 21.11, while factor 3 includes 21.1, 21.2 and 21.3. Factor 2 has only two components, 21.4 and 21.5, and could not be interpreted by this analysis. The first factor was titled the “Challenges of inappropriate placement” and the second factor the “Challenges of university support”. The naming of the factors is usually derived from the question the factor represents.

Factor Analysis – Q23

The data for question 23 were analysed. KMO and Bartlett’s test details are presented in Table 4.15.

Table 4.15
KMO and Bartlett's test for Question 23

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.906
	Approx. Chi-Square	1115.147
Bartlett's Test of	df	55
Sphericity	Sig.	.000

The KMO value was extremely close to 1 and was considered as a very good value for factor analysis. The principal component analysis results are shown below. These indicate the presence of two principal components with eigenvalues greater than 1.

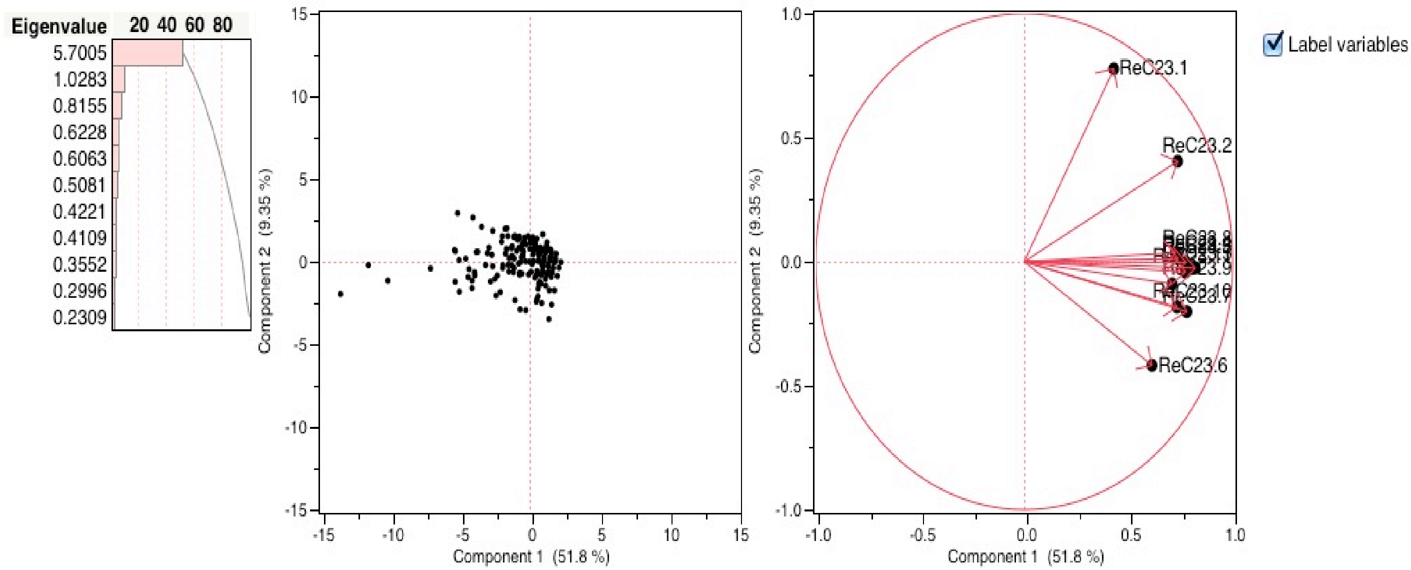


Figure 4.3: Principal component plots for Question 23

The communalities for Question 23 are depicted in Table 4.16.

Table 4.16
Communalities for Question 23

	Initial	Extraction
Q23.1	1.000	0.22116
Q23.2	1.000	1.00000
Q23.3	1.000	0.55037
Q23.4	1.000	0.48740
Q23.5	1.000	0.65975
Q23.6	1.000	0.38046
Q23.7	1.000	0.57335
Q23.8	1.000	0.47489
Q23.9	1.000	0.47298
Q23.10	1.000	0.52717
Q23.11	1.000	0.55740

Table 4.17
Total variance for Question 23

Component	*Total Variance*			
	Total	*% of Variance*	*% of Variance*	*Cumulative %*
Q23.1	5.7005	51.823		51.823
Q23.2	1.0283	9.348		61.171
Q23.3	0.8155	7.414		68.585
Q23.4	0.6228	5.662		74.246
Q23.5	0.6063	5.511		79.758
Q23.6	0.5081	4.619		84.377
Q23.7	0.4221	3.837		88.214
Q23.8	0.4109	3.735		91.949
Q23.9	0.3552	3.229		95.178
Q23.10	0.2996	2.723		97.901
Q23.11	0.2309	2.099		100.000

The two components have a total cumulative percentage of 61.171%.

Table 4.18
Total variance explained by each factor for Question 23

Component	*Variance*		
	Variance	% of Variance	Cumulative %
Factor 1	5.7005	51.823	51.823
Factor 2	1.0283	9.348	61.171

Table 4.19
Total rotated factor loading for Question 23

	Component	
	1	2
Q23.1	0.1726177	**0.4374540**
Q23.2	0.2905449	**0.9568613**
Q23.3	**0.6547624**	0.3487917
Q23.4	**0.6011211**	0.3550463
Q23.5	**0.6437373**	0.4953323
Q23.6	**0.6038190**	0.1259407
Q23.7	**0.6798298**	0.3334341
Q23.8	**0.5882174**	0.3590148
Q23.9	**0.6522659**	0.2180033
Q23.10	**0.6933998**	0.2153281
Q23.11	**0.6726971**	0.3238437

Table 4.20
Total rotated factor loading for Question 23 -arranged

	Component	
	1	2
Q23.3	**0.6547624**	0.3487917
Q23.4	**0.6011211**	0.3550463
Q23.5	**0.6437373**	0.4953323
Q23.6	**0.6038190**	0.1259407
Q23.7	**0.6798298**	0.3334341
Q23.8	**0.5882174**	0.3590148
Q23.9	**0.6522659**	0.2180033
Q23.10	**0.6933998**	0.2153281
Q23.11	**0.6726971**	0.3238437
Q23.1	0.1726177	**0.4374540**
Q23.2	0.2905449	**0.9568613**

One principal factor only for question 23 was identified. The second factor had two components only and could not be used statistically, although theoretically matched well with the results. This factor was titled “Attitudes and skills for WIL”.

4.1.3 Reliability Analysis for Questions 19, 21 and 23

Reliability measures the consistency of a measuring instrument such as a questionnaire. In other words, reliability determines whether the measurements of the same instrument give or are likely to give the same values.

In order to test the reliability of the questionnaire, an item analysis was performed on the questions of a particular dimension/construct/factor in the questionnaire in order to produce Cronbach’s alpha values. The Cronbach’s alpha value generally increases when the correlations between the items (questions) of the measuring instrument increase. For this reason the Cronbach’s alpha value (or coefficient) is also known as the internal consistency of the test. The Cronbach’s alpha can assume values between negative infinity and 1 (although positive values only make sense).

The Cronbach’s alpha values calculated may be interpreted in the following ways:

- For a value above 0.8, reliability is considered to be good.
- For a value between 0.6 and 0.8, reliability is considered to be acceptable.
- For a value below 0.6, reliability is considered to be unacceptable.

It was essential to ensure that all the questions were stated in the same direction (i.e. all positively stated) before conducting the item analysis (also called reliability analysis). If there were negatively stated questions then the specific questions had to be recoded so that they would be in the same direction as the rest of the questions, for example, 1 = 5, 2 = 4, 3 = 3, 4 = 2, 5 = 1.

In the sections below, the Cronbach's alpha value on the top of the output indicates the overall alpha. The Cronbach's alpha values next to each question indicate the Cronbach's alpha value if that item (or question) were excluded from the analysis. Therefore

- if one of the individual Cronbach's alpha values were higher than the overall alpha value, then this item could be excluded from the measuring instrument and the overall alpha value would be increased
- if the individual corrected item-total correlation (the correlation of the individual item with the total) were either negative or extremely low (0.10), then this item could be excluded from the measuring instrument.

Accordingly, if the individual corrected item-total correlation value was lower than the overall Cronbach's alpha value, then the item was retained. In addition, if the individual corrected item-total correlation value were a positive value and above 0.10 then this item could be retained.

Reliability for Question 19

Factor 1 in Qestion 19 includes items such as 19.4, 19.5, 19.6, 19.7, 19.11, 19.12 and 19.13. In order to check the reliability of the results and the factor selection, the overall Cronbach's alpha was calculated for the correlation. The next set of results shows the Cronbach's alpha value when one of the items was excluded. The results are presented in the table below. It emerged that reliability was good with the overall Cronbach's alpha of 0.8390.

Table 4.21
Multivariate correlation for Factor 1 in Question 19

Multivariate

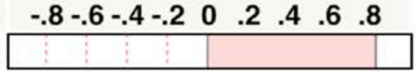
Correlations

	ReC19.4	ReC19.5	ReC19.6	ReC19.7	ReC19.11	ReC19.12	ReC19.13
ReC19.4	1.0000	0.2735	0.6284	0.5509	0.3892	0.5399	0.4749
ReC19.5	0.2735	1.0000	0.2942	0.1733	0.3775	0.1838	0.2127
ReC19.6	0.6284	0.2942	1.0000	0.4714	0.4159	0.5801	0.4672
ReC19.7	0.5509	0.1733	0.4714	1.0000	0.4978	0.5232	0.4505
ReC19.11	0.3892	0.3775	0.4159	0.4978	1.0000	0.6075	0.4531
ReC19.12	0.5399	0.1838	0.5801	0.5232	0.6075	1.0000	0.4925
ReC19.13	0.4749	0.2127	0.4672	0.4505	0.4531	0.4925	1.0000

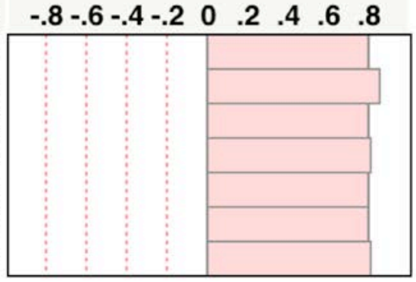
There are 15 missing values. The correlations are estimated by REML method.

Cronbach's α

	α
Entire set	0.8390



Excluded Col	α
ReC19.4	0.8060
ReC19.5	0.8580
ReC19.6	0.8054
ReC19.7	0.8144
ReC19.11	0.8094
ReC19.12	0.8018
ReC19.13	0.8186



The Cronbach Alpha value was calculated for factor 2 in the same way. Factor 2 included items 19.1, 19.2 and 19.3.

Table 4.22

Multivariate correlation for Factor 2 in Question 19

Multivariate

Correlations

	ReC19.1	ReC19.2	ReC19.3
ReC19.1	1.0000	0.6598	0.3601
ReC19.2	0.6598	1.0000	0.3879
ReC19.3	0.3601	0.3879	1.0000

There are 4 missing values. The correlations are estimated by REML method.

Cronbach's α

	α	-.8 -.6 -.4 -.2 0 .2 .4 .6 .8
Entire set	0.7091	

Excluded Col	α	-.8 -.6 -.4 -.2 0 .2 .4 .6 .8
ReC19.1	0.5498	
ReC19.2	0.5201	
ReC19.3	0.7951	

The overall Cronbach's alpha value was 0.7091 which is an acceptable reliability. The results also indicate that, by removing item 19.3, it would be possible to improve reliability but, in that case, there would be two items only left in the group and this was not acceptable. Accordingly, all three items in this factor were retained.

Reliability for Question 21

A similar process was followed for Question 21. There were two acceptable factors only – factor 1 and factor 2. Factor 1 included items 21.7, 21.8, 21.9, 21.10 and 21.11, while factor 2 included items 2.1, 21.2, and 21.3. The reliability analysis which used Cronbach's Alpha is presented in table 4.23.

Table 4.23

Multivariate correlations for factor 1 in question 21

Multivariate

Correlations

	ReC21.7	ReC21.8	ReC21.9	ReC21.10	ReC21.11
ReC21.7	1.0000	0.4329	0.2204	0.3359	0.2672
ReC21.8	0.4329	1.0000	0.4407	0.5212	0.3732
ReC21.9	0.2204	0.4407	1.0000	0.6476	0.3981
ReC21.10	0.3359	0.5212	0.6476	1.0000	0.4648
ReC21.11	0.2672	0.3732	0.3981	0.4648	1.0000

There are 6 missing values. The correlations are estimated by REML method.

Cronbach's α

	α	-.8 -.6 -.4 -.2 0 .2 .4 .6 .8
Entire set	0.7765	

Excluded Col	α	-.8 -.6 -.4 -.2 0 .2 .4 .6 .8
ReC21.7	0.7823	
ReC21.8	0.7199	
ReC21.9	0.7257	
ReC21.10	0.6863	
ReC21.11	0.7535	

The Cronbach's alpha value showed an acceptable value of 0.7765. Similar calculations for factor 2 indicated a value of 0.6531 which was also acceptable but not as strong an association as factor 1.

Table 4.24

Multivariate correlations for factor 2 in question 21

Multivariate

Correlations

	ReC21.1	ReC21.2	ReC21.3
ReC21.1	1.0000	0.3805	0.2253
ReC21.2	0.3805	1.0000	0.5452
ReC21.3	0.2253	0.5452	1.0000

There are 6 missing values. The correlations are estimated by REML method.

Cronbach's α

	α
Entire set	0.6531

Excluded Col	α
ReC21.1	0.7053
ReC21.2	0.3677
ReC21.3	0.5509

Reliability for question 23

The calculation of reliability for question 23 factor 1 showed an extremely good result – a Cronbach's alpha of 0.9031 (see table 4.25).

Table 4.25

Multivariate correlations for factor 1 in question 23

Multivariate

Correlations

	ReC23.3	ReC23.4	ReC23.5	ReC23.6	ReC23.7	ReC23.8	ReC23.9	ReC23.10	ReC23.11
ReC23.3	1.0000	0.6070	0.5915	0.4532	0.5605	0.4829	0.5172	0.5287	0.4997
ReC23.4	0.6070	1.0000	0.5603	0.4445	0.5276	0.4686	0.4520	0.5538	0.5489
ReC23.5	0.5915	0.5603	1.0000	0.4964	0.6442	0.5121	0.4624	0.5541	0.6293
ReC23.6	0.4532	0.4445	0.4964	1.0000	0.5787	0.2773	0.3613	0.3969	0.4201
ReC23.7	0.5605	0.5276	0.6442	0.5787	1.0000	0.5466	0.5232	0.4739	0.5086
ReC23.8	0.4829	0.4686	0.5121	0.2773	0.5466	1.0000	0.5501	0.5272	0.5597
ReC23.9	0.5172	0.4520	0.4624	0.3613	0.5232	0.5501	1.0000	0.5369	0.5403
ReC23.10	0.5287	0.5538	0.5541	0.3969	0.4739	0.5272	0.5369	1.0000	0.5615
ReC23.11	0.4997	0.5489	0.6293	0.4201	0.5086	0.5597	0.5403	0.5615	1.0000

There are 6 missing values. The correlations are estimated by REML method.

Cronbach's α

	α	-.8 -.6 -.4 -.2 0 .2 .4 .6 .8
Entire set	0.9031	

Excluded Col	α	-.8 -.6 -.4 -.2 0 .2 .4 .6 .8
ReC23.3	0.8900	
ReC23.4	0.8911	
ReC23.5	0.8873	
ReC23.6	0.9014	
ReC23.7	0.8887	
ReC23.8	0.8947	
ReC23.9	0.8947	
ReC23.10	0.8917	
ReC23.11	0.8902	

The second factor included two items of 23.1 and 23.2 only which was difficult to interpret because of the fact that they were two items only. However, theoretically they had a close relationship. The details of the reliability for the second factor are presented in table 4.26

Table 4.26

Multivariate correlations for factor 2 in question 23

Multivariate

Correlations

	ReC23.1	ReC23.2
ReC23.1	1.0000	0.4674
ReC23.2	0.4674	1.0000

There are 2 missing values. The correlations are estimated by REML method.

Cronbach's α

	α	-.8 -.6 -.4 -.2 0 .2 .4 .6 .8
Entire set	0.6227	

Excluded Col	α	-.8 -.6 -.4 -.2 0 .2 .4 .6 .8
ReC23.1	.	
ReC23.2	.	

This factor has an acceptable overall correlation of 0.6227, but included two items only. Accordingly, question 23 had one main factor with the items 23.3 to 23.11 only and was considered as "Attitudes and skills for WIL".

In conclusion, after examining the results of factor loading and Cronbach's alpha, it was possible to choose two factors for question 19 which would include the following questions:

- *Factor 1* included Q19.4, Q19.5, Q19.6, Q19.7, Q19.11, Q19.12 and Q19.13. It was titles as "Experience of WIL".
- *Factor 2* included Q19.1, Q19.2 and Q19.3. It was titles as "Importance of WIL".

In the same manner, based on the data obtained from the statistical analysis, two reliable factors for question 21 were found and were categorised as follows:

- *Factor 1* included Q21.7, Q21.8, Q21.9, Q21.10, and Q21.11. It was titled as a factor related to "Challenges of inappropriate placement".
- *Factor 2* included Q21.1, Q21.2, and Q21.3. It was titled as factor related to "Challenges of university support".

For question 23, one main factor was identified and it included the following questions:

- *Factor 1* included Q23.3, Q23.4, Q23.5, Q23.6, Q23.7, Q23.8, Q23.9, Q23.10 and Q23.11. It signified the “Attitudes and skills for WIL”

After examining the results the descriptive statistics which emerged are presented in Table 4.27.

Table 4.27
Descriptive statistics AFTER examining the results

	N	Mean	StdDev	Min	Max
Q19 Factor1: 4,5,6,7,11,12,13	250	3.69	0.81	1.57	5.00
Q19 Factor2: 1,2,3	251	4.42	0.72	1.00	5.00
Q21 Factor1: 7-11	240	3.16	0.87	1.00	5.00
Q21 Factor2: 1-3	241	3.33	0.95	1.00	5.00
Q23 Factor1: 3-11	232	4.31	0.61	1.11	4.89
Q23 Factor2: 1-2	232	4.54	0.67	1.00	5.00

1. Most of the respondents answered the questions pertaining to Factor1_Q19 as more “often” than “sometimes” but not as often as “often”.
2. Most of the respondents answered the questions pertaining to Factor 2_Q19 as more often than “often” but not as often as “almost always”.
3. Most of the respondents answered the questions pertaining to Factor 1_Q21 as “sometimes”.
4. Most of the respondents answered the questions pertaining to Factor 2_Q21 as slightly more than “sometimes”.
5. Most of the respondents answered the questions pertaining to Factor 1_Q23 as slightly more than “often” but not as often as “almost always”.

The standard deviation was fairly low relative to the mean; thus indicating a low variation in the agreement among the sub-constructs.

4.1.4 Analysing Likert Data in Combination with Other Questions

The information provided in section 3.6 revealed the difference between Likert-type and Likert scale data and provided recommendations for the descriptive statistics to be used during analysis. According to the differences explained, questions 19, 21 and 23 were Likert scale, while questions 24 to 29 were Likert-type data.

Likert scale data were analysed using the interval measurement scale and a composite score was created from the four or more Likert-type items. Accordingly, the composite score for the Likert scales was analysed using the interval measurement scale.

The descriptive statistics recommended for this process include the mean for central tendency, the standard deviation for variability, as well as Pearson's r, t-test, ANOVA and the regression procedure. For the Likert-type data, which fall in the ordinal measurement scale, the descriptive statistics recommended include the mode or median for central tendency and frequencies for variability. Additional forms of analysis, appropriate for ordinal scale items, include the chi-square measure of association, Kendall tau B, and Kendall tau C.

Nonparametric test was used when the variable was not normally distributed and ANOVA could not be used. Nonparametric test is NOT the usual Chi-square test. It is called the Kruskall Wallis test (more than two groups) or Wilcoxon test (2 groups) with the Chi-Square approximation.

Comparing the factors in the Likert-type questions with some of the other questions produced the following results.

QUESTION 19

4.1.4.1 Comparison of Question 19 – Factor_1_ Mean with Question 10

Factor 1 in question 19 was considered as a combination of the 19.4, 19.5, 19.6, 19.7, 19.11, 19.12, and 19.13 items. It represented "Experience of WIL". The Y-axis was used for Q19_factor1_ mean and the X-axis for question 10 which asked "What was your expectation of work integrated learning". Comparison graphs were drawn. The details of this analysis are contained in Appendix H, while a summary is reflected in Table 4.28. The *p*-value was smaller than 0.05 for question 10.3 only and indicated that the various expectations of students as regards the WIL had had no effect on their satisfaction with the WIL experience **except** for the expectation 10.3, namely, "To develop employment skills such as communication, team work and problem solving". Respondents who answered "yes" had a higher mean than those that answered "no". This is an indication that satisfaction with the WIL experience was dependent only on the students' expectation of "Developing employment skills such as communication, team work and problem solving".

Table 4.28
One-way test, Chi square (χ^2) approximation Q19_factor 1 with Q10

Question no.	Chi Square(χ^2)	DF	Prob>ChiSq(χ^2)
Q10.1	0.7177	1	0.3969
Q10.2	1.3219	1	0.2503
Q10.3	6.2282	1	0.0126*
Q10.4	0.0156	1	0.9006
Q10.5	0.0044	1	0.9472

4.1.4.2 Comparison of Question 19 – Factor_1_Mean with Question 11

In this section each factor represented a few items. The mean of factor 1 of question 19 which represented "Experience of WIL" was compared with question 11 which was related to the presence or absence of a mentor. The Y-axis was used for the Q19_factor1_ mean and the X-axis for question 11.

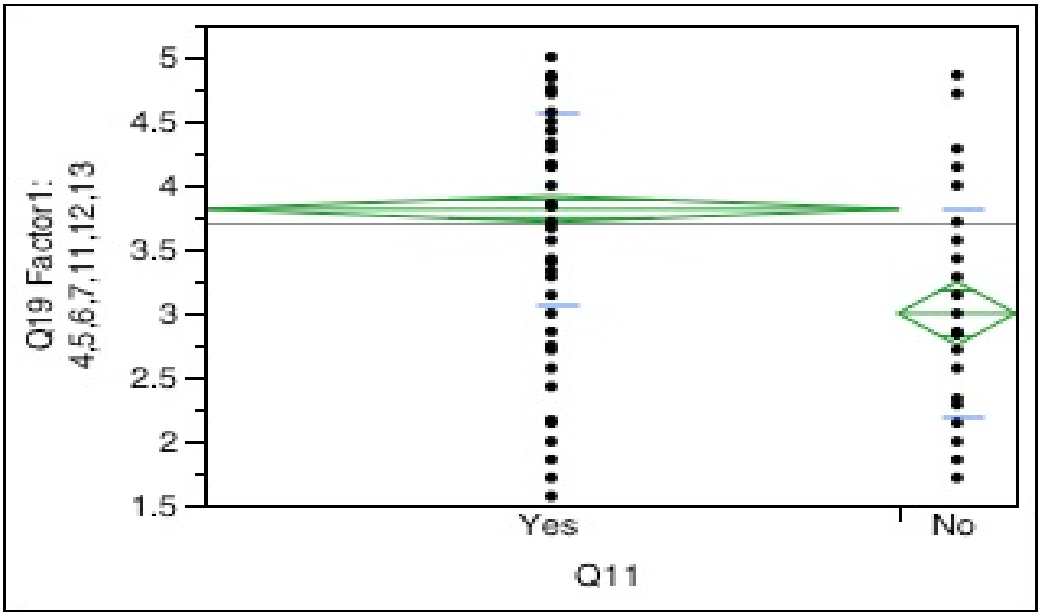


Figure 4.4: Fit Y by X group – one-way analysis of Q19_factor1_mean by Q11

Appendix F (F1) contains the details of the one-way ANOVA summary of fit, t-test, analysis of variance, means for one-way ANOVA, one-way test, chi-square (χ^2) approximation, tests that variances are equal, and Welch's test. The summary of the results is presented in Tables 4.29, 4.30 and 4.31. It emerged from the results that the Pearson chi-square value, which gives the *p*-value, was 0.0001.

Table 4.29
Analysis of variance for Q19_factor1 by Q11

Source	*DF*	*Sum of Squares*	*Mean Squares*	*F Ratio*	*Prob > F*
Q11	1	20.45153	20.4515	35.8921	<.0001*
Error	247	140.74190	0.5698		
C. Total	248	161.19343			

Table 4.30
Means for one-way ANOVA for Q19_factor1 by Q11

Level	*Number*	*Mean*	*Std Error*	*Lower 95%*	*Upper 95%*
Yes	213	3.81559	0.05172	3.7137	3.9175
No	36	3.00066	0.12581	2.7529	3.2485

Table 4.31
One-way rest, chi-square (χ^2) approximation Q19_factor1 _mean by Q11

Chi Square(χ^2)	*DF*	*Prob>ChiSq(χ^2)*
27.7750	1	<.0001*

Since the *p*-value was smaller than 0.05 (>.0001), there were significant differences between the mean scores of factor 1 of question 19 and those persons who had either had a mentor or not. Thus, statistically significant differences existed between the mean scores. This, means that persons who had a mentor (mean = 3.81559) scored higher for Q19_factor1 than those persons who had not had a mentor (mean = 3.00066). Thus, satisfaction with the "WIL experience" was dependent on either having a mentor or not.

4.1.4.3 Comparison of Question 19_Factor_1_Mean with Question 12

Question 19 factor 1, Satisfaction with the "WIL experience", was compared with question 12 which asked "Did you have a supervisor in the university for WIL period?" The Y-axis was used for the Q19_factor1_ mean and the X-axis for question 12.

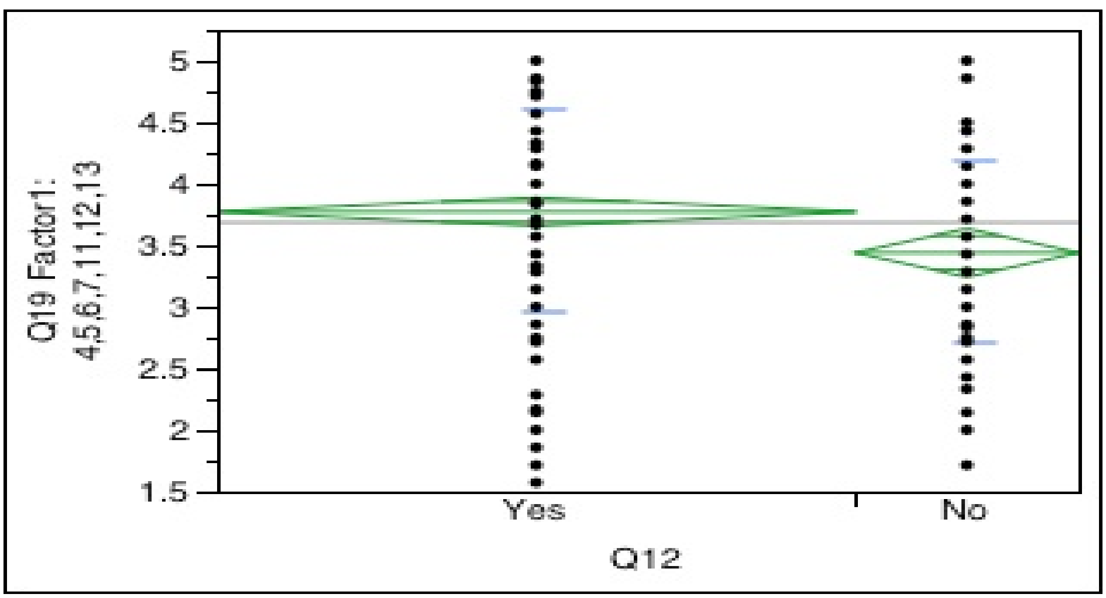


Figure 4.5: Fit Y by X group – one-way analysis of Q19_factor1_mean by Q12

The details of the analysis are contained in Appendix F1.2 and the summary is presented in

Tables 4.32, 4.33 and 4.34.

Table 4.32
Analysis of variance for Q19_factor1 by Q12

Source	*DF*	*Sum of Squares*	*Mean Squares*	*F Ratio*	*Prob > F*
Q12	1	5.27945	5.27945	8.2396	0.0045*
Error	245	156.98174	0.64074		
C. Total	246	162.26120			

Table 4.33
Means for one-way ANOVA for Q19_factor1 by Q12

Level	*Number*	*Mean*	*Std Error*	*Lower 95%*	*Upper 95%*
Yes	183	3.77322	0.05917	3.6567	3.8898
No	64	3.43955	0.10006	3.2425	3.6366

Table 4.34
One-way test, chi-square approximation for Q19_factor1 by Q12

Chi Square(X^2)	*DF*	*Prob>ChiSq(X^2)*
9.8446	1	0.0017*

Since the *p*-value was smaller than 0.05 (>.0017), there were significant differences between the mean scores of factor 1 of question 19 and those persons who either had a supervisor at the university or not. Thus, there were statistically significant differences between the mean scores. This, means that those persons who had had a supervisor (mean = 3.77322) had scored higher for Q19_factor1 than those persons who had not had a supervisor (mean = 3.43955). This is indicative of the dependency of satisfaction with "Experience of WIL" on either the presence or absence of a supervisor.

4.1.4.4 Comparison of Question 19- Factor_1_Mean with Question 13

Question 19_factor_1 was compared with question 1 which related to the presence or absence of a curriculum. The Y-axis was used for the Q19_factor1_ mean and the X-axis for question 13. The details are contained in Appendix F (F1.3) and the summaries are presented in Tables 4.35, 4.36, and 4.37.

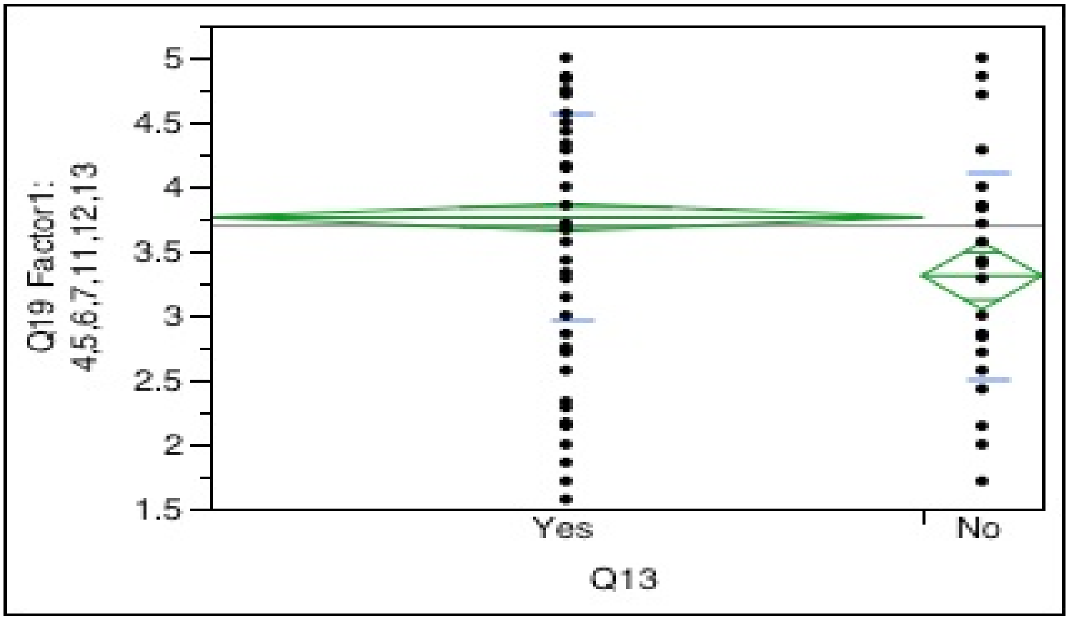


Figure 4.6: Fit Y by X group – one-way analysis of Q19_factor1_mean by Q13

Table 4.35
Analysis of variance for Q19_factor1 by Q13

Source	*DF*	*Sum of Squares*	*Mean Squares*	*F Ratio*	*Prob > F*
Q13	1	6.33785	6.33785	10.0049	0.0018*
Error	247	156.46805	0.63347		
C. Total	248	162.80590			

Table 4.36
Means for one-way ANOVA for Q19_factor1 by Q13

Level	*Number*	*Mean*	*Std Error*	*Lower 95%*	*Upper 95%*
Yes	213	3.76107	0.05453	3.6537	3.8685
No	36	3.30741	0.13265	3.0461	3.5687

Table 4.37
One-way rest, chi-square (X^2) approximation for Q19_factor1 by Q13

Chi Square(X^2)	*DF*	*Prob>ChiSq(X^2)*
11.0620	1	0.0009*

The *p*-value was smaller than 0.05 (<.0009), indicating that there were significant differences between the mean scores of factor 1 of question 19 and those respondents who had either had a curriculum/syllabus or not. Thus, there were statistically significant differences between the mean scores. This means that those persons who had had a curriculum (mean = 3.76107) had scored higher for Q19_factor1 than those persons who had had no curriculum (mean =3.30741). This, in turn, is indicative of the fact that satisfaction with the "WIL experience" is dependent on the presence or absence of a curriculum.

4.1.4.5 Comparison of Question 19_Factor_1_Mean with Question 17

In this section, the question 19 factor 1 is compared with question 17 which asked "How long did you need to complete the curriculum?" The Y-axis was used for the Q19_factor1_ mean and the X-axis for question 17. The details are contained in Appendix F (F1.4) and the summaries are depicted in Figure 4.7 and Tables 4.38, 4.39 and 4.40.

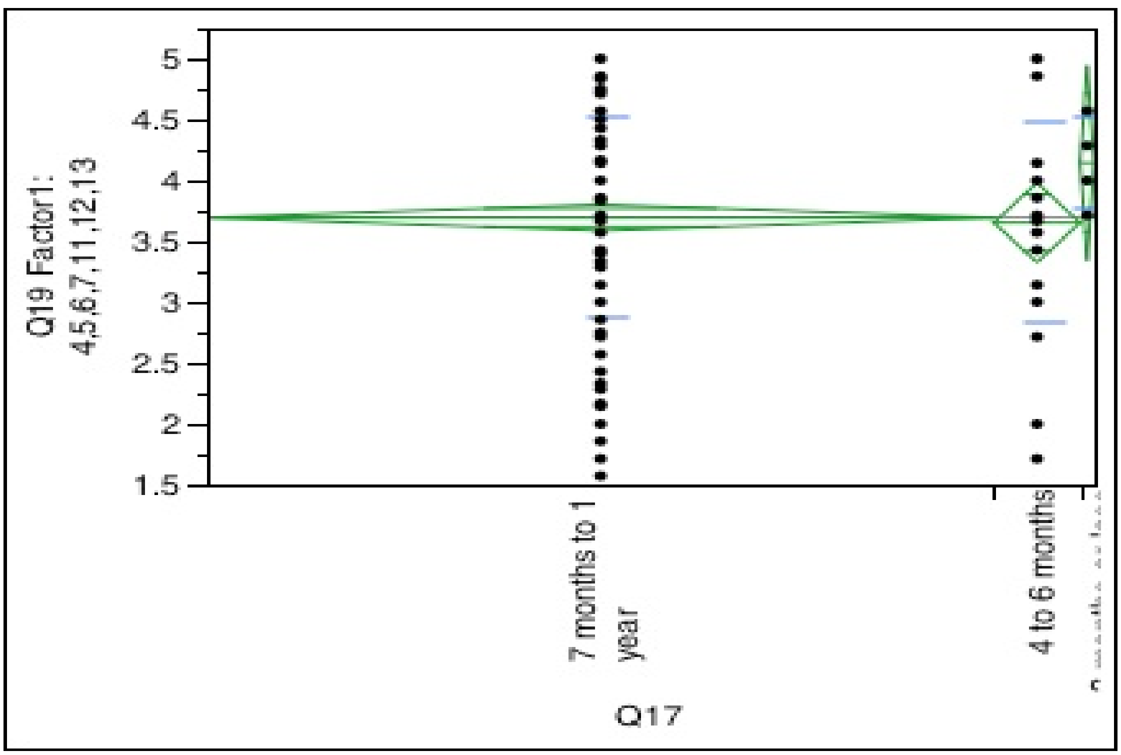


Figure 4.7: Fit Y by X group – one way analysis of Q19_factor1_mean by Q17

Table 4.38
Analysis of variance for Q19_factor1 by Q17

Source	***DF***	***Sum of Squares***	***Mean Squares***	***F Ratio***	***Prob > F***
Q17	2	0.84329	0.421645	0.6345	0.5311
Error	244	162.14573	0.664532		
C. Total	246	162.98902			

Table 4.39
Means for one-way ANOVA for Q19_factor1 by Q17

Level	***Number***	***Mean***	***Std Error***	***Lower 95%***	***Upper 95%***
7 months to 1 year	219	3.69453	0.05509	3.5860	3.8030
4 to 6 months	24	3.65278	0.16640	3.3250	3.9805
3 months or less	4	4.14286	0.40759	3.3400	4.9457

Table 4.40
One-way rest, chi-square (X^2) approximation for Q19_factor1 by Q17

Chi Square (X^2)	***DF***	***Prob>ChiSq (X^2)***
1.5951	2	0.4504

Welch’s test, as well as Levene’s test, showed a value greater than 0.05. As the *p*-value was greater than 0.05, there were therefore no significant differences between the mean scores of factor 1 of question 19, satisfaction with the WIL experience and those persons who had required different time periods to complete their WIL. This was specifically the case for the first two options of “7 months to 1 year” and “4 to 6 months”. Thus, no statistically significant differences exist between the mean scores for the different options and, specifically, for the two options of “7 months to 1 year” (mean = 3.69453) and “4 to 6 months” (mean = 3.65278) and satisfaction with the “Experience of WIL”. However, it must be borne in mind that all the respondents in this study had had a one-year period for their WIL.

4.1.4.6 Comparison of Question 19 – Factor_2_Mean with Question 10

Question 19 factor 2 represents the “Importance of WIL”, while question 10 enquired into the respondents’ expectations of their WIL. These two questions were compared statistically. The Y-axis was used for the Q19_factor 2_ mean and the X-axis for question

10. Graphs were drawn for each of these sub-questions. The details of this analysis are contained in Appendix H (H1–H5). A summary of the analysis is presented in Table 4.41 and indicates that the various expectations which the students had of WIL had had no effect on the "Importance of WIL".

Table 4.41
One-way test, chi-square (χ^2) approximation for Q19_factor 2 with Q10

Question No.	*Chi Square (χ^2)*	*DF*	*Prob>Chi Square (χ^2)*
Q10.1	1.7306	1	0.1883
Q10.2	1.1756	1	0.2782
Q10.3	1.6297	1	0.2017
Q10.4	1.1589	1	0.2817
Q10.5	3.6162	1	0.0572

4.1.4.7 Comparison of Question 19 – Factor_2_Mean with Question 11

Question 19 factor 2 was compared with question 11. The Y-axis was used for the Q19_factor 2_ mean and the X-axis for question 11. The details are contained in appendix F (F2.1). Question 19 factor 2 represents the "Importance of WIL" while question 11 asked "Did you have mentors in the work place?". The results are presented in Tables 4.42, 4.43 and 4.44.

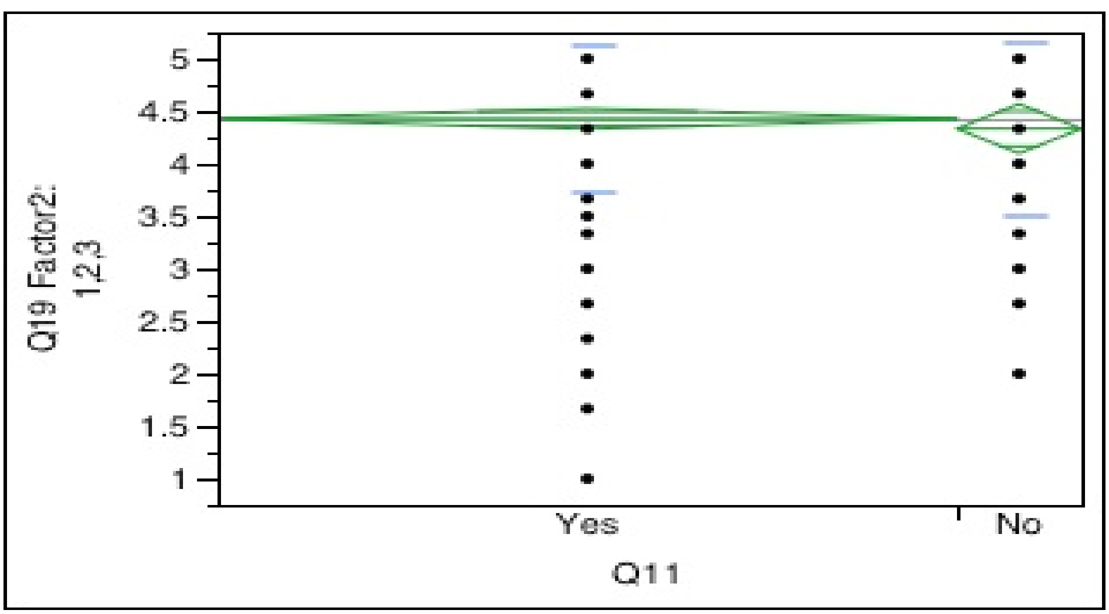


Figure 4.8: **Fit Y by X group – one way analysis of Q19_factor2_mean by Q11**

Table 4.42
Analysis of variance for Q19_factor2 by Q11

Source	*DF*	*Sum of Squares*	*Mean Squares*	*F Ratio*	*Prob > F*
Q11	1	0.27821	0.278206	0.5394	0.4634
Error	248	127.90135	0.515731		
C. Total	249	128.17956			

Table 4.43
Means for one-way ANOVA for Q19_factor2 by Q11

Level	*Number*	*Mean*	*Std Error*	*Lower 95%*	*Upper 95%*
Yes	214	4.42835	0.04909	4.3317	4.5250
No	36	4.33333	0.11969	4.0976	4.5691

Table 4.44
One-way test, chi-square (χ^2) approximation for Q19_factor2 by Q11

Chi Square(χ^2)	*DF*	*Prob>ChiSq (χ^2)*
0.0367	1	0.8480

Since the *p*-value was greater than 0.05 (<.8480), there are no significant differences between the mean scores of factor 2 of question 19 and whether or not the respondents had had a mentor in the industry. Thus, there are no statistically significant differences between the mean scores. This means those persons who had had a mentor (mean = 4.42835) had scored only slightly higher for Q19_factor 2 than those persons who had had no mentor (mean = 4.33333). This indicates that, statistically, the “Importance of WIL” is not dependent on either the presence or absence of a mentor.

4.1.4.8 **Comparison of Question 19 – Factor_2_Mean with Question 12**

Question 19 factor 2 was compared with question 12 which related to the presence or absence of a supervisor. The Y-axis was used for the Q19_factor 2_ mean and the X-axis for question 12. The details are contained in Appendix F (F2.2) and summary is presented in Tables 4.45, 4.46 and 4.47.

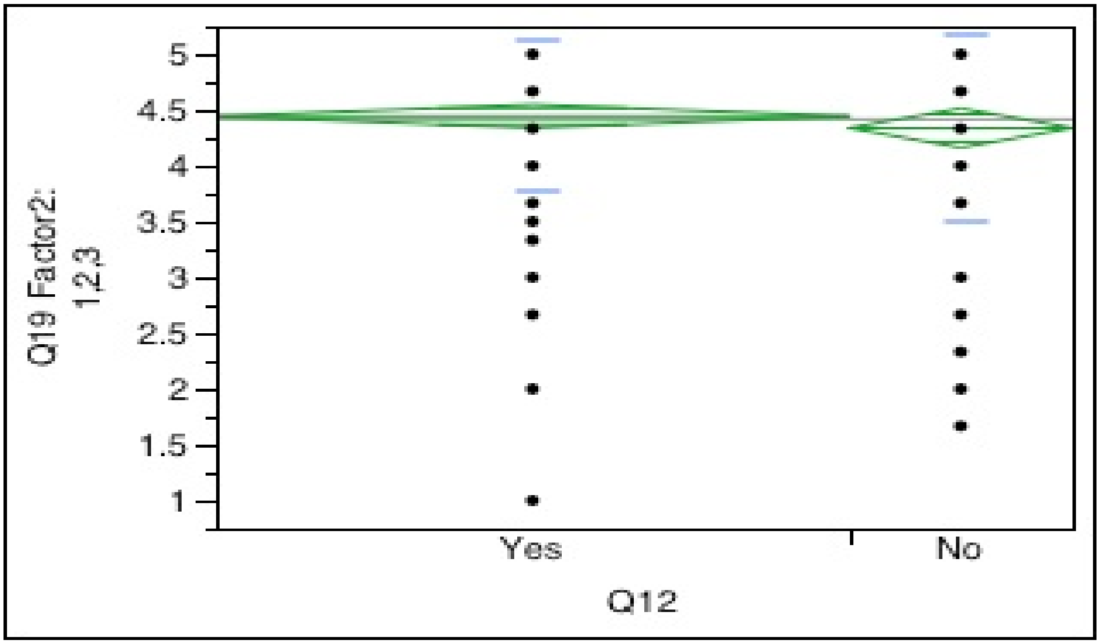


Figure 4.9: Fit Y by X group – one-way analysis of Q19_factor2_mean by Q12

Table 4.45
Analysis of variance for Q19_factor2 by Q12

Source	*DF*	*Sum of Squares*	*Mean Squares*	*F Ratio*	*Prob > F*
Q12	1	0.53338	0.533384	1.0299	0.3112
Error	247	127.91798	0.517887		
C. Total	248	128.45136			

Table 4.46
Means for One-way ANOVA for Q19_factor2 by Q12

Level	*Number*	*Mean*	*Std Error*	*Lower 95%*	*Upper 95%*
Yes	184	4.44384	0.05305	4.3393	4.5483
No	65	4.33846	0.08926	4.1627	4.5143

Table 4.47
1-way Test, Chi Square(χ^2)Approximation Q19_factor2 by Q12

Chi Square (χ^2)	*DF*	*Prob>ChiSq (χ^2)*
0.1991	1	0.6555

Since the *p*-value was greater than 0.05 (<.6555), there were no significant differences between the mean scores of the factor 2 of question 19 (Importance of WIL) and those persons who had had a supervisor in the university or not. Thus, there are no statistically significant differences between the mean scores. This means that those persons who had had a supervisor (mean = 4.44384) had scored only slightly higher for the Q19_factor 2 than those persons who had had a supervisor (mean = 4.33846). Accordingly, it would not appear that the “Importance of WIL” is dependent on either the presence or absence of a supervisor.

4.1.4.9 Comparison of Question 19 – Factor_2 _Mean with Question 13

The question 19 factor 2 was compared with question 13 which related to the presence or absence of a curriculum. The Y-axis was used for the Q19_factor 2_ mean and the X-axis for question 13. The details of the calculation are contained in Appendix F (F2.3) and the summary is presented in Tables 4.48, 4.49 and 4.50.

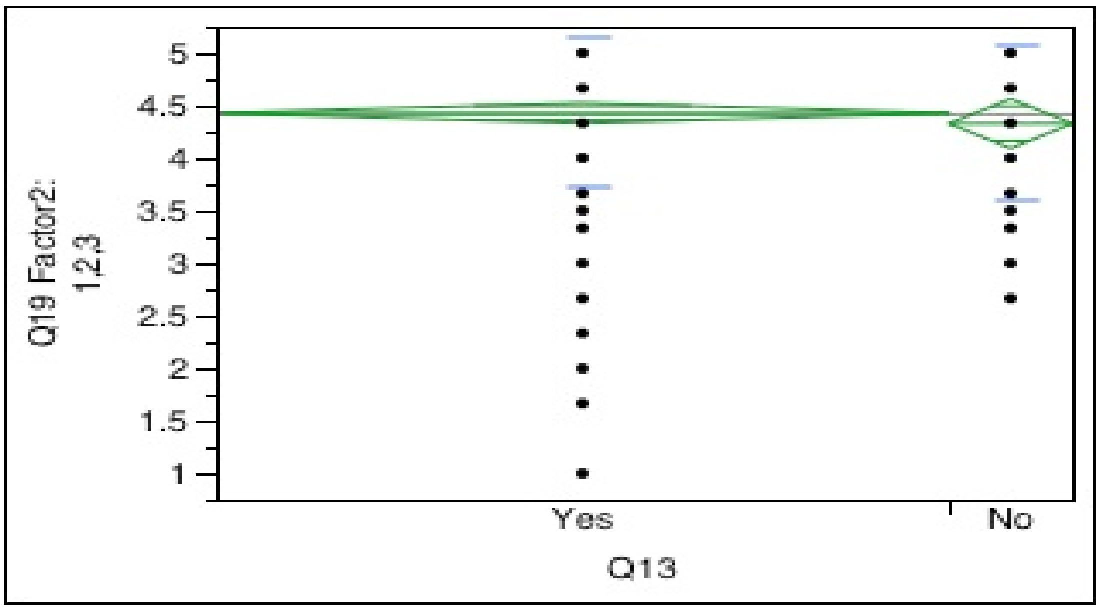


Figure 4.10: Fit Y by X group – one-way analysis of Q19_factor2_mean by Q13

Table 4.48
Analysis of variance for Q19_factor2 by Q13

Source	*DF*	*Sum of Squares*	*Mean Squares*	*F Ratio*	*Prob > F*
Q13	1	0.31078	0.310779	0.6028	0.4383
Error	248	127.86878	0.515600		
C. Total	249	128.17956			

Table 4.49
Means for one-way ANOVA for Q19_factor2 by Q13

Level	*Number*	*Mean*	*Std Error*	*Lower 95%*	*Upper 95%*
Yes	214	4.42913	0.04909	4.3325	4.5258
No	36	4.32870	0.11968	4.0930	4.5644

Table 4.50
One-way test, chi-square (X^2) approximation for Q19_factor2 by Q13

Chi Square (X^2)	*DF*	*Prob>ChiSq (X^2)*
0.7957	1	0.3724

Since the *p*-value was greater than 0.05 (< .3724), there were no significant differences between the mean scores of factor 2 of question 19 and those persons who had either had a curriculum/syllabus for WIL or not. Thus, there are no statistically significant differences between the mean scores and, therefore, it would appear that the “Importance of WIL” is not dependent on either the presence or absence of a curriculum.

4.1.4.10 Comparison of Question 19 – Factor_2_Mean with Question 17

The question 19 factor 2 was compared with question 17 which related to the period of WIL required for the completion of the curriculum. The Y-axis was used for the Q19_factor 2_ mean and the X-axis for question 17. The details are contained in appendix F (F2.4) and the summary is presented in Tables 4.51, 4.52 and 4.53.

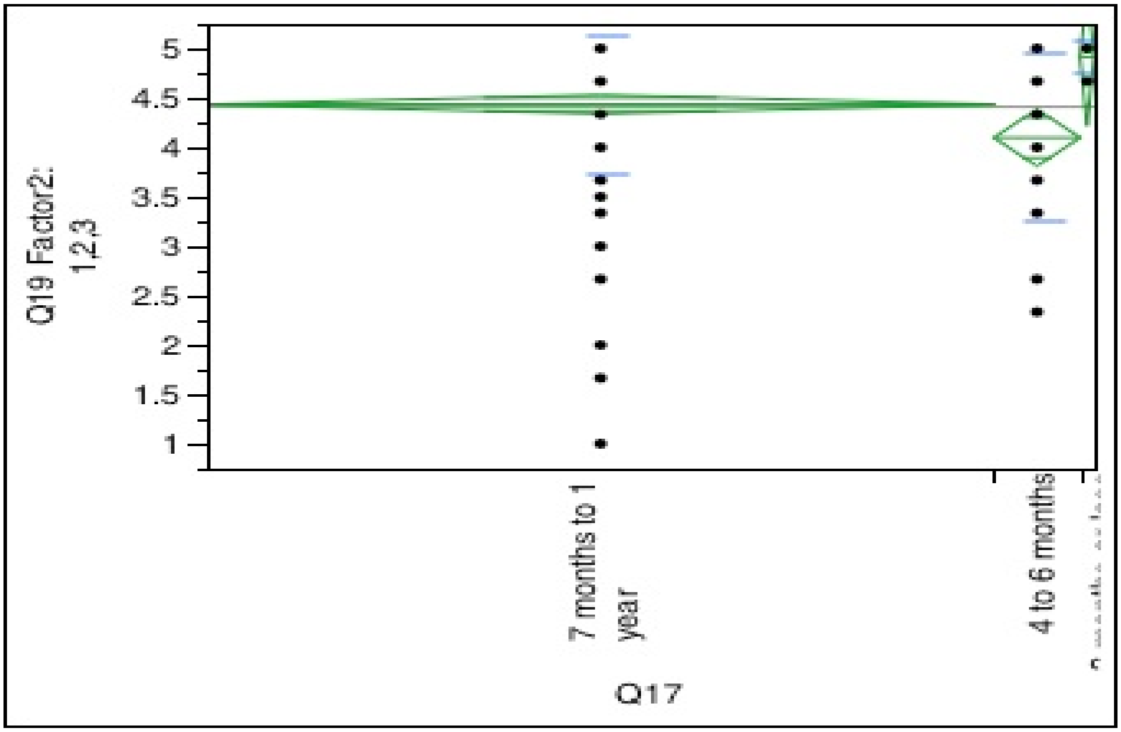


Figure 4.11: Fit Y by X group – one-way analysis of Q19_factor2_mean by Q17

Table 4.51
Analysis of variance for Q19_factor2 by Q17

Source	*DF*	*Sum of Squares*	*Mean Squares*	*F Ratio*	*Prob > F*
Q17	2	3.51506	1.75753	3.4593	0.0330*
Error	244	123.96785	0.50806		
C. Total	246	127.48291			

Table 4.52
Means for one-way ANOVA for Q19_factor2 by Q17

Level	*Number*	*Mean*	*Std Error*	*Lower 95%*	*Upper 95%*
7 months to 1 year	219	4.43531	0.04817	4.3404	4.5302
4 to 6 months	24	4.09722	0.14550	3.8106	4.3838
3 months or less	4	4.91667	0.35639	4.2147	5.6187

Table 4.53
One-way test, chi-square (χ^2) approximation for Q19_factor2 by Q17

Chi Square (χ^2)	*DF*	*Prob>ChiSq (χ^2)*
6.4321	2	0.0401*

The Welch test also showed a value of 0.0007. Since the *p*-value was smaller than 0.05, there are significant differences between the mean scores of factor 2 of question 19

(Importance of WIL) and the period of the WIL. Thus, there are statistically significant differences between the mean scores and, therefore the importance of WIL is dependent on the period of the WIL. The lowest mean was found in the period of four to six months.

QUESTION 21

4.1.4.11 Comparison of Question 21 – Factor_1_Mean with Question 9

Question 21 factor 1 included items 7 to 11 and represented the "Challenges of inappropriate placement" while question 9 related to the various types of employment (contract/permanent/placement) during the WIL period. The Y-axis was used for the Q21_factor 1_ mean and the X-axis for question 9. The details are contained in appendix F (F3.1) and the summary is presented in Tables 4.54, 4.55 and 4.56.

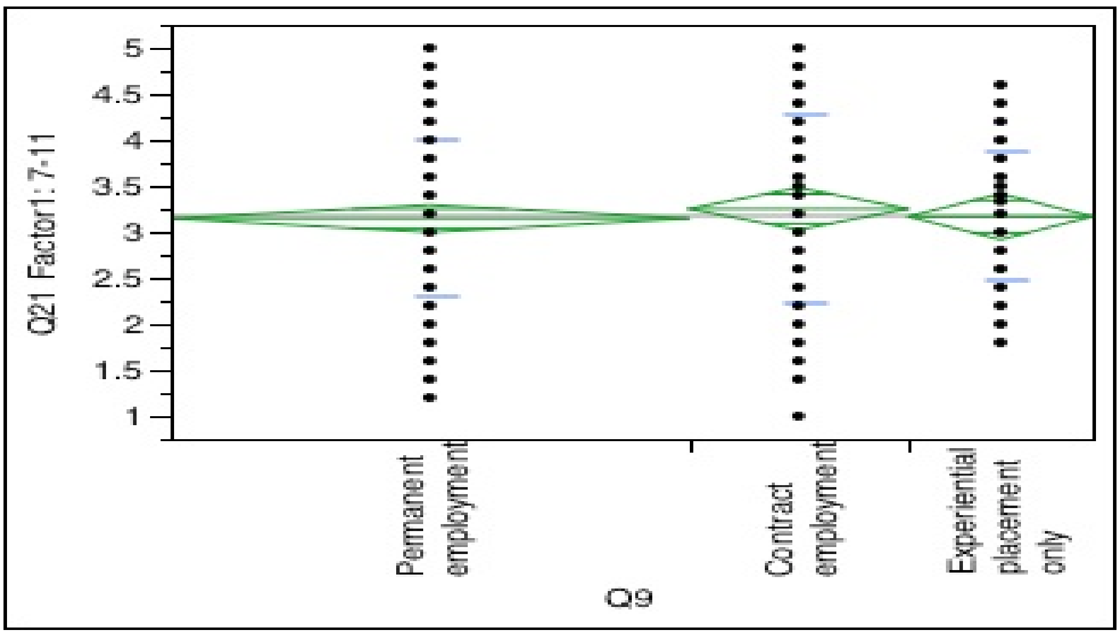


Figure 4.12: Fit Y by X group – one-way analysis of Q21_factor1_mean by Q9

Table 4.54
Analysis of variance for Q21_factor1_mean by Q9

Source	*DF*	*Sum of Squares*	*Mean Squares*	*F Ratio*	*Prob > F*
Q9	2	0.44867	0.224335	0.2989	0.7419
Error	232	174.12265	0.750529		
C. Total	234	174.57132			

Table 4.55
Means for one-way ANOVA for Q21_factor 1 by Q9

Level	*Number*	*Mean*	*Std Error*	*Lower 95%*	*Upper 95%*
Permanent employment	132	3.14545	0.07540	2.9969	3.2940
Contract employment	56	3.25179	0.11577	3.0237	3.4799
Experiential placement only	47	3.16667	0.12637	2.9177	3.4156

Table 4.56
One-way test, chi-square (χ^2) approximation for Q21_factor 1 by Q9

Chi Square (χ^2)	*DF*	*Prob>ChiSq (χ^2)*
0.6741	2	0.7139

The *p*-value was greater than 0.05 (< .7139).This means there are no significant differences between the mean scores of factor 1 of question 21 and those persons who had either had permanent employment or not. Thus, there are no statistically significant differences between the mean scores. This means that the scores of those persons who had had permanent employment (mean = 3.14545) were extremely close to the scores of those persons who had had either contract employment (mean = 3.25179) or experiential placement (mean = 3.16667). Accordingly, the challenges of inappropriate placement are not dependent on the type of employment (permanent/contract/placement). Nonparametric comparisons for each pair using the Wilcoxon method were also carried out. The *p*-values did not show any significant differences. The details are contained in Appendix F (F3).

4.1.4.12 Comparison of Question 21 – Factor_1_Mean with Question 14

The question 21 factor 1 represented the "Challenges of inappropriate placement" while question 14 related to the options for improved training during the WIL period. These two variables were compared for different options. The Y-axis was used for the Q21_factor 1_ mean and the X-axis for the various options listed in question 14. The summary of the calculation is presented below with a summary discussion at the end of this section. The details are contained in Appendix G. Only the fit of Y by X group-one-way analysis of Q21_factor1_mean by Q14 and the *p*-value is included here.

Q14.1

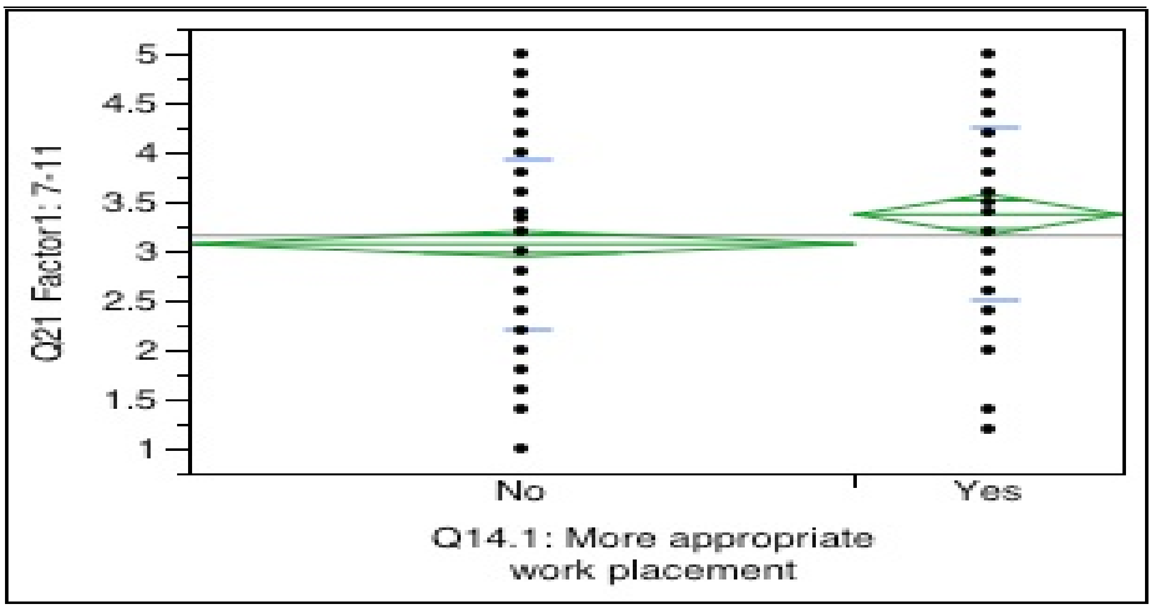


Figure. 4.13: Fit Y by X Group- One-way Analysis of Q21_factor1_mean by Q14.1

Table 4.57

One-way test, chi-square (χ^2) approximation for Q21_factor 1 by 14.1

Chi Square (χ^2)	***DF***	***Prob>ChiSq (χ^2)***
5.3378	1	0.0209*

Q14.2

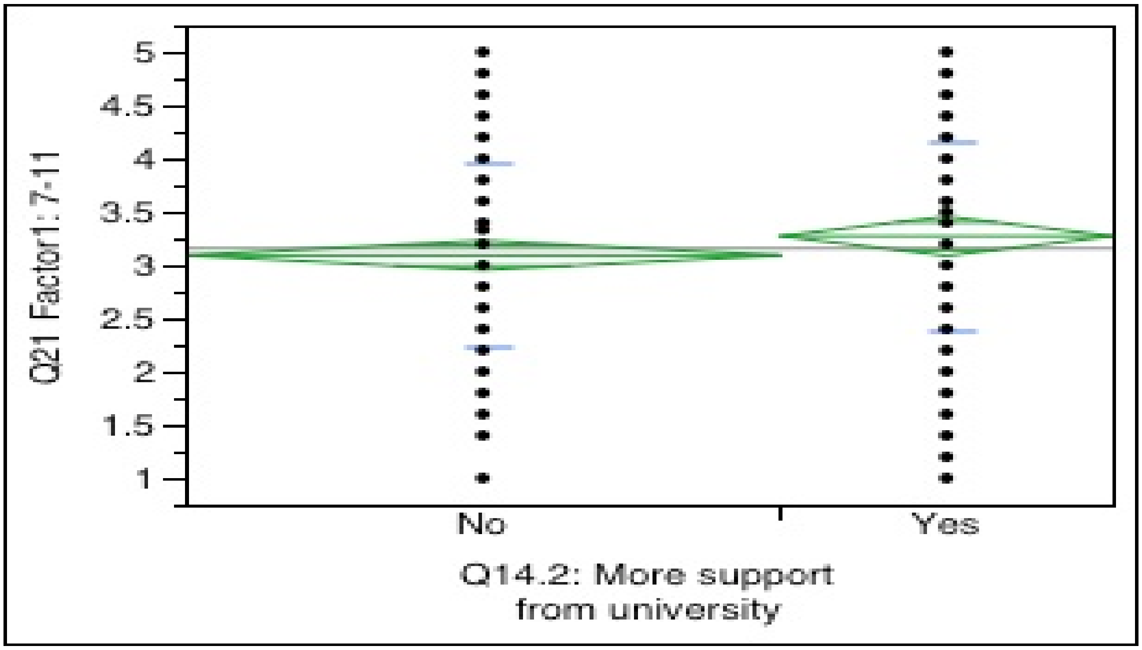


Figure 4.14: Fit Y by X group – one-way analysis of Q21_factor1_mean by Q14.2

Table 4.58

One-way test, chi-square (χ^2) approximation for Q21_factor1 by 14.2

Chi Square (χ^2)	***DF***	***Prob>ChiSq (χ^2)***
2.0148	1	0.1558

Q14.3

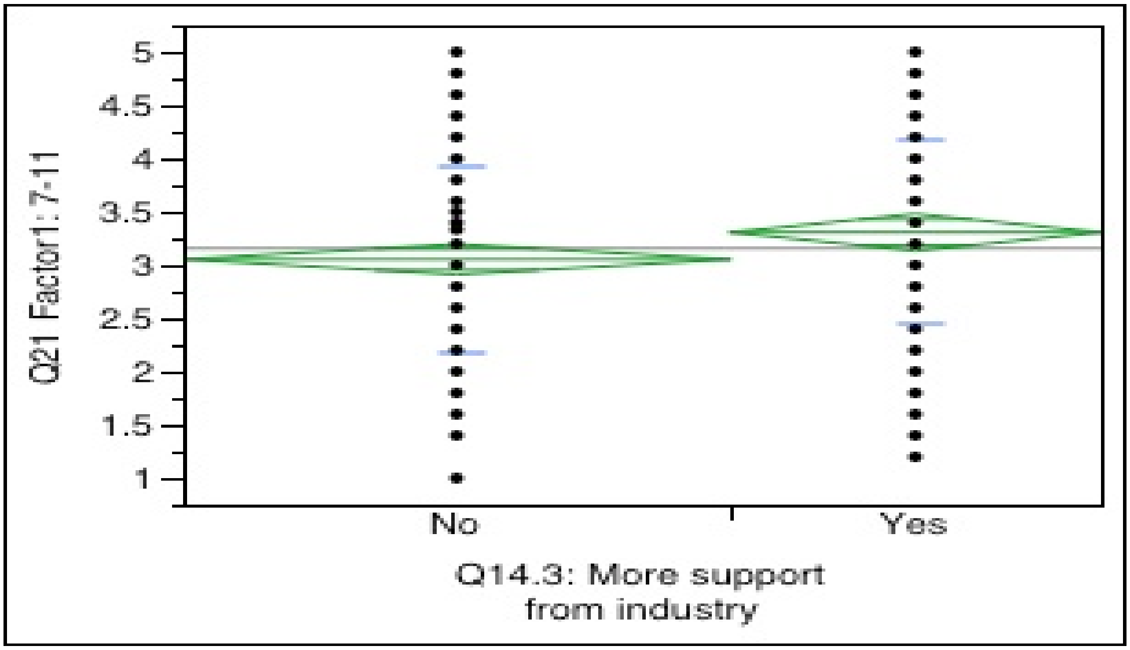


Figure 4.15 Fit Y by X group – one-way analysis of Q21_factor1_mean by Q14.3

Table 4.59

One-way test, chi-square (χ^2) approximation for Q21 factor1 by Q14.3

Chi Square (χ^2)	*DF*	*Prob>ChiSq (χ^2)*
4.6586	1	0.0309*

Q14.4

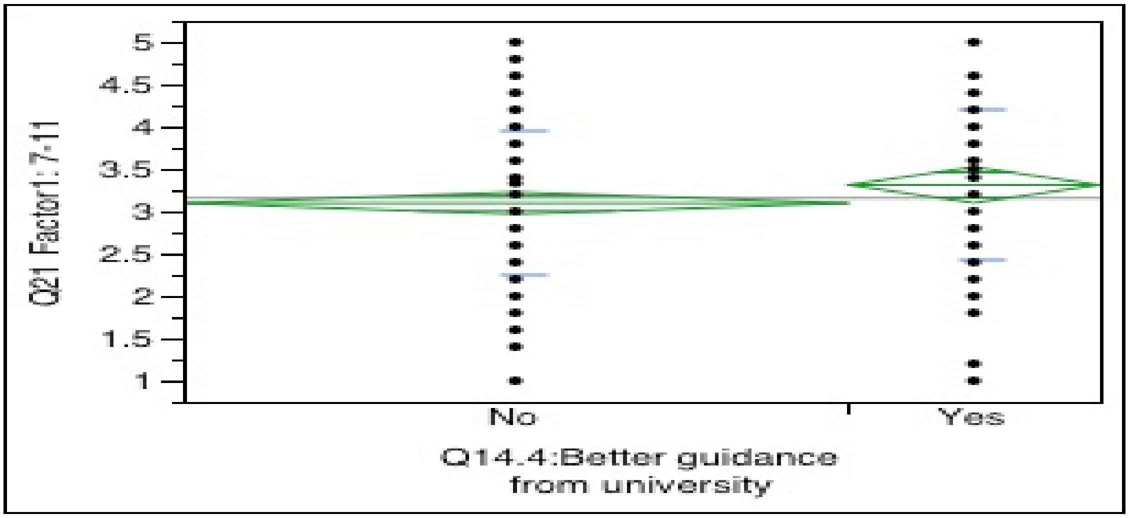


Figure 4.16: Fit Y by X group – one-way analysis of Q21_factor1_mean by Q14.4

Table 4.60

One-way test, chi-square (χ^2) approximation for Q21 factor 1 by Q14.4

Chi Square (χ^2)	*DF*	*Prob>ChiSq (χ^2)*
3.5161	1	0.0608

Q14.5

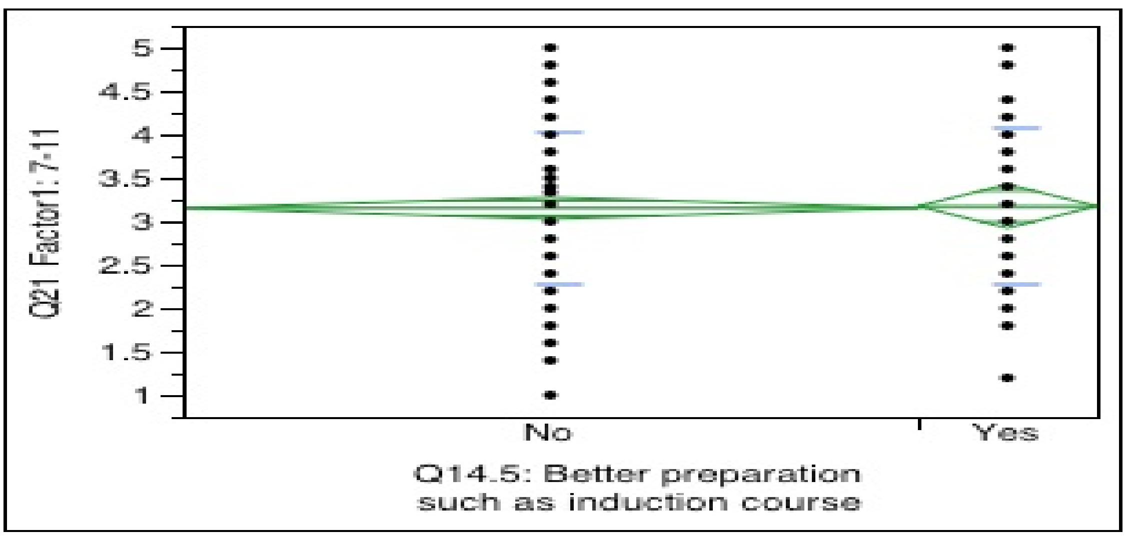


Figure 4.17: Fit Y by X group – one-way analysis of Q21_factor1_mean by Q14.5

Table 4.61

One-way test, chi-square (χ^2) approximation for Q21 Factor 1 by Q14.5

Chi Square (χ^2)	*DF*	*Prob>ChiSq (χ^2)*
0.0070	1	0.9335

Q14.6

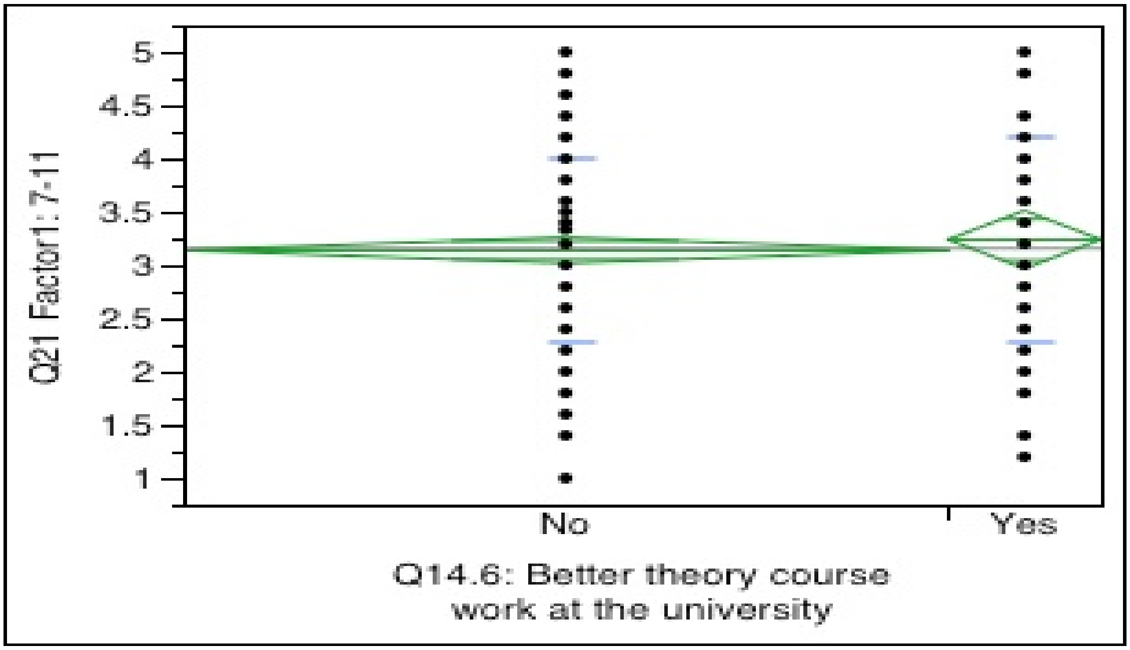


Figure 4.18: Fit Y by X group – one-way analysis of Q21_factor1_mean by Q14.6

Table 4.62

One-way test, chi-square (χ^2) approximation for Q21 Factor 1 by Q14.6

Chi Square (χ^2)	*DF*	*Prob>ChiSq (χ^2)*
0.6713	1	0.4126

Q14.7

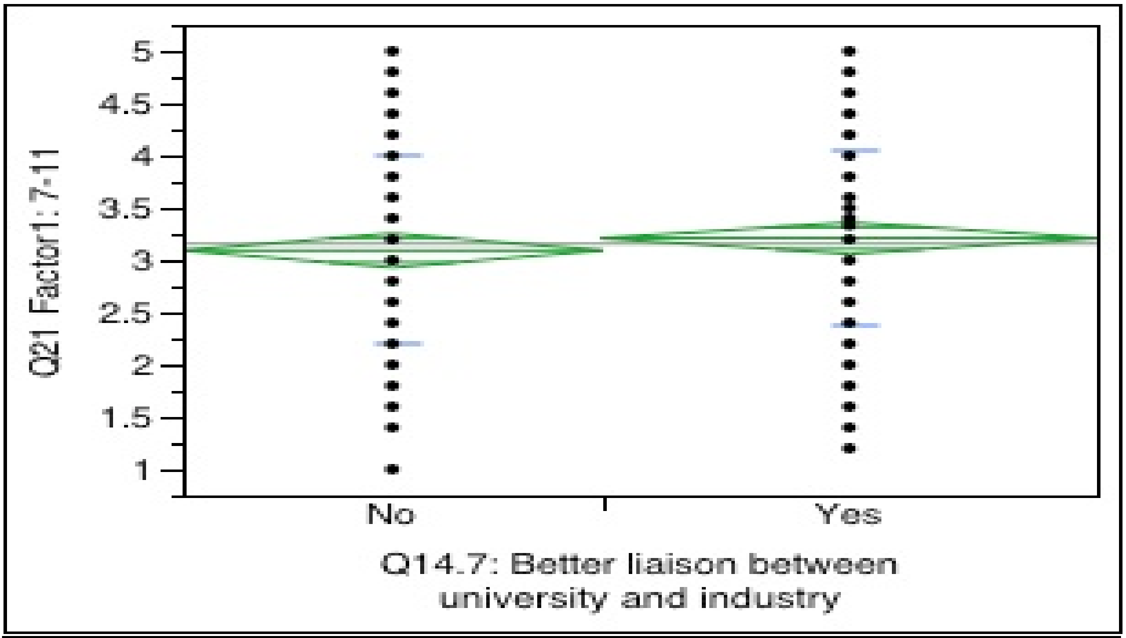


Figure 4.19: Fit Y by X group – one-way analysis of Q21_factor1_mean by Q14.7

Table 4.63

One-way test, chi-square (χ^2) approximation for Q21 factor 1 and Q14.7

Chi Square (χ^2)	***DF***	***Prob>ChiSq (χ^2)***
1.0805	1	0.2986

It emerged from the results of these seven options that the *p*-value was smaller than 0.05 for questions Q14.1 and Q14.3 (0.0209 and 0.0309 respectively) and, therefore, there are significant differences between the mean scores of factor 1 of question 21 (challenge of inappropriate placement) and the experiences of those persons with or without “More appropriate work placement” and “More support from industry”. Thus, there are statistically significant differences between the mean scores. This, in turn, means that those persons who had had “More appropriate work placement” and “More support from industry” had experienced fewer challenges during WIL period.

4.1.4.13 Comparison of Question 21- Factor_2_Mean with Question 9

Similar processes and calculations were used for the question 21-factor 2 mean with question 9. The factor 2 of question 21 represented the “Challenges of university support” while question 9 related to the types of employment (contract/permanent/placement). The details of the calculations are contained in appendix F (F4) while the summary is presented below.

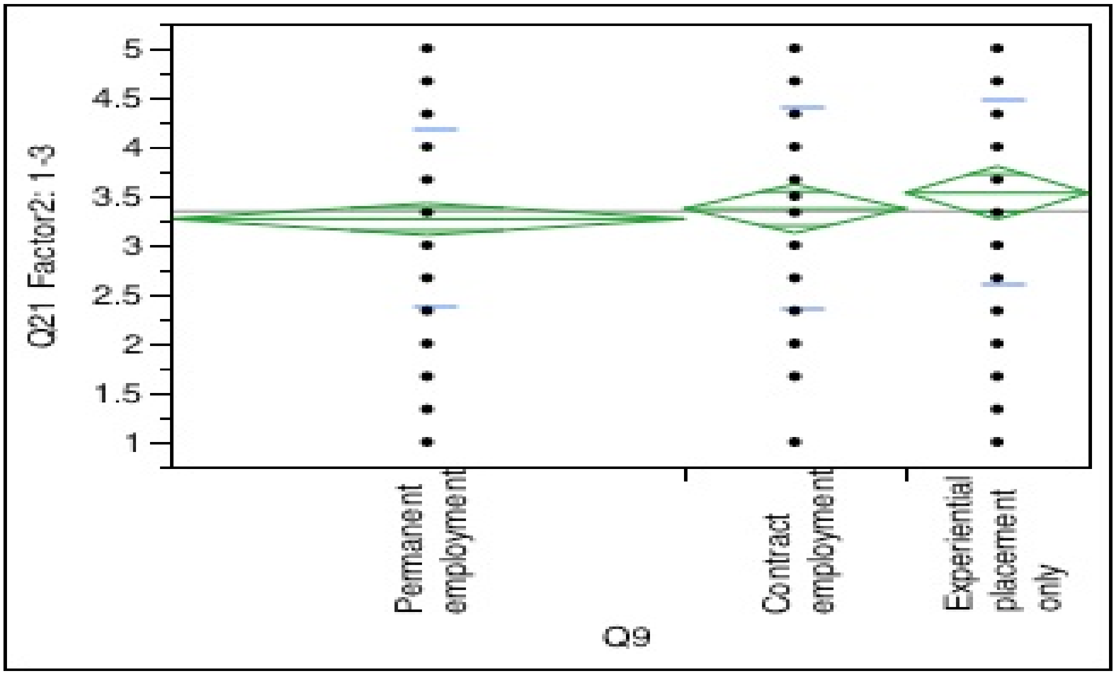


Figure 4.20: Fit Y by X group – one-way analysis of Q21_factor2_mean by Q9

Table 4.64
One-way test, chi-square (χ^2) approximation for Q21-factor 2 by Q9

Chi Square (χ^2)	***DF***	***Prob>ChiSq (χ^2)***
3.7071	2	0.1567

Since the *p*-value was larger than 0.05 for question Q9, this means that there is no significant difference between the various types of employment (permanent, contract, experiential placement) and Q21_factor 2 which referred to the “Challenges of university support” for WIL.

4.1.4.14 Comparison of Question 21 – Factor_2_Mean with Question 14

A similar comparison was carried out for question 21-factor 2 and the various options referred to in question 14. The chi-square values are presented in Table 4.65.

Table 4.65
One-way test, chi-square (χ^2) approximation for Q21-factor 2 by Q14

	Chi Square (χ^2)	*DF*	*Prob>ChiSq (χ^2)*
14.1	0.1872	1	0.6653
14.2	7.6252	1	0.0058
14.3	0.3825	1	0.5362
14.4	3.1509	1	0.0759
14.5	0.0411	1	0.8393
14.6	0.3073	1	0.5793
14.7	1.6040	1	0.2053

The *p*-value was smaller than 0.05 for question 14.2 only (Support from university) but not for the other options and, therefore, there are no significant differences between the mean scores of factor 2 of question 21 (Challenges of university support) and those persons who had experienced the different types of support or guidance, except for "Support from university". According to the participants, an improvement in "More support from university" could have made a difference in their training and resulted in their experiencing fewer challenges as regards their placements.

4.1.5 Data Analysis of the Biographical Information

In this section, the questions on the biographical information are compared.

4.1.5.1 Contingency Analysis of Question 1 with Question 4

Question 1, which referred to the gender of the participants, was compared with question 4, which indicated their various disciplines. In Figure 4.24 the Y-axis is used for Q1 and the X-axis for Q4 in order to produce a mosaic plot.

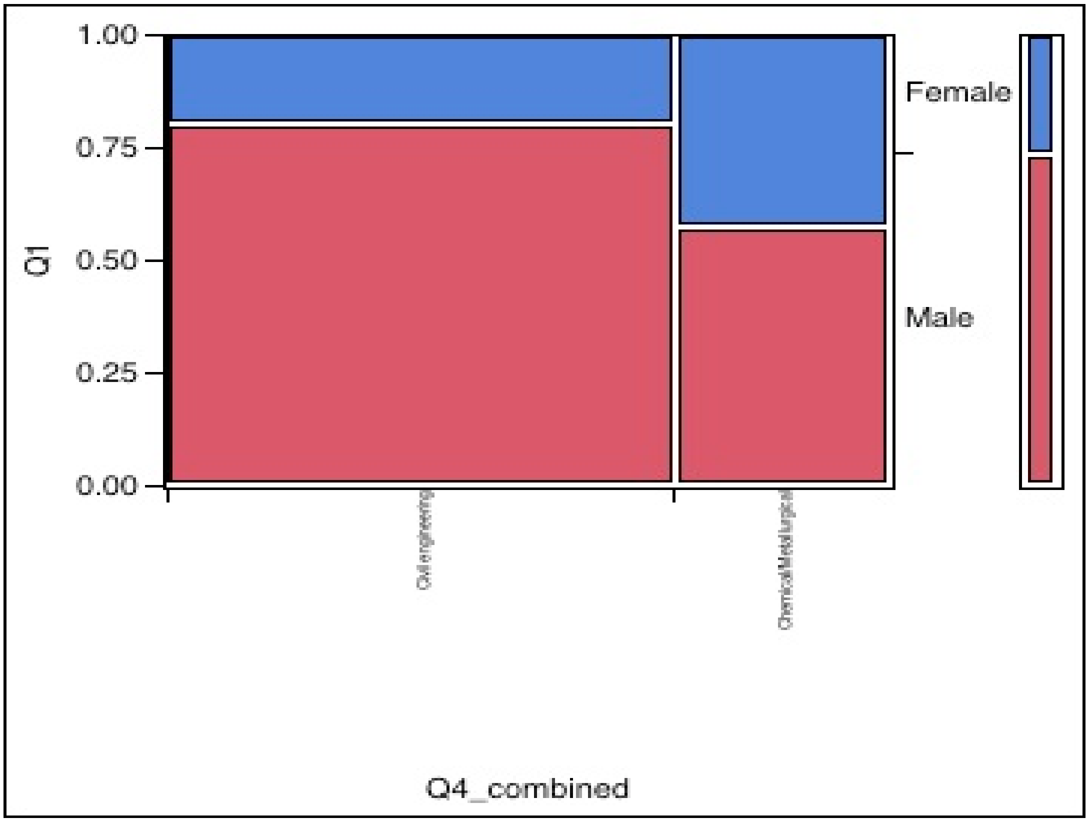


Figure 4.21: Contingency analysis of Q1 By Q4_combined mosaic plot

This figure is based on the data in Table 4.66, which illustrates the number of male/female students in each discipline.

Table 4.66

The cross-tabulation table of Q4_combined with Q1

Count *Total %* *Col %* *Row %*	*Male*	*Female*	
Other	1 0.39 0.53 100.00	0 0.00 0.00 0.00	1 0.39
Civil engineering	143 56.30 76.47 80.34	35 13.78 52.24 19.66	178 70.08
Chemical/metallurgical	43 16.93 22.99 57.33	32 12.60 47.76 42.67	75 29.53
	187 73.62	67 26.38	254

Table 4.67

Test Summary for Q4_combined with Q1

N	***DF***	***-LogLike***	***RSquare (U)***
254	2	7.1412246	0.0487

Table 4.68

Tests for Q4_combined with Q1

Test	***Chi Square***	***Prob>ChiSq***
Likelihood Ratio	14.282	0.0008*
Pearson	14.738	0.0006*

The table above depicts the results for the "Pearson chi-square value which gives the *p*-value. The chi-square value = 14.738, $p = 0.0006$. Since the *p*-value of 0.0006 is smaller than the constant alpha value of 0.05, this means that there is statistically significant association between the different discipline categories and gender. A significant association implies that the results that were found cannot be attributed to chance, and that, in fact, a real association exists between the variables.

Clearly there is a higher proportion of males (143/187 = 76.47%) in Civil Engineering than females (35/67 = 52.24%).

4.1.5.2 Contingency Analysis of Question 1 with Question 7

Question 1 and question 7 are compared in Figure 4.25. Question 7 indicated employment types, for example, government, companies, or consulting firms, etc. The Y-axis was used for Q1 and the X-axis for Q7 in a mosaic plot.

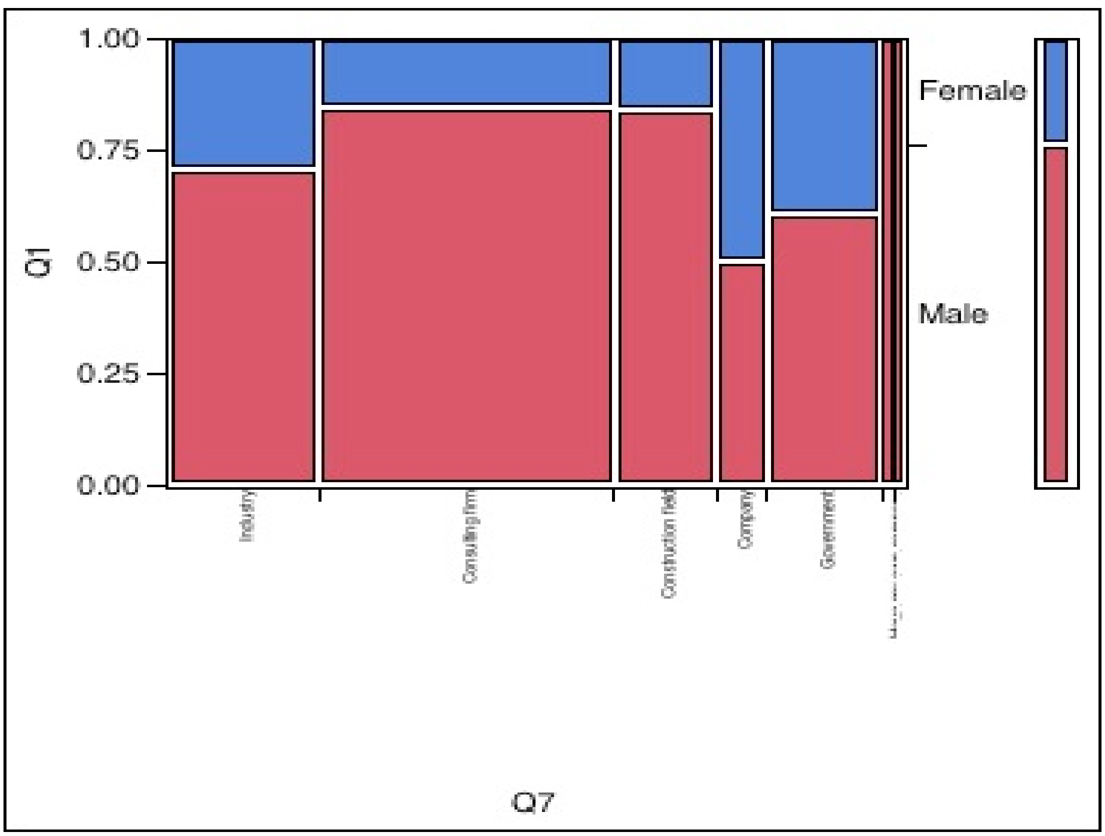


Figure 4.22: Contingency analysis of Q1 By Q7_combined mosaic plot

This figure is based on the data presented in Table 4.69.

Table 4.69

The Cross-tabulation table of Q1 by Q7 combined

Count *Total %* *Col %* *Row %*	*Male*	*Female*	
Industry	34 14.72 19.32 70.83	14 6.06 25.45 29.17	48 20.78
Consulting firm	79 34.20 44.89 84.95	14 6.06 25.45 15.05	93 40.26
Construction field	27 11.69 15.34 84.38	5 2.16 9.09 15.63	32 13.85
Company	8 3.46 14.55 50.00	8 3.46 14.55 50.00	16 6.93
Government	22 9.52 12.50 61.11	14 6.06 25.45 38.89	36 15.58
Have my own company	4 1.73 2.27 100.00	0 0.00 0.00 0.00	4 1.73
Education (any type)	2 0.87 1.14 100.00	0 0.00 0.00 0.00	2 0.87
	176 76.19	55 23.81	231

Table 4.70

Test summary for Q1 by Q7_combined

N	***DF***	***-LogLike***	***RSquare (U)***
231	6	9.4007608	0.0741

Table 4.71

Tests for Q1 by Q7_combined

Test	***Chi Square (χ^2)***	***Prob>ChiSq (χ^2)***
Likelihood Ratio	18.802	0.0045*
Pearson	18.309	0.0055*

The chi-square value = 18.309 and p = 0.0055. Since the p-value of 0.0055 is smaller than the constant alpha value of 0.05, this means that there is a statistically significant association between the places of employment and gender. A significant association implies that, in fact, a real association exists between the variables. Clearly there is a higher proportion of males in construction and consulting firms than females.

4.1.5.3 Contingency Analysis of Question 1 with Question 8

A similar comparison was made between question 1 (gender) and question 8 which indicated the type of WIL placement, for example, the construction field, government or a consulting firm. The Y-axis was used for Q1 and the X-axis for Q8 in a mosaic Plot.

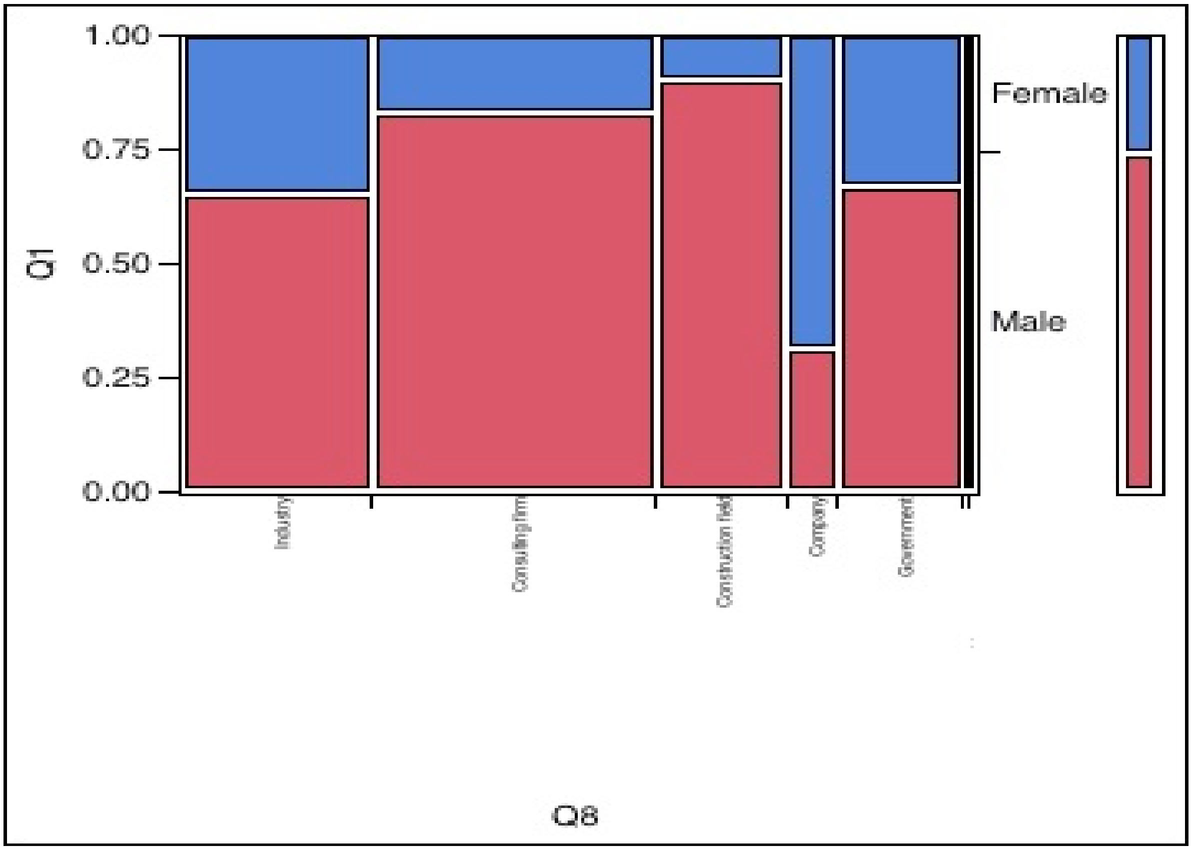


Figure 4.23: Contingency analysis of Q1 By Q8_combined mosaic plot

This figure is based on the data presented in Table 4.72.

Table 4.72

The cross-tabulation table of Q1_combined by Q8

Count *Total %* *Col %* *Row %*	*Male*	*Female*	*Total*
Industry	39 15.73 21.20 65.00	21 8.47 32.81 35.00	60 24.19
Consulting firm	74 29.84 40.22 83.15	15 6.05 23.44 16.85	89 35.89

Construction field	37	4	41
	14.92	1.61	16.53
	20.11	6.25	
	90.24	9.76	
Company	5	11	16
	2.02	4.44	6.45
	2.72	17.19	
	31.25	68.75	
Government	26	13	39
	10.48	5.24	15.73
	14.13	20.31	
	66.67	33.33	
Have my own company	2	0	2
	0.81	0.00	0.81
	1.09	0.00	
	100.00	0.00	
Education (any type)	1	0	1
	0.40	0.00	0.40
	0.54	0.00	
	100.00	0.00	
	184	64	248
	74.19	25.81	

Table 4.73

Test summary for Q1 by Q8_combined

N	***DF***	***-LogLike***	***RSquare (U)***
248	6	14.531018	0.1026

Table 4.74

Tests for Q1 by Q8_combined

Test	***Chi Square (χ^2)***	***Prob>ChiSq (χ^2)***
Likelihood Ratio	29.062	<.0001*
Pearson	29.499	<.0001*

The *p*-value is smaller than 0.05, indicating a statistically significant association between the type of work integrated placement and gender. Clearly there is a higher proportion of females in companies than males and a higher proportion of males in construction and in consulting firms than females.

4.1.5.4 Contingency Analysis of Question 1 with Question 9

Question 1 (gender) was compared with question 9 which indicated whether the student's WIL site was a placement or his or her own place of employment. The Y-axis was used for Q1 and the X-axis for Q9 in a mosaic plot.

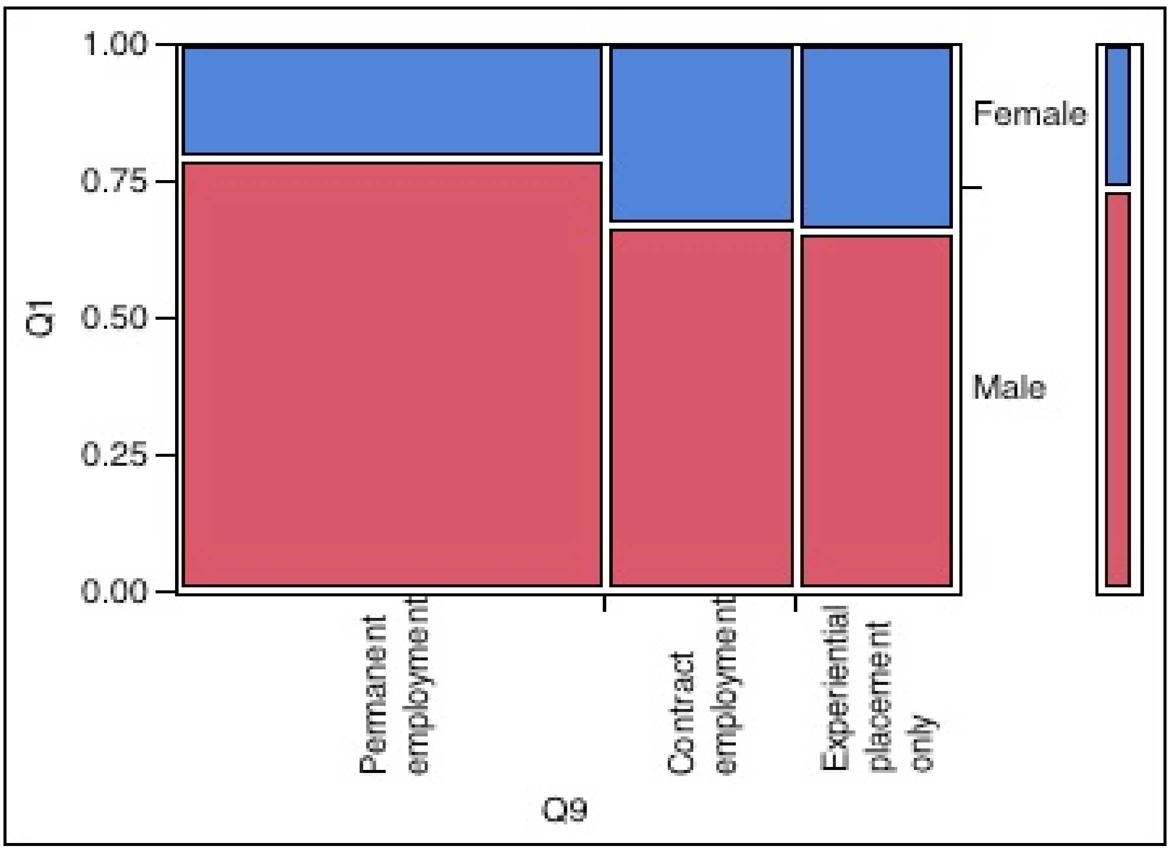


Figure 4.24: Contingency analysis of Q1 by Q9_combined mosaic plot

This figure is based on the data presented in Table 4.75.

Table 4.75

The cross-tabulation table of Q1 by Q9_combined

Count Total % Col % Row %	Male	Female	
Permanent employment	108	28	136
	43.72	11.34	55.06
	59.34	43.08	
	79.41	20.59	
Contract employment	41	20	61
	16.60	8.10	24.70
	22.53	30.77	
	67.21	32.79	
Experiential placement only	33	17	50
	13.36	6.88	20.24
	18.13	26.15	
	66.00	34.00	
	182	65	247
	73.68	26.32	

Table 4.76

Test summary for Q1 by Q9_combined

N	***DF***	***-LogLike***	***RSquare (U)***
247	2	2.5613845	0.0180

Table 4.77

Tests for Q1 by Q9_combined

Test	***Chi Square (χ^2)***	***Prob>ChiSq (χ^2)***
Likelihood Ratio	5.123	0.0772
Pearson	5.141	0.0765

The p-value is greater than 0.05, indicating no statistically significant association, between the permanent/contract type of employment/WIL placement and gender.

4.1.5.5 Comparison of Question 6 with Question 7

In Figure 4.25, question 6 was compared with question 7. The Y-axis was used for Q6 and the X-axis for Q7. Question 6 related to whether the student was employed, studying or both while question 7 related to the place of employment/placement.

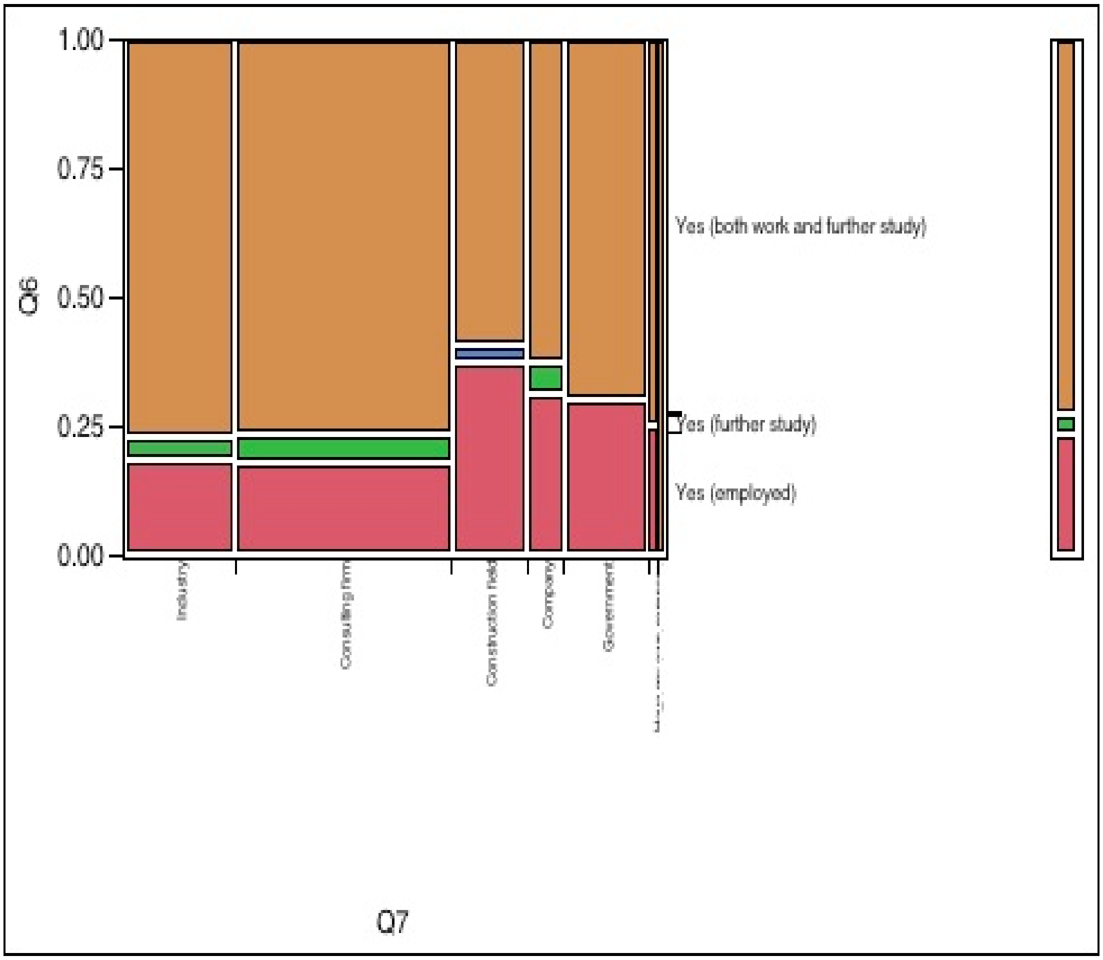


Figure 4.25: Contingency analysis of Q6 By Q7_combined mosaic plot

This figure is based on the data presented in Table 4.78.

Table 4.78

The cross-tabulation table of Q6 By Q7_combined

Count Total % Col % Row %	Yes (employed)	Yes (further study)	No (no work and no further study)	Yes (both work and further study)	Total
Industry	9 3.90 16.36 18.75	2 0.87 25.00 4.17	0 0.00 0.00 0.00	37 16.02 22.16 77.08	48 20.78
Consulting firm	17 7.36 30.91 18.28	5 2.16 62.50 5.38	0 0.00 0.00 0.00	71 30.74 42.51 76.34	93 40.26
Construction field	12 5.19 21.82 37.50	0 0.00 0.00 0.00	1 0.43 100.00 3.13	19 8.23 11.38 59.38	32 13.85
Company	5 2.16 9.09 31.25	1 0.43 12.50 6.25	0 0.00 0.00 0.00	10 4.33 5.99 62.50	16 6.93
Government	11 4.76 20.00 30.56	0 0.00 0.00 0.00	0 0.00 0.00 0.00	25 10.82 14.97 69.44	36 15.58
Have my own company	1 0.43 1.82 25.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	3 1.30 1.80 75.00	4 1.73
Education (any type)	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	2 0.87 1.20 100.00	2 0.87
	55 23.81	8 3.46	1 0.43	167 72.29	231

Table 4.79

Test summary for Q6 by Q7_combined

N	***DF***	***-LogLike***	***RSquare (U)***
231	18	8.8966453	0.0538

Table 4.80

Tests for Q6 by Q7_combined

Test	*Chi Square* (χ^2)	***Prob>ChiSq*** (χ^2)
Likelihood Ratio	17.793	0.4693
Pearson	17.531	0.4869

The chi-square value = 17.531, and p = 0.4869, thus indicating that there is statistically no significant association between the employment/study options and place of employment because the p-value is greater than 0.05.

4.1.6 Data Analysis of Biographical Information Versus Work Integrated Learning Questions

The questions in the biographical section were compared with the questions in section B – the questions on WIL.

4.1.6.1 Comparison of Question 4 combined by Question 16

The Y-axis was used for Q4 and the X-axis for Q16. Question 4 indicated the participants' engineering discipline, while question 16 asked " If WIL were optional, and you could choose between being placed in industry or taking courses in other subjects, would you still choose WIL?"

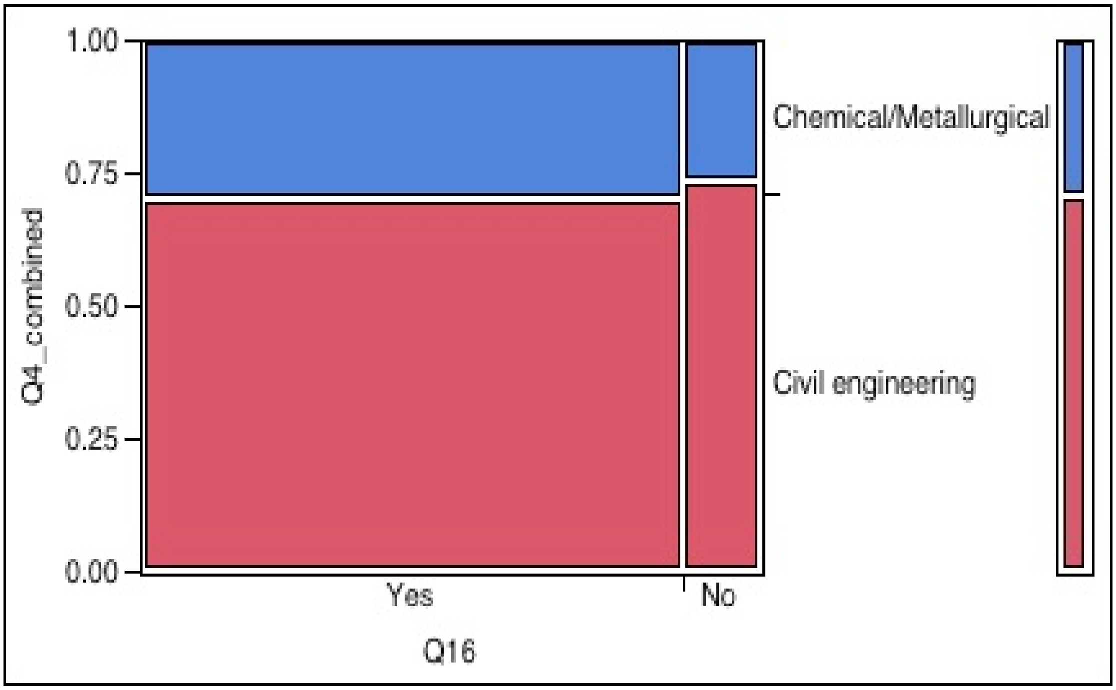


Figure 4.26: Contingency analysis of Q4 by Q16 combined mosaic plot

This figure is based on the data presented in Table 4.81.

Table 4.81

The cross-tabulation table of Q4_combined By Q16

Count *Total %* *Col %* *Row %*	*Civil engineering*	*Chemical/metallurgical*	*Total*
Yes	153 61.94 87.43 70.51	64 25.91 88.89 29.49	217 87.85
No	22 8.91 12.57 73.33	8 3.24 11.11 26.67	30 12.15
	175 70.85	72 29.15	247

Table 4.82

Test summary for Q4 by Q16 combined

N	***DF***	***-LogLike***	***RSquare (U)***
247	1	0.05175159	0.0003

Table 4.83

Tests for Q4 by Q16 combined

Test	***Chi Square (χ^2)***	***Prob>ChiSq (χ^2)***
Likelihood Ratio	0.104	0.7477
Pearson	0.102	0.7495

Table 4.84
Fisher exact test for Q4 by Q16 combined

Fisher's Exact Test	***Prob***	***Alternative hypothesis***
Left	0.4674	Prob(Q4_combined=Chemical/Metallurgical) is greater for Q16=Yes than No
Right	0.6970	Prob(Q4_combined=Chemical/Metallurgical) is greater for Q16=No than Yes
2-Tail	0.8330	Prob(Q4_combined=Chemical/Metallurgical) is different across Q16

As evident from Tables 4.83 and 4.84, both Pearson's chi-square test and the two-tail Fisher's exact test indicated no significant association (*p*-value > 0.05). In addition, the values differed only slightly (0.7495 vs 0.8330). This means that the majority of students in both disciplines had selected "yes" as an answer, and, thus, that the answer does not depend on the discipline.

4.1.6.2 Comparison of Question 4 combined by Question 17

Question 4 (discipline) was compared with question 17 which related to the WIL duration required to complete the curriculum. The Y-axis was used for Q4 and the X-axis for Q17.

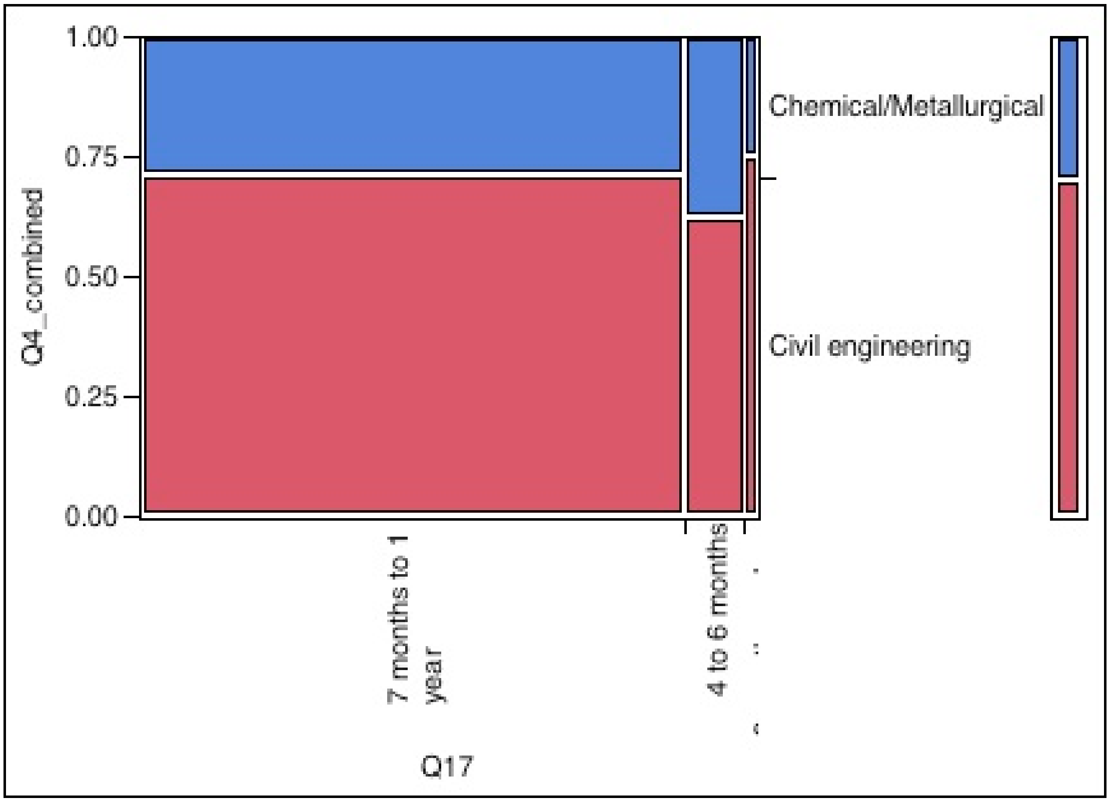


Figure 4.27: Contingency analysis of Q4 by Q17_combined mosaic plot

This figure is based on the data presented in Table 4.85.

Table 4.85

The Cross-tabulation table of Q4 combined by Q17

Count *Total %* *Col %* *Row %*	*Civil engineering*	*Chemical/ metallurgical*	*Total*
7 months to 1 year	156 63.16 89.66 71.23	63 25.51 86.30 28.77	219 88.66
4 to 6 months	15 6.07 8.62 62.50	9 3.64 12.33 37.50	24 9.72
3 months or less	3 1.21	1 0.40	4 1.62

	1.72	1.37	
	75.00	25.00	
	174	73	247
	70.45	29.55	

Table 4.86

Test summary for Q4 by Q17_combined

N	***DF***	***-LogLike***	***RSquare (U)***
247	2	0.40121565	0.0027

Table 4.87

Tests for Q4 by Q17_combined

Test	***chi Square (χ^2)***	***Prob>chiSq(χ^2)***
Likelihood Ratio	0.802	0.6695
Pearson	0.833	0.6594

The *p*-value is greater than 0.05 and, therefore, there is no statistically significant difference between civil/chemical engineers with regard to the period of WIL required to complete their curricula. The majority of the participants selected the period of seven months to one year.

4.1.6.3 Comparison of Question 4 combined by Question 18

The Y-axis was used for Q4 and the X-axis for Q18. Question 4 (discipline) was compared with question 18 which asked “Could you have received this WIL at the university”.

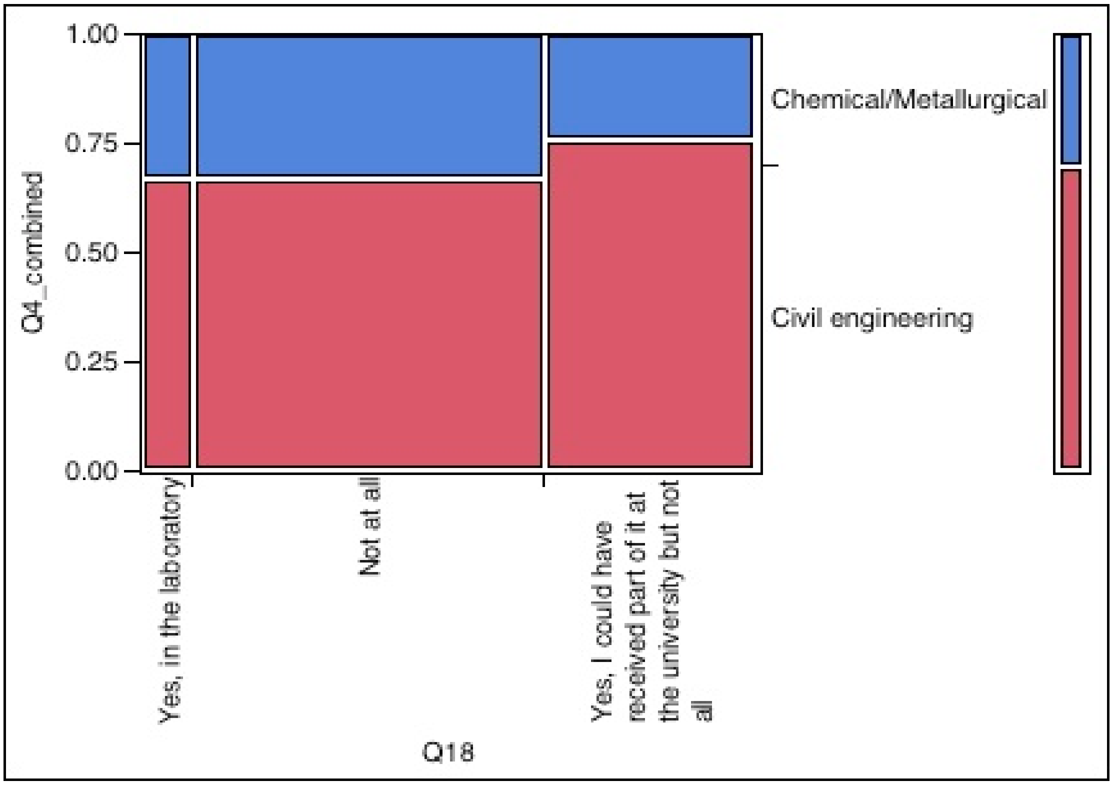


Figure 4.28: Contingency analysis of Q4 by Q18_combined mosaic plot

This figure is based on the data presented in Table 4.88.

Table 4.88

The Cross-tabulation table of Q4 by Q18_combined

Count ***Total %*** ***Col %*** ***Row %***	***Civil engineering***	***Chemical/ metallurgical***	***Total***
Yes, in the laboratory	14 5.60 8.00 66.67	7 2.80 9.33 33.33	21 8.40
Not at all	96 38.40 54.86 67.13	47 18.80 62.67 32.87	143 57.20
Yes, I could have received part of it at the	65 26.00	21 8.40	86 34.40

university but not all	37.14	28.00	
	75.58	24.42	
	175	75	250
	70.00	30.00	

Table 4.89

Test summary for Q4 by Q18_combined

N	***DF***	***-LogLike***	***RSquare (U)***
250	2	0.99313577	0.0065

Table 4.90

Tests for Q4 by Q18_combined

Test	***Chi Square (χ^2)***	***Prob>ChiSq (χ^2)***
Likelihood Ratio	1.986	0.3704
Pearson	1.947	0.3778

The *p*-value is greater than 0.05 and, therefore, there is no statistically significant difference between civil/chemical engineers with regard to the notion of WIL at the university. However, Figure 4.31 indicates that majority of both civil and chemical engineer respondents believed either that WIL is not possible at the university (57.20%) or that part of it only may be done in the laboratory (34.40%).

4.1.7 Shared Responses to Questions Combined

4.1.7.1 Shared Responses to Question 10 and Question 1

The frequency of the responses to question 10 with the various options from 10.1 to 10.6 was recorded, the percentages calculated and a shared chart drawn up to depict the distribution of the results. A similar process was followed for question 10 combined with question 1, showing the male, female distribution for the various options under question 10. All the details are contained in Appendix I (I1) although the shared charts are also included in this section.

Categorical
Share of Responses

Response	No	Yes	Responses
Q10.1: To obtain an opportunity for future employment	0.3465	0.6535	254
Q10.2: To obtain practical experience during the placement	0.2087	0.7913	254
Q10.3: To develop employment skills such as communication, team work and problem solving	0.2795	0.7205	254
Q10.4: No expectation	0.9961	0.0039	254
Q10.5: To pass the subject	0.7598	0.2402	254
Q10.6: Other	0.9921	0.0079	254

Table 4.91
Share Chart – Q10

Options	Responses
Q10.1: To obtain an opportunity for future employment	254
Q10.2: To obtain practical experience during the placement	254
Q10.3: To develop employment skills such as communication, team work and problem solving	254
Q10.4: No expectation	254
Q10.5: To pass the subject	254
Q10.6: Other	254

No
Yes

Table 4.92
Share Chart – Q10 by Q1

Options	Q1	Q10.	Responses
Q10.1: To obtain an opportunity for future employment	Male		187
Q10.1: To obtain a future employment opportunity	Female		67
Q10.2: To obtain practical experience during the placement	Male		187
Q10.2: To obtain practical experience during the placement	Female		67
Q10.3: To develop employment skills such as communication, team work and problem solving	Male		187
Q10.3: To develop employment skills such as communication, team work and problem solving	Female		67
Q10.4: No expectation	Male		187
Q10.4: No expectation	Female		67
Q10.5: To pass the subject	Male		187
Q10.5: To pass the subject	Female		67

Options	Q1	Q10.	Responses
Q10.6: Other	Male		187
Q10.6: Other	Female		67

No
Yes

It is clear from the shared results that majority of students (whether male or female) wanted to do WIL because of future employment opportunities, and/or to obtain practical experience, and/or to develop employment skills and not for the purpose of passing the subject.

4.1.7.2 Shared Responses to Question 14 and Question 1

A similar process was followed for question 14 combined with question 1. The summary of responses is recorded below although the details are contained in Appendix I (I2). In this section, question 1(gender) is compared with question 14 which presents the options for the improvement of WIL training.

Table 4.93
Share Chart – Q14

Response	Q14.	Responses
Q14.1: More appropriate work placement		254
Q14.2: More support from university		254
Q14.3: More support from industry		254
Q14.4:Better guidance from university		254
Q14.5: Better preparation such as an induction course		254
Q14.6: Better theory course work at the university		254
Q14.7: Better liaison between university and industry		254
Q14.8: Other		254

No
Yes

Table 4.94
Share Chart – Q14 by Q1

Response	Q1	Q14.	Responses
Q14.1: More appropriate work placement	Male		187
Q14.1: More appropriate work placement	Female		67
Q14.2: More support from university	Male		187
Q14.2: More support from university	Female		67
Q14.3: More support from industry	Male		187
Q14.3: More support from industry	Female		67
Q14.4:Better guidance from university	Male		187
Q14.4:Better guidance from university	Female		67
Q14.5: Better preparation such as an induction course	Male		187
Q14.5: Better preparation such as an induction course	Female		67
Q14.6: Better theory course work at the university	Male		187
Q14.6: Better theory course work at the university	Female		67
Q14.7: Better liaison between university and industry	Male		187
Q14.7: Better liaison between university and industry	Female		67
Q14.8: Other	Male		187
Q14.8: Other	Female		67

No
Yes

The shared results indicate that the female students required more support for WIL than the male students. The only two exceptions were the responses to the two questions of "Better theory coursework" and "Better preparation such as an induction course" where there the male students scored higher than the female students. More than 50% of students responded that better liaison between university and industry is required.

Table 4.95
Share Chart – Q14 by Q1-Total

Response	Q1	Q14.	Responses
Q14.1: More appropriate work placement	Male		187
Q14.1: More appropriate work placement	Female		67
Q14.2: More support from university	Male		187
Q14.2: More support from university	Female		67
Q14.3: More support from industry	Male		187
Q14.3: More support from industry	Female		67
Q14.4:Better guidance from university	Male		187
Q14.4:Better guidance from university	Female		67
Q14.5: Better preparation such as an induction course	Male		187
Q14.5: Better preparation such as an induction course	Female		67
Q14.6: Better theory course work at the university	Male		187

Response	Q1	Q14.	Responses
Q14.6: Better theory course work at the university	Female		67
Q14.7: Better liaison between university and industry	Male		187
Q14.7: Better liaison between university and industry	Female		67
Q14.8: Other	Male		187
Q14.8: Other	Female		67

No
Yes

4.1.7.3 Shared Responses to Question 14 and Question 4

Similar charts are shown for question 14 combined with question 4 (disciplines). The details are contained in Appendix I (I3).

Table 4.96
Share Chart - Q14 by Q4

Response	Q4_combined	Q14.	Responses
Q14.1: More appropriate work placement	Civil engineering		178
Q14.1: More appropriate work placement	Chemical/Metallurgical		75
Q14.2: More support from university	Civil engineering		178
Q14.2: More support from university	Chemical/Metallurgical		75
Q14.3: More support from industry	Civil engineering		178
Q14.3: More support from industry	Chemical/Metallurgical		75
Q14.4:Better guidance from university	Civil engineering		178
Q14.4:Better guidance from university	Chemical/Metallurgical		75
Q14.5: Better preparation such as induction course	Civil engineering		178
Q14.5: Better preparation such as induction course	Chemical/Metallurgical		75
Q14.6: Better theory course work at the university	Civil engineering		178
Q14.6: Better theory course work at the university	Chemical/Metallurgical		75
Q14.7: Better liaison between university and industry	Civil engineering		178
Q14.7: Better liaison between university and industry	Chemical/Metallurgical		75
Q14.8: Other	Civil engineering		178
Q14.8: Other	Chemical/Metallurgical		75

No
Yes

The shared results showed that the chemical engineering students indicated a higher need for “More support from industry” and “Better liaison between university and industry” than the other respondents.

4.1.7.4 Shared Responses to Questions 24 to 29

The responses to questions 24 to 29 are shown below. The details are contained in Appendix I (I4). The students were asked different questions regarding the responsibilities of the various role players in WIL.

Table 4.97
Share Chart – Q24

Response	Q24.	Responses	Sample
Q24.1: Student		254	
Q24.2: WIL Convener		254	
Q24.3: Academic Supervisor		254	
Q24.4: Industry Mentor		254	
Q24.5: Placement Coordinator		254	

No
Yes

Table 4.98
Share chart – Q25

Response	Q25.	Responses	Sample
Q25.1: Student		254	
Q25.2: WIL convener		254	
Q25.3: Academic supervisor		254	
Q25.4: Industry mentor		254	
Q25.5: Placement coordinator		254	

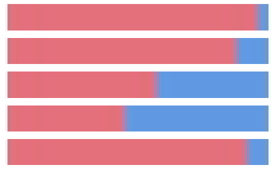
No
Yes

Table 4.99
Share chart – Q26

Response	Q26.	Responses	Sample
Q26.1: Student		254	
Q26.2: WIL Convener		254	
Q26.3: Academic Supervisor		254	
Q26.4: Industry Mentor		254	
Q26.5: Placement coordinator		254	

Table 4.100
Share Chart – Q27

Response	Q27.	Responses	Sample
Q27.1: Student		254	
Q27.2: WIL Convener		254	
Q27.3: Academic Supervisor		254	
Q27.4: Industry Mentor		254	
Q27.5: Placement coordinator		254	



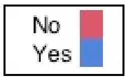
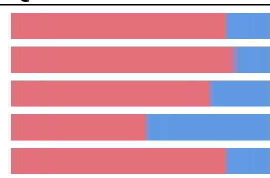


Table 4.101
Share Chart – Q28

Response	Q28.	Responses	Sample
Q28.1: Student		254	
Q28.2: WIL Convener		254	
Q28.3: Academic Supervisor		254	
Q28.4: Industry Mentor		254	
Q28.5: Placement coordinator		254	



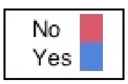
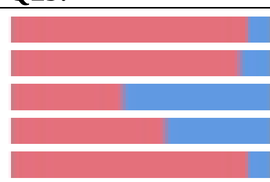


Table 4.102
Share Chart – Q29

Response	Q29.	Responses	Sample
Q29.1: Student		254	
Q29.2: WIL Convener		254	
Q29.3: Academic Supervisor		254	
Q29.4: Industry Mentor		254	
Q29.5: Placement coordinator		254	



The results indicated that there is no clear understanding of the role and responsibilities of the university supervisor and the industry mentor. Some students were not even aware of their roles.

4.1.8 Responses to the Open-ended Questions

The questionnaire included a few open-ended questions that required input from the participants and were not multiple-choice types. These were questions 15, 20 and 22.

The "0" input indicates no comments and "1" is indicative of comments. The tables below present the percentage of responses to these questions:

Table 4.103
Frequency for open-ended question 15

Responses		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	145	57.1	57.3	57.3
	1	108	42.5	42.7	100.0
	Total	253	99.6	100.0	
Missing	System	1	.4		
Total		254	100.0		

Table 4.104
Frequency for open-ended question 20

Responses		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	193	76.0	78.8	78.8
	1	52	20.5	21.2	100.0
	Total	245	96.5	100.0	
Missing	System	9	3.5		
Total		254	100.0		

Table 4.105
Frequency for open-ended question 22

Responses		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	209	82.3	87.8	87.8
	1	29	11.4	12.2	100.0
	Total	238	93.7	100.0	
Missing	System	16	6.3		
Total		254	100.0		

As may be seen from the tables, 42.7% of the participants responded to question 15, 21.2% responded to question 20 and 12.2% only responded to question 22. The responses to these questions are contained in Appendix J, but they are categorised here in subsections based on the specific topic.

4.1.8.1 Question 15 – Do you have any suggestions for the improvement of the work integrated learning?

The responses are mainly in the same format that was used by the students in the survey, with the exception of a few cases where the content would have been unclear if the same format had been retained. The responses are categorised under different topics. The exact responses of the students are contained in appendix J (J1). In certain instances a few of the words in a response were removed and replaced by dots in order to avoid acknowledging a university or discipline and to ensure that the data remained confidential.

Importance of WIL

1. Don't stop WIL.
2. I believe that 12 months is not enough and should be 24 months.
3. It should be scrapped, since the universities do not do much to ensure that every student gets such a placement and it delays a student in getting her/his diploma.
4. All was well with my situation. Continue with it. It is the right thing to do.
5. Organise discussions with different firms to move students around, for example from consultants to contractors, within the WIL period.

6. I think the way it is done is ok.

Curriculum for WIL

1. More subjects should be computer-based learning.
2. Some of the criteria for the WIL are irrelevant.
3. The mentor at the industry must understand that the learner should acquire more insight into the work.
4. Give candidates more responsibility in the workplace.
5. Make student aware of new and better technology.
6. Companies/industry should be encouraged to have better/well structured in-service training programmes.
7. More work and projects are required.
8. Students should be given more responsibility in terms of projects and overall production processes.
9. The curriculum in the university must include courses on safety, health & environment to help students.
10. Companies should have well-structured training programmes and refrain from using students as full-time employees.
11. Curriculum/syllabus for WIL should be drafted in conjunction with industry management and revised annually for different organisations.
12. For industry a training schedule may be implemented to ensure experience in all relevant areas.
13. A fixed, written programme with guidelines and outcomes for the mentor so that he/she always knows what the criterion for acceptable WIL would be.
14. Proper guidelines and criteria for the WIL are required.
15. The universities must expose students to the industries during their theory period so that, when they are finished, they can easily adapt to the industries and know what is expected from them.

16. Stricter monitoring of WIL, a more comprehensive syllabus and testing after WIL are required.
17. Set special tasks to complete.
18. Induction into working environment is required.
19. Industries are not obliged to cover WIL curriculum, negotiations with the industry must be emphasised. The company focuses on what they think (routine) is good for them to benefit from you as a future employee.
20. There should be two contact sessions for students
21. Adequate exposure on different disciplines of ……….engineering is required.
22. There should be a specific programme that every ….or………..industry use for experiential training.
23. Students must be taught each and everything that is required of a … engineer, so that they can become the … engineers in the future.
24. The university should approve the training facility before the training commences.

WIL Placement

1. Avoid working for government.
2. Place trainees with relevant companies for short and long terms.
3. Yes, the university should help students to find training and make sure people are qualified to be our mentors.
4. (WIL) should start after all first level subjects have been passed.
5. It is difficult to get training, so it is better if the university organises training with companies for students.
6. Can … University please find us (WIL), and stop making us re-register for part 1 and part 2 because we didn't find WIL.
7. There should be a programme where students should rotate between government, consulting firms and construction.
8. That … university may register WIL module at any time during the year.

9. The University of … must ensure that the students are placed in the appropriate work area, for example, a student must submit a brief summary of the scope of work he/she will be doing.

10. Mentors or supervisors must ensure that students have work to do at all times. Students should be given more responsibilities.

11. Universities should make it their sole business to ensure experiential placement for students in industries.

12. If your mentor in that particular industry is not qualified in your field, but in other discipline, for example BSc in other fields, with the help of the university you should be allowed to source the support of someone else (*another person*) from outside.

Better liaison between university and industry

1. Supervisor and mentor to communicate effectively on a weekly basis so that weaknesses can be dealt with in time.

2. Good communication between the university supervisor and industry mentor

3. To work hand in hand with the industry

4. Better liaison between mentor and supervisor

5. Better liaison with industry (government) about requirements of WIL

6. University should get feedback from industry to cover any gaps

7. A proper liaison between university and industry needs to be strengthened

8. Clear communication between institutions and industry is required. Student must show the schedule for his/her working in industry

9. Tertiary institutions and the respective academic departments must liaise with industry and tell them exactly what is required from the student during the WIL process in order to achieve the desired outcome

Industry support

1. More support from industry

2. Industry must provide more mentors

3. Industry is full of bureaucracy; those who have been long in industry and in power are limiting access for others (through loop-holed political policy). Students must

gain more by experimenting, not being told every time how you should do it or otherwise.

4. The university must try to understand the training system of the workplace and liaise with the company.
5. Students to be taken through the WIL syllabus on a monitored basis and work mostly for training purposes rather than industry needs such as production.
6. Industry to develop proper procedures for this training to cover all fields of engineering.
7. Companies seem not to know what to do with students doing WIL. We end up doing irrelevant things. Improve the information about the WIL to all registered students because, at the beginning, you don't have any idea!
8. Industries are not obliged to cover the WIL curriculum, negotiations with the industry must be emphasised. The company focuses on what they think (routine) is good for them, benefitting from you as a future employee.
9. People who are responsible for training students in companies often do not know what to do. Suggestion: thus train them to train students.
10. Placing learners with an experienced mentor for transferring skills.
11. Dedicated mentor at workplace is required.
12. Follow ups must be done by the institutions and industry.
13. There should be a programme by the company, not only from universdity, that will serve as a training programme/guideline for experiential learning students.
14. More support from the university, and more support from industry is required.

Regular visits and guidance by supervisor

1. To be visited at least four times during the period of experiential learning by the supervisor from the university.
2. Supervisors appointed should make it a priority to visit student during the training period.
3. Increase the student visits from the lecturers or mentors from the university.

4. The mentor at the industry should understand that the learner should acquire more insight into the work.
5. Supervisors must really do their work for inspecting the students' progress and guide them.
6. The student should be visited soon enough by his/her supervisor or any other university mentor.
7. Lecturers must visit the industry regularly and communication between the university and industry is required.
8. A full-time supervisor is required.
9. More supervision
10. There needs to be an independent body monitoring the employers of the university responsible for WIL, otherwise many requirements remain ignored but are portrayed as being met.
11. The university to follow up on what the student is doing at the place of work, like liaising with them and may be visiting them.
12. It is fine, just more support from university is lacking.
13. The university/institutions should visit the student at the workplace regularly.
14. Moral support from university and lots of guidance from the industry and university for practical skills are required.
15. The university must visit the students regularly.
16. The supervisor should interact with the students more during their learning period
17. The university to pay attention to each person and understand the background.
18. The university should be more involved in order to see how we are progressing and the industry should have more structured training.
19. Yes, the university should help students to find training and make sure people are qualified to be our mentors.
20. Supervisors from the universities should visit the work place to check if their students are getting proper training.
21. A brief discussion about the content of the logbook. Contact time with the lecturer (visit at work place) is required.

22. Stricter monitoring of WIL, more comprehensive syllabus, and testing after WIL are required.
23. Universities need to be hands on in the development of a student. They should keep track of a student's development during WIL and should also try to assist students in finding suitable WIL.
24. More visits from lecturer are important. Log book needs to be easy to understand in order to avoid confusion.
25. The university should visit the student's work location to see the situation and to support students.
26. Follow up from university to ensure student is doing the relevant and appropriate work (not a messenger or tea person).
27. The university should check on their students at industry to find out how they are being treated.
28. The university **to do monthly visits**, checking on the student's progress. Employers to give females a site to supervise or assist as student in training.
29. University to be more involved and send feedback on reports, not just marks.
30. A problem I experienced was the lack of guidance on the way forward for completing my studies and experiential learning.
31. Follow-up by the university/technikon is required.
32. Follow-ups must be done by the institutions and industry.
33. The lecturers should make sure that they visit the industry to check how well the students are being treated most of the time.
34. For the university to be more involved.

Communication with students

1. To be notified of what is expected from me as a student and what is the employer's role.
2. File the reports that were sent in, so that duplicates would not be necessary
3. Better description of experiences required and reporting method.
4. They should monitor the student's task and give them work to do.

5. Students should be thoroughly prepared before doing experiential training.
6. The expectations, of what is expected from the student by the university should be better communicated.
7. Better recognition of students.
8. Better relationship between me and senior management in my department is required.
9. To improve communication between a student, employer and university.
10. A more hands-on mentor/guide from the university will be great.
11. Study guideline and training programme are required.
12. Clarify the duties of the trainee and be specific on the tasks to be performed by students.

Other general points

1. Specify minimum wage and employment conditions.
2. There must be job opportunities after we are done with WIL.
3. Provide extended contract for better experience.
4. I think the institution must have their own facilities to help students with training.
5. That the government built a WIL facility for the University … so that the good theory is practised by students.

Summary: As may be seen, the majority of the improvements recommended for WIL are related to supervision by the university supervisors in the form of a visit or contact. There were also recommendations for improved communication and liaison, curriculum setting and the role of industry mentors. They have requested for more responsibility during the training. Although the suggestions were from a few students only, they have included extremely valuable points for supervisors and university departments.

4.1.8.2 Question 20 – If you were not provided with the experiences required in your curriculum, during the work integrated learning, then briefly explain why.

Inexperienced mentors

1. There were no prescribed mentors.
2. Not enough support from employer.
3. For the first six months of WIL mentor, who was not a qualified engineering technician/technologist, could not always provide applicable tasks.
4. Mentors not technical but just experienced. They should have a good academic background.
5. I did not have a good experience, because I was not provided with a mentor. Managers don't have time for the student.
6. There were not enough educated people to help me with my report and project.
7. Some of the required experiences were not provided because my mentor was not purely qualified in engineering, but had a BSc (pure science).
8. (Company name) uses specialised people, the work I did was only in one field of … engineering.

Limited opportunities for learning

1. I was placed in one project for a long time, acquired limited experiences.
2. Placed in a different field.
3. It was a small company and most of the duties were given to seniors and only non-design work was given to us.
4. It did provide basic knowledge on some (aspects) as it was dealing with only part of engineering and not a broad spectrum.
5. I learnt more at school (university) than what I learnt on site.
6. I was in a company that was focusing on one thing and I had to go around and get the experience for my curriculum myself.

7. It depends on the division within the industry, I inspected … which is nowhere covered in our curriculum.

8. I have to gain experience in … work (design) not administration only.

9. Everyone was focusing on production.

10. Industry can't afford to put too much trust on students to do relevant responsibilities, so they just let them do their test works for them.

11. I was hoping for a job placement thereafter. Not enough training was offered.

12. The curriculum was based on a … engineering point of view and not in my field.

13. Sometimes you spend the whole year on a contract where you just repeat the same kind of work.

14. Industry is quite specific on the training that they provide. Most of the items required by the WIL curriculum are left out of one's training as they do not form part of the employment core business.

15. I was only based on one site which means I was learning only that aspect of the process.

16. Sometimes, other industries are very small to put into practice everything you have done in the class.

17. No single industry encompasses the programme outlined in the curriculum content. If more than 70% is covered then training should be approved.

18. The company I worked for had different divisions of … engineering and I wasn't allowed to work on the other divisions to get experience.

19. The people at the … (i.e. mentors) were very supportive but the training structure from the company's training centre was not up to standard.

20. It depends on the nature of a project that the employer was busy with at the time (resources).

21. The problem with doing WIL for government is that most of the projects are given to the consultants and there is little work to be done.

22. Supervisors focus on the routine work of the division/department and train you on that. The student's goals/objectives at the end of WIL period were overlooked.

23. The experience is quite limited for that specific industry, the whole syllabus is not covered and more attention was given to industry needs rather than training.

24. At times in the industry, they push for more production than project exposure.

25. The work was entirely the same as what was taught at university but we were taught the basics. So it was hard to perform tasks.

26. I wanted to be in charge of a project but I had no experience, I was just helping here and there.

No curriculum

1. Even though I have learnt a lot during my WIL; I didn't have a curriculum/study guide and, therefore, I can't be sure.

2. The objectives for … students were not specified clearly.

3. The work was not really for a … engineer.

4. Industry experience was very broad, not specific. Industry not having proper guidelines for this training.

5. Companies or industries don't have a proper structure for WIL; they are more in production than training.

Wrong attitudes

1. Because I was black and intelligent, they didn't give me much work to do.

2. There was not enough work to be given and a lack of trust.

3. Not given responsibilities to experiment and express one's potential (which turns formal/academic education to be stereotypical). The colour being the main concern, followed by rigid culture.

4. Miscommunication

5. Employees at work give students a hard time and unpleasant attitude, thus making it hard to gain experience.

6. The trust wasn't enough from management because of inexperience.

Other

1. The biggest problem was being not familiar with commercial design programmes while at the university.
2. Depends on the company and who you work with.
3. National Diploma obtained in 1987. Experiences obtained through practical experience. Furthering studies now.
4. Different experiences were in different departments, but to have gained the experience I had to take it upon myself and asked to be rotated for a certain period in each of those departments.
5. I had to work as if I already knew the job. One day training was given; I had to trouble shoot the plant/process I knew nothing about.

Summary: The majority of the complaints regarding non-completion of curriculum were related to the fact that there were limited opportunities available during the industry placement. Some opportunities were not even in their own field and there was no one to talk to in this regard.

4.1.8.3 Question 22 – Do you have any other challenges?

Training curriculum not completed

1. At times students are treated as employees and they do what the company keeps saying he/she should do and end up not doing some aspects of the learning.
2. Being used as a driver or a tea lady
3. Yes, most of the things that are done in industry are the same.
4. Not placed in the right workplace.
5. After few months company used students to do all jobs and using them to reduce costs instead of employing staff.

Not paid during the work placement

1. Students had to feed themselves as they were not paid well.

Experiencing racism at workplace

1. Racism at work
2. Racism and victimisation of black students
3. Trainees are not seen as part of the company, especially by trade unions who think that trainees will be taking jobs of permanent employees who were employed because of experience and no qualifications.

Support from university and industry

1. After you have been placed, not even one person will make follow up on your progress.
2. Support to WIL students is vitally important.
3. Supervisors from the company took time to mark my report.
4. The challenge of always being considered as a student by industry, and not as an employee who is part of a team.
5. The university should periodically get feedback from the student's mentor to make sure that he/she is on a right track.
6. Universities tend to forget about students once they go for their WIL period in industry or company. Universities need to offer support to their students and practise such a code. This should not be a policy which is good on paper.
7. Teach students how to start projects and how to compile detailed reports and research.
8. Relevant lecturers not visiting students in their workplace.
9. Industry working together with varsity to develop the necessary training required to equip students for employment and also ensure that they graduate.
10. Please contact and liaise with students more.
11. There is a need to have a fully qualified mentor in your field of study.
12. Improvement of industrial relation with universities, students, and employees as well.
13. Set out criteria
14. Accountability in industry: All work has to be supervised to prevent students being targeted as "scapegoats"

Others

1. Lack of confidence in the students.
2. The challenge of being employed with a National Diploma
3. Supervision of experienced people while from school ourselves

Summary: In this section the respondents indicated why they did not complete the curriculum assigned to the WIL. As can be seen from the responses, a major problem appeared to be the liaison between the supervisor, the industry and the student in addition to a few other points which were mentioned.

4.2 Data from Qualitative Analysis (Interviews)

All the interviews, except for one, were carried out face to face. The purpose of the interview was explained to the participants at the beginning and the participants signed a consent letter. The actual interview was tape recorded and notes were also taken. All the records were transcribed from the tape recording into text. Some of the questions and the responses that were directly related to the research questions are recorded below. These questions are grouped, based on their relation with the research questions that were cited in chapter 1. The questions are mentioned in sequence and the text of the answers from lecturer no 1 to 7 is tabulated below the question. At the end of each question conclusions are drawn or observations made, based on the responses given. The questions are as follows:

4.2.1 Interview Questions Related to Research Question 1

It is believed that finding placement for all the students in engineering constitutes one of the obstacles to the timeous completion of the National Diploma. This is indirectly related to research question 1 regarding appropriate placement. The related questions are:

How many students were not able to find placement in 2009? How many could not find placement in 2008?

1. Only a few students, probably less than 10%. Usually they are not students with good marks. They struggle to find placement.
2. No one had a problem with placement in the years 2008 and 2009. There were 25 students who were looking for placement but the majority of them were not yet registered.
3. Only one student.
4. All had placement. Some were interviewed by industry but couldn't do well in the interview. Eventually even those students got jobs and didn't do so badly during WIL.
5. About 30% of … engineering students and 5% of … students could not find placement.
6. All are placed. One or two students had problems. The SETAs sometimes help with funding for placement.
7. All the students have placement

According to the responses given, it does not appear that placement was a major problem in 2008 and 2009. It may, however, become a problem in future with the higher numbers of students who are registering: in one case, between 5 and 30% of students remained without placement and, in another case, less than 10%.

How do the students find their placements?

1. They usually find the placements themselves.
2. They do find the placement themselves. The majority were employed in 2008 and 2009. In the year 2010 some were unemployed and this created problems for placement.
3. The majority are employed. Only one unemployed student so it is not difficult to find placement.
4. Normally they find it themselves. Potential employers send a list of their requirements. We also ask the mentor if there is space for more students. They usually say yes.
5. They find it themselves. SETAs also help.

6. They recruit students and get monthly salary and employ them for a period. Even two students from outside the country were placed.
7. They have placement before registering.

The responses indicated that the students usually find placements themselves although the universities do help when there are problems with finding appropriate placements.

Do you support them in finding placements? If yes, how?

1. Employers come to the UOT and look for good students. The positions are advertised on the notice-board. They are assisted with telephone calls.
2. Yes, during plant visit, we enquire about other possible placements. We also contact HR departments. Some regional offices also help in finding placement. Use SETAs for funding. Give students a letter of introduction. They organise once a month workshops for report writing. They learn how to write a CV, do job hunting, and discuss assessment. They have information on the website too. They also organise functions for industry participants.
3. Yes, we do.
4. Yes, by contacting mentors in the industry and getting the list of possible placements.
5. Yes, since 2009. When we visit students, we promote our specific university as a good provider of students. However, we can’t always get placement for all our students.
6. No record of those registered. The engineering departments are going to help so that we get the actual record of registered students.
7. All students are placed because we recruit them. They work as students for one year. They get employment as operators after a year of study and they continue with their studies. It means everyone would have a job at the end.

The universities support the students by providing information about the different industries. However, according to the new framework from HEQSF (2013), this practice must change and the universities have to find placements for all their students. This will place extra pressure on the universities but it would provide a support system for the students. Creative approaches will have to be devised so that more placement opportunities are provided. This, in turn, will require a closer relationship between the universities and industry.

4.2.2 Interview Questions Related to Research Question 2

The research question 2 involved the minimum duration required for WIL. The following two questions from the interview guide were linked to research question 2.

What do you think of the period of WIL? Is it too long or too short?

1. Too long. In construction they can do one to two months in the office.
2. Very important period. One year is needed but it can be managed in 6 months if organised.
3. Six months is fine if everything is working. It can even be three months intensive.
4. One year is right, preferably after S4. They usually get job if they do very well during this period. Therefore, it is good to send them after S4.
5. The period of six months is good enough. They can learn enough in six months. In the first six months, they learn about big environments, they do shift work and learn a lot. In the second six months they look at different problems and projects. We really don’t need the second six months. However, it must be a quality programme.
6. One year is recommended. Sometimes, it even takes two years.
7. One year is right.

According to the interviews, in one area of engineering, the majority of the lecturers identified one year as a good period for WIL while, in another field, 6 months was recommended. Based on these views, in some areas it may be possible to reduce the period to six months with some of this initial preparation being done at the university. However in other areas, the period will, perhaps, to remain at one year. Consultation with industry in this regard is crucial. All the placement issues are sorted out before registration and effective liaison between the supervisor and mentor is established so that problems may be sorted out efficiently.

What do you think of the period of placement? One year, six months, or three months?

1. Three months on site and three months on the campus was suggested.
2. One year is a good time. They employ them not only for training but use them too. The six-month period will give us a chance to employ more people
3. One year is preferred. It takes time to place the students but the syllabus can be completed in six months.
4. One year is required. Six months is short.
5. Six months
6. One year is good. Shorter time is not possible. Sometimes even two years are required to complete the syllabus.
7. Not less than one year. May be even 18 months is preferable.

For chemical engineering, all the lecturers unanimously recommended one year of WIL placement. However, as regards civil engineering, there were a variety of views, with between six months and a year being recommended.

4.2.3 Interview Questions Related to Research Questions 3 and 5

The following two questions from the interview guide addressed research question 3 which enquired "Whether a strict syllabus for WIL would have any effect on the training received" and question 5 – "Does WIL require a clear guidelines for effective training".

Do you provide them with any material before going to industry? Do you think that is important? Please explain.

1. Study guides and syllabi are provided. It is very important. It gives them a general direction.
2. Provide students with study material, guidelines and a logbook. It is very important.
3. It is important to give them the study material. Different aspects of the syllabi are explained, required qualification of mentor is indicated, and mode of assessment is clarified. The material is informative.
4. There is a manual for students, indicating what is expected and what task had to be completed. The seven categories of tasks are mentioned. All the necessary forms are also there.
5. No. There is no documentation provided but they have induction. We don't tell them what to learn. No prescribed curriculum. They get different training based on the company.
6. Yes, the study guide is important. They are planning to update the study guide. A logbook system is required. We need interim and final reports with summaries. There is a study guide but no detailed syllabi. We ask them to do 5 components and report on each aspect. One company might not be able to provide all five components.
7. We provide them with study material which contains a guide for the student, a guide for the supervisor and a logbook. The coordinator and representative guide students through the WIL period.

In the majority of cases (6 out of 7) study material and a syllabus were provided. However, the quality and type of these materials appeared to differ. Some are extremely comprehensive and others are very open and flexible.

What are they expected to do in the industry? Do you give them any curricula or guidelines? Please specify the form.

1. Study guides and syllabi are provided. It is very important. It gives them a general direction.

2. We familiarise them with the work of a (specific) engineer within an (specific) environment. The curriculum explains what they have to do. They need to apply the theory. They also need to communicate effectively. They need to learn to work with others.
3. We give them the necessary phases that should be covered during their training. They have four main phases to cover. These are planning, construction, contract and design. They have to cover at least two phases per module.
4. Students are supposed to give the manual to their employers. Companies in the area (75% of them) use their students regularly. Therefore, they are familiar with what is expected of them. During the visits, after three to four months, the lecturer checks if there is any deficiency in the work done, such as the use of AutoCAD, etc and will advise the company accordingly. The most important aspect of the work is the need to understand how a site works.
5. There is a WIL guide for students. In this guide, we provide them with a list of possible skills that they can learn. They can't be too prescriptive because not all industries could provide the same learning. There are 20 to 25 topics. They expect companies to choose 50% of their topics from the list.
6. They have to complete each component and write a report. Therefore, they have to move from one section to another.
7. The coordinator and representatives have discussions with the individuals right from the beginning and make a three-month plan and leave one month for the writing of the report. They provide them with details that are very specific. They want them to become senior operators at the end of the training. They ask them to recommend changes during the training.

In the majority of cases, study material or a guide were provided. The lecturers considered this as extremely important. In one case there was flexibility in the curriculum and a three-month plan was formulated for each individual without following a firm curriculum. In another case broad phases were introduced and the details were left to discretion of the company/ industry.

What do you do with your students before placement? Any induction course offered?

1. They have an orientation course during the foundation period only. One session for P1 students only.
2. No induction is provided but we provide them with study materials, explaining their roles and responsibilities. They also have discussion classes.
3. We provide them with study guide. It indicates what must be covered during this period but no induction course at the university.
4. There is induction during the first WIL module in the industry.
5. At S4 level they have an induction course which is for one day. We teach them how to prepare a CV and tell them of possible placements. We ask them to give attention to ads in newspapers, internet, etc. Encourage them to show willingness in their work.
6. Report writing session will be organised for the students. Noted the need for such an effort after visiting students.
7. They go through induction, first aid and safety courses before getting to the …….(actual work environment).

It was noted that there was no preparation for work placement in the majority of cases while, in a few cases, there were report writing and CV preparation (one-day) short courses offered. There was one case (interview no. 7) only in which the students were recruited and prepared for employment and, hence, induction was carried out. This notion of preparation for work placement could be expanded upon.

4.2.4 Interview Questions Related to Research Question 4

Research question 4 referred to the presence of supervisors and mentors during the WIL programme.

Do the students have mentors in the industry? How is your liaison with them? Do you consider your liaison important? Please explain.

1. Yes, we do. Liaison depends on the site, some mentors contact us and we are sure of the quality of the offering but sometimes it is difficult to liaise with mentors. This is a challenge.
2. Yes, we have. Liaison is in the form of visit. We visit the student and mentor at the same time. There are different types of mentors. Some are interested in the progress of students but others are not. Some mentors don't know what to do. Big companies are better than small ones because they have training schedule.
3. Yes, we do. The liaison is good but could be improved and must become more regular. We may need to contact the mentor after the submission of the first assignment or at least communicate with them immediately. There has to be once or twice a month correspondence.
4. Yes, we have. This is done through appointment and a meeting with the mentor face to face (if possible). Sometimes they call if things are not working well as they were supposed to. However, if everything is ok we don't hear from them.
5. Yes, we do. The qualification of the mentor is important. It is checked. We liaise with him. Students send (email) monthly report. The 1st page is filled in by the mentor and the second page is a summary of activities. The second page is evaluated and marked by the mentor. There are 10 questions to report on. If there is any problem, then a visit is organised immediately.
6. All have mentors. Yes, the liaison is important. The mentor has to look at the tasks and provide an opportunity for missing skills. The mentor has to read the report before it comes to the supervisor.
7. They all have mentors. Very good and regular.

It appeared that all students have mentors. Liaison with mentor is mainly in the form of visits. However, contact is made if there is a problem. Nevertheless, there is clearly room for improvement in the liaison between mentor and supervisor. This process should be formalised and regular monthly contact via email or telephone could become the norm, especially if the period of experiential learning is reduced. However, if this process is to be implemented it is essential that the lecturers in charge of experiential learning be given a reduced academic load as regards teaching so that they are able to concentrate more on liaison with the mentors and students in order to visit and support them.

What is their (mentor) role? Is it important to have mentors?

1. Their role is important but it is also a challenge.
2. Yes, it is important. They guide students.
3. They guide the student. He/she should be experienced with an engineering background. The mentor shouldn't solve the problem for the student but should guide him.
4. They are part of the process.
5. The role of the mentor is to supervise and help the student. Brain training is done by the university but practical work and hands on experiences are done by industry.
6. Ideally one mentor is not enough for all the tasks because they are very different tasks and need different expertise.
7. Mentors guide them on a day-to-day basis.

The majority replied that the role of mentor was important in terms of guiding the students on a day-to-day basis.

Does appropriate placement, supervision and mentoring have an effect on the value of the WIL?

1. Yes
2. All three are important.
3. Yes. Placement, mentoring and supervision can affect WIL. Quality assurance is required.
4. Yes, good employers are required. Otherwise, students will be used as cheap labour. Experiential learning placement must be near otherwise visiting will be difficult.
5. Yes, all three are required. We can't compromise quality
6. Yes, all three are required.
7. Yes, all three of them are important.

All the participants agreed that these three factors are important aspects of the training.

4.2.5 Interview Questions Related to Research Question 6

Research question 6 referred to ongoing contact between the institutions of higher learning, students and industry. The following questions from the interview guide addressed this research question:

Do you visit all your students? How many times in a year?

1. Eighty percent of students are visited. Only those who are abroad or very far cannot be visited but they are contacted by other means.
2. Yes, once every module. If registered for both P1 and P2, then they are visited only once.
3. We visit only those who have submitted their progress report because it is costly to visit students that haven't even started. If registered for both P1 and P2 at the same time, then they are visited only once. If registered for one module, then they are visited during each module.
4. All lecturers get a list of WIL students. It is divided among them. They try to visit all students. However, it is difficult to visit those who are really far. The lecturer starts with the further ones first.
5. No, not all the students are visited. We visit 60 to 70% of them. However, there are foreign students in Africa, in Canada and some on oil rigs so it is not possible to visit all of them. We try to visit them at least once during P1 or P2. We had 12 students in Namibia and visited them once.
6. Once for P1 and another time for P2
7. The WIL representative visit students regularly, at least once during each module.

Generally, it would appear that the majority of students are visited except those who are in distant places or overseas. However, students are usually visited if they are progressing well with their courses.

4.2.6 Interview Questions Related to Research Question 7

Research question 7 was aimed at ascertaining the effect of the student's attitude on WIL.

What is the attitude of students during WIL? Please explain.

1. They want to do it.
2. Apart from WIL placement that is sometimes problematic, the attitude is good.
3. Attitude is good in most cases. They are hard working as visits show.
4. The majority have a good attitude during this period of learning. The majority enjoy it.
5. In all these years of supervision only one student had a bad attitude. But, usually, they are good. They know that people talk and don't listen only to their point of view. The only problem is report writing. More responses from employers indicate that students are good students and almost none complain about any of them. University accredited companies and that means that we are happy with their programs. The student must add value to the company, otherwise they become redundant.
6. White students are usually very positive but some black students complain. They are negative and have financial problems too.
7. The vast majority (98%) are positive. Only shift work is a point of unhappiness

The attitude of the majority of students appeared to be good. However, lecturer no 6 identified a serious concern that needs to be addressed because of the racial tension that exists in this country.

4.2.7 Interview Questions Related to Research Question 8

Research question 8 referred to whether WIL is an important part of syllabus for the training of technicians. The following interview questions related to this question.

Do you think we can do part of this training at the universities? If yes, what could we do?

1. The first three months could be used for documentation training, preliminary design and similar aspects at the universities. Surveying and practicals could be done during the other three months.
2. No, I don't think so. The work environment cannot be replaced.
3. Because of the nature of the work, it is difficult to do it at the university.
4. Yes, we can do the material testing work at university. Documentation and project management is done at the university presently but should also be practised at a site.
5. No, this is necessary for the National Diploma. The employees will be reluctant to take students without WIL. Usually 80% of the National Diploma students get jobs after their training. Some on a permanent basis and others on contract.
6. No, they need industry exposure. Some departments have full time staff for this WIL training.
7. It can't be done at university.

All the lecturers believed that it would not be possible to replace experiential learning with any kind of work at the university. However, there does seem to be room for doing some sections of the syllabus at the university and, therefore, reducing the period of experiential learning, although it appears that this would be easier in certain areas of engineering than others.

Is WIL an important part of the National Diploma? Could we do without it?

1. It is a good thing. We can't do without it. It can be done after ND and before registration with ECSA because we have too little time for all the subjects in ND.
2. It is important and can't be replaced from the student's point of view. They become more mature and practical after Experiential Learning. They learn how to apply theory. They think differently.
3. Yes, it is a very important component of National Diploma. If it is not possible to do it during ND, then they have to get it afterwards. They should have hands on experience.

4. Yes, that is the reason for the existence of universities of technology. It is important but a better option for the training of technicians is the Higher Certificate + Advanced Certificate + One year of Experiential Learning.
5. It is very important, especially for universities of technology. Almost 80% of our students get jobs after WIL.
6. Yes, it is a very important part.
7. Yes, very important.

All the lecturers agreed that WIL is an important part of the National Diploma and could not be replaced by anything else.

4.2.8 Interview Questions Related to Research Questions 9 and 10

These following two research questions related to the WIL requirement in the HEQF document. The HEQSF document was not yet available at the time of the interview.

Are you familiar with the HEQF document? Are universities equipped to find placements for all Diploma students?

1. Yes, it is possible but students have to pay more for their experiential learning module so that universities organise part of the training work at the university.
2. Yes, we can find enough placement if companies cooperate.
3. Universities will struggle because of the lack of funding for these modules.
4. Yes, finding 300 to 400 placements is possible. It is not a problem.
5. No, it is dangerous to ask universities to find placements for all their students. The economy changes and we can't make promises. It is not always possible. There is also competition between all universities.
6. Universities can find placements with the support from the SETA's at present. The Higher Certificate and Advanced Certificate could be a replacement also.
7. All are placed right now. Only problem could be overseas students.

The majority believe that it is possible to find placements for all students. However, there were concerns raised by some of the lecturers regarding the need for support from the SETAs for funding. It was also suggested that students should be asked to pay a higher fee for their experiential learning module.

Is your university planning to offer the new diploma qualification (HEQF)?

1. Yes
2. Yes, they are going to offer the diploma.
3. Yes, they do. The new PQM is approved.
4. The university is planning to offer a Higher Certificate, Advanced Certificate, Degree and Diploma.
5. Not yet sure, some engineering departments are planning to go for the Diploma and others will go for the three-year technology degree programme. The experiential learning will be part of all the programmes based on a senate decision.
6. Slowly the National Diploma will be phased out.
7. Yes, the new diploma will be offered.

The majority responded in the affirmative to this question.

4.2.9 Interview Questions Related to Reports

What is the format of the WIL final report?

1. In small companies it is hard to get all aspects of training. For example, Water Affairs has a good training programme for WIL students. For P1 they send monthly reports. The assessment of the mentor is done on site. For P2, a technical report is written, an additional report on specific problems on site (which is research oriented). They also have oral presentations at the campus in the presence of mentor and supervisor.
2. They provide portfolio of their activities. Evidence is required. They need to do projects too.

3. They are advised to write a full report based on those phases. At least two areas of the … engineering must be covered, for example, … and …, etc. The final report is subdivided into smaller reports. There are eleven chapters or small reports. During the visit one or two good reports are shown to the students for training purposes.
4. We want to know what they have done. We need them to write a good report. I need a lot of drawing and it should be self explanatory. The report contains the work done in each of the seven categories identified. They diarise every day's work. The logbook is also there.
5. All the work is included in the final report, projects, day to day work, mini-dissertation. The mentor marks the report and makes sure that the information is not copied from industry sites. The supervisor would then check the quality of the documentation and mark it again. In the P1report, mainly day to day plant work, induction, safety, flow diagram of a section of the plant and plant layout are included. However, P2 includes projects.
6. It is a report.
7. They write a report based on the requirements of the module.

There appeared to be different requirements for report writing. Some reports are in a very basic form, such as logbook, while others take the form of a mini dissertation. However, it is essential that there be at least a minimum requirement for the WIL report which is a major contributor to the WIL assessment.

Do the students reflect on what they have done (and their experiences and learning) during their placement period?

1. They only have reflection during the oral presentation but not in writing.
2. No, not really, but their responses are positive. They can send them a questionnaire for reflection.
3. This should be an important element to consider in future. It should be initiated. We can ask them to reflect on their work. There is no reflection if everything is going well. However, if there are problems we ask them some questions during the visit.

4. The department has interviews with the students after the completion of their P1 and P2. During the interview students are forced to reflect on the work they have done. Unfortunately, mentors are usually busy and can’t attend the interviews regularly. They make presentations and problems are mentioned.
5. They reflect. They have questionnaires at the end of their training. The perception of the student before going to industry is reflected in the left column and the right column shows their impressions afterwards. No trend has been found yet because they have different experiences. Not easy to find trends. We might be able to find a trend if we do it for all students in one industry.
6. No reflection
7. No formalised reflection and no questionnaire about Experiential Learning and no feedback from lecturer to students. They only receive feedback from mentors (representative).

With the exception of lecturer no. 5, the results showed that there is no formal reflection on the work done. However, lecturer no. 5 indicated that some sort of impression is required after training. It is essential that reflection on the process become part of the WIL training to enable continuous improvement. It may be helpful to consider anonymous reflection so that students are able to give their opinions freely and not worry about being penalised.

Who marks the WIL report?

1. The supervisors and mentors both mark the report. Marking is a challenge because there are many supervisors for each module and the consistency of marking will be a problem. All lecturers are in charge. Detailed criteria are required.
2. The mentor evaluates the student and fills in the form and indicates if he agrees or disagrees with the report but the supervisor does the final marking.
3. It is marked by the supervisor but the initial evaluation is done by the mentor and it will be considered by the supervisor.
4. The supervisor at the university marks the report. There are a few lecturers and they might mark differently. We need to find a way of harmonising the marking by employing a lecturer for this job.

5. The mentor marks it first and then the lecturer. Both marks are added and then divided by 2.
6. The mentors evaluate and give a general mark but they really don't read the details. The final mark is given by the supervisor and is very different to the mentor's mark sometimes. Many mentors are not registered but have experience.
7. The reports are first marked by the mentor (including all flow diagrams and operations). The supervisor then makes sure that there is consistency in the marking and provides the final mark.

In the majority of cases, the mentor evaluates and awards a mark but the supervisor or lecturer gives the final mark. However, in view of the large numbers of students and the few lecturers who work with experiential learning students, some lecturers mentioned that consistency in marking is a challenge. Also in other cases, different mentors use different methods of marking. Accordingly, it is recommended that a rubric with a detailed marking schedule be provided in order to harmonise the work of the evaluator, mentor and supervisor.

4.2.10 Interview Questions in General

Any challenges with WIL?

1. Assessment criteria are required so that all supervisors mark using the same criteria.
2. Too much work. Funding is a problem. Placement is also a challenge.
3. Visiting students in remote areas is a challenge. Visiting students outside South Africa is also a challenge. The quality assurance of the WIL done outside South Africa is also a problem. It is an expensive exercise.
4. Yes, distance is one challenge. For example, we can't visit students in Angola. Finding a good employer is another challenge. Lecturers must have experience. They should be ECSA registered or eligible for registration.
5. It is the paper work and storage. We are developing tutor system online on our website. They register for the system online, do their assignment and submit it. The lecturer will mark online and the result is calculated and final mark is provided.

They can also check the copyright issues and make sure it is authentic. Placement is also a challenge. As long as it is a partnership between student and university, it is ok. However, if it becomes the university's responsibility, then it is a problem. The workload of the lecturer in charge of WIL is another challenge. They don't value the amount of work done by the lecturer and even some HODs do not see the necessity of WIL.

6. The study guide must be upgraded.
7. The recruitment process is important. They also have to do shifts as senior operators and that is usually a problem. Although they were informed that they would become senior operators in this specific field yet, at the end, they have expectations of becoming technicians.

A variety of challenges were identified. Some challenges are local and depend on a specific university. Some of the challenges, such as visiting students in faraway places and overseas, the workload of WIL lecturers appear to be more general and related to the majority of universities of technology. However the need for more placement opportunities requires closer collaboration between the university and industry.

Do you have any suggestions for the improvement of WIL?

1. Well-developed and well-organised experiential learning is very beneficial.
2. The industries should be encouraged to place more students. At least one student from each university per industry, depending on the size.
3. Regular contact between the supervisor and mentor is necessary. We need to be sure that the student is in good hands, well before visiting students. We need to ask for two progress reports rather than one. The lecturer should visit students after both reports have been received.
4. One person should mark all the reports and they shouldn't be distributed among all lecturers.
5. Use online marking system for contacting students. Use technology such as Skype for those we can't visit.

6. Place students in the right environment. The stipend must increase. The mentors must be registered.
7. The operation of the plant must be part of the syllabus for WIL.

Some recommendations were local and applied to a specific university or industry but others were related to the challenges identified earlier. For example, it was suggested technologies such as Skype be used to contact those students who are placed overseas or in faraway places. Consistent marking was also recommended. This may be achieved by having a rubric for assessment. It was also suggested that industries be encouraged to accept more students. This, in turn, would require either an effective marketing strategy or legislation of some sort.

What do you think of the future of WIL?

1. Part of the training could be done in-house and place them for a shorter period. If we have to find placement for all students, then we can make use of simulation processes.
2. It is needed. It is not a good idea to remove it. Students need the training.
3. It is problematic because placing all students might not be easy. It is also costly to run this course.
4. We need it.
5. Yes. This is a way of ensuring collaboration between industry and university.
6. It is not possible for the university to do the entire placement. The value will be reduced if the Diploma has no WIL component. The students usually get employed after its completion.
7. It will be the same as it is now.

The majority of the lecturers considered WIL to be an important aspect of the curriculum although two lecturers expressed concern about the placement of all the students. In another instance a shorter period of training was recommended.

4.2.11 Summary

In this chapter the data from the questionnaire was statistically analysed. The relationship between different questions in the questionnaire was investigated in order to find a logical response to each research question. Some of these interrelations were simple such as the relationship between biographical information, such as gender and discipline, while others needed some statistical interpretation and confirmation. For example factor analysis for challenges faced during WIL experience.

For open-ended questions, all the comments were categorised under a few topics and a summary was added. In the interview section, response to each question was tabulated and a short summary was made of the collective responses.

CHAPTER 5
DISCUSSION

In this discussion we will concentrate on the results that are directly related to the research questions in section 5.1. We will also attempt to link the results obtained from the questionnaire with those obtained from the interview. In section 5.2 we will discuss the data that are not directly related to the research questions, but that are the by-products of our research. The results mentioned in this study are unique because there has not been similar research on the Work Integrated Learning of engineering students in different institutions in South Africa. Research work has been carried out in other countries of the World and their literature was reflected in the literature review. For example we noted that in Australia, the inclusion of Work Integrated Learning in the curriculum has been increasing (Abeysekera, 2006) while in South Africa since the introduction of the HEQF, interest in this component is on the decline.

5.1 Discussion on Research Questions

The main research question in this investigation is: "Does the present format, placement, collaboration, time period, guidance, and syllabus of work integrated learning (WIL) and the attitude of the students directly affect the practical experience gained from WIL and eventually the training of engineering technicians; and what learning can be gained from the present practices for the future restructuring of these modules in light of the HEQSF document?"

Several research questions were derived from the main question, based on the variables that could be affecting the operation of WIL. These sub-questions are the following:

RQ1 Does appropriate placement for WIL make any difference in the training of technicians?

RQ2 Does the duration of WIL have any effect on the training of technicians? If yes, what should the minimum required period be?

RQ3 Does having a strict syllabus for WIL have any effect on the training received?

RQ4 Is the presence of a mentor or supervisor an important part of WIL?

RQ5 Are clear guidelines necessary for a WIL module for learning?

RQ6 Is continuous contact between institutions of higher learning, students, and industry crucial to WIL training?

RQ7 Does the attitude of a student have any effect on his or her practical learning during the WIL period?

RQ8 Is WIL an important part of the syllabus for the training of technicians and technologists?

RQ9 What are the WIL requirements in the new HEQSF document?

RQ10 How can we use the outcome of our current research of present practices in the restructuring of the WIL component in light of the HEQSF document?

We will analyse the data related to each sub-question and discuss them separately. The summary of each section is indicated in italic.

5.1.1 *Research Question 1 – Does appropriate placement for WIL make any difference in the training of technicians?*

Questionnaire

It is important to note from the frequency data obtained for question 9 in Table 4.1A that 55.1% of those who responded had permanent employment, 24.7% had contract employment and only 20.2 per cent had to be placed for WIL. Therefore, the majority of the sample group was already employed. This is deemed to be a good employment rate.

Factor 2 in question 19 was identified as the "Importance of WIL" in training engineering technicians. This factor is a combination of three questions, 19.1, 19.2 and 19.3. The statistical data are tabulated in Table 4.27. The mean value is 4.42, which falls between value 4, which indicates "often", and value 5 which is "almost always", based on the questionnaire. This demonstrates that most respondents rated the questions pertaining to Factor2_Q19 as more "often", but not as high as "almost always". Therefore, factor 2 question 19, which shows the "Importance of WIL" in the training of technicians, is often rated high but not necessarily in all cases. We need to note that some cases were not ideal WIL placements.

In question 21, the respondents were asked to identify the challenges they faced as a result of their inappropriate WIL placement. The majority of respondents in this group did not seem to have many challenges in this regard, because in question 21 factor 1 (challenges of inappropriate WIL placement) the results show a mean of 3.16 (see Table 4.27), which is right in the middle of the range. That means that most respondents answered the questions pertaining to NFactor1_Q21 as "sometimes". The response seems to be very reasonable because the majority of students had contract or permanent employment and only a small percentage of them were placed for WIL. Therefore, they had less challenges during the WIL period.

Therefore, the sample group identified WIL as an important part of their work. In addition, only "sometimes" did it happen that they experienced challenges with inappropriate WIL. This is confirmed by responses to question 14 in the questionnaire, reflected in Table 4.93. In this question they were asked "Do you think improvement in any of the following areas would have helped you to receive a better training?" In this case, they were allowed to mark more than one answer. This shows that a major shortcoming with regard to WIL that was identified by this question was a need for "better liaison between universities and industry" and to a lesser extent the support from industry.

The statistical analysis obtained from the combination of question 21 factor 1 (challenges of inappropriate WIL placement) and question 14 (if improvement in any of the following areas would have helped you to receive better training) revealed that from the seven options given in question 14, the *p*-value was smaller than 0.05 for answers 1 and 3 (0.0209 and 0.0309 respectively); therefore there were significant differences between the mean scores of factor 1 of question 21, which relates to the challenges of inappropriate WIL, and experience of persons with regard to "more appropriate work placement" and "more support from industry". Therefore, statistically significant differences exist between the mean scores. That means that persons who had "more appropriate work placement" and "more support from industry" experienced fewer challenges with their WIL than persons who experienced none of these conditions (see section 4.1.5.12).

In addition, when the respondents were asked in question 18 whether they "could have received this WIL at the university", the reply, based on their own judgement, indicates that 57% believed that it would not be possible to get WIL experience at the universities and 34% believed that only part of it could be done at the universities (Table 4.1A).

Question 16 tested the respondents' opinion on whether they would have opted for alternative courses in place of WIL placement if there had been such opportunities. The majority (87.9%) (Table 4.1A) indicated that they would have chosen WIL. This is an indication of the acceptance of WIL as a component of the respondents' training.

These results indicate the importance of WIL in the training of technicians. This however does not match the fact that the inclusion of WIL is on the decline in South Africa. In other countries, for example in Australia, Griffith University planned to include WIL in 70 percent of its programs by 2010 (Griffith University, 2007). We believe this is the case because the responsibility for the placement of students during the WIL period has been shifted to the institution, according to the HEQSF document. The merger of institutions has also forced them to streamline their offerings. As a result the offering of the Diploma program in engineering might be sacrificed.

Interview

During the interview all lecturers responded that WIL is a very important part of the National Diploma and cannot be replaced with anything else (see section 4.2.6). In the same section, when the lecturers were asked whether appropriate placement, supervision and mentoring have an effect on the value of WIL, they unanimously responded that all three factors have a major effect on the value of WIL.

In another part of the interview, section 4.2.3, all lecturers responded that it is not possible to replace experiential learning with any other kind of work at the university. However, there seems to be room for doing some sections of the syllabus at the university and thus reducing the period of experiential learning. However, this would seem to be more of a possibility in some areas of engineering than in others.

We can therefore conclude, based on the above discussions that a proper placement has a major effect on the training of technicians and technologists. Students would face less challenges, if the WIL placement is appropriate and more support is available from industry. Although this research showed that students in the National Diploma appreciate the value of work placement in South Africa and the research indicates its importance in the training of technicians, nevertheless it showed that its importance is really dependent on a good liaison between university and industry. To improve the offering of WIL in South Africa, we need more human resources allocated to this endeavour and hopefully a full subsidy from government would support work placement and offering of Diploma in the *institutions of higher learning. In Griffith university in their 'Good Practice Guide', it is indicated that student placements must be in 'authentic professional contexts as learning environment' (Smith and Simbag, 2009*).

5.1.2 Research Question 2- *Does the duration of WIL have any effect on the training of technicians? If yes, what should be the minimum required period?*

Questionnaire

In question 17, participants were asked about the duration of WIL and how long they needed to complete the curriculum. They were given three options: seven months to one year; four to six months; and three months or less. The majority of responses fell into the category of seven months to a year, as can be seen in Figure 5.1 and frequency Table 4.1A.

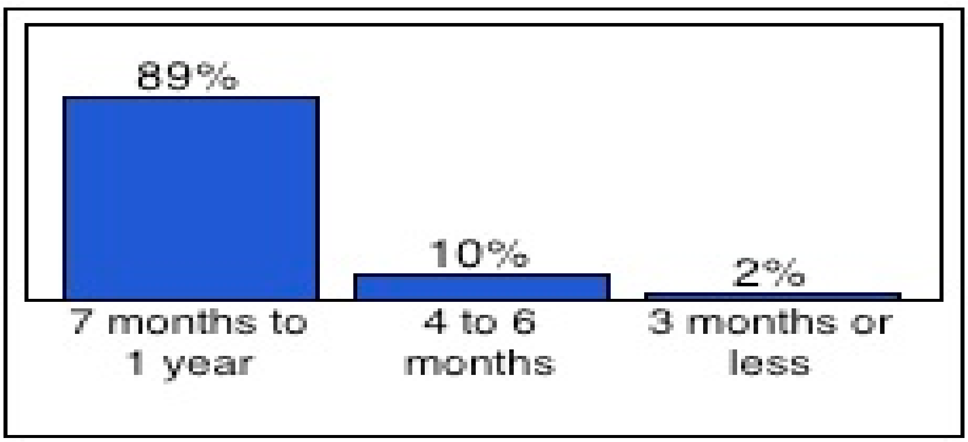


Figure 5.1: Preferred period of WIL

A comparison of results for question 19 factor 2 (Importance of WIL) and question 17, with regard to the period of WIL (Table 4.55), indicates a *p*-value of 0.0401, which is lower than 0.05. Since the *p*-value is lower than 0.05 (> .0401), significant differences between the mean scores of factor 2 question 19 (importance of WIL) and the different durations of WIL are indicated. The mean score for the category of seven months to one year is higher than for four to six months. Therefore the importance of WIL is dependent on its duration.

A similar comparison between the mean of question 19 factor 1 (satisfaction with WIL experience) and question 17, that is, the period of WIL (see Table 4.42) produced a *p*-value much higher than 0.05. Therefore, satisfaction with the WIL experience does not indicate a statistically significant difference between the mean scores of factor 1 of question 19 and participants' preferences for different durations of WIL. It is important to note here that all the participants served a one-year WIL period.

These results indicate that the importance of WIL is dependent on the respondents' selection of a preferred period of WIL. However, the satisfaction with the WIL experiences was not affected by the WIL preferred period because all of them participated in a one-year WIL programme.

A statistical combination of question 17 (period of WIL) and question 4 (discipline of engineering) produced a *p*-value greater than 0.05. Therefore, there is no statistically significant difference between civil/chemical engineers with regard to the preferred duration of WIL (see Table 4.87 and Figure 4.29).

Interview

During the interview, when asked about the period of placement, the majority of lecturers felt that one year of experiential learning was satisfactory (section 4.2.2). However, when asked whether this period is too long or too short, they responded that the period could be reduced to six months and that, especially for civil engineers, part of the training could be completed at university (see section 4.2.6). In addition, they specified that if this period were to be shortened, then some of the preparatory courses should be done beforehand and placements should be in place before the WIL period starts.

In summary, both students and lecturers choose the period of 7 months to a year as their preferred period for work placement in Engineering Diploma programme. This finding is very timely and it matches the content of HEQSF in South Africa (HEQSF, 2013).

5.1.3 *Research Question 3 - Does having a strict syllabus for WIL have any effect on the training received?*

Questionnaire

In question 13, the participants were asked “Have you been provided with a curriculum or syllabus for WIL?” Accordingly, the majority (85.3%) responded to the question in the affirmative.

A comparison of question 19 factor 1 (which shows satisfaction with WIL experience) with question 13 (which is the presence or absence of syllabus) produced a *p*-value of 0.0009, which is lower than 0.05. This indicates that there is a statistically significant difference with regard to their satisfaction with the WIL experience between those that had a syllabus and those that did not (see Table 4.39 and Figure 4.9). Those with a syllabus had a better experience.

A similar comparison between question 19 factor 2 (importance of WIL) and question 13 produced a *p*-value of 0.3724, which is greater than 0.05. This indicates that there are no significant differences between the mean scores of factor 2 of question 19 for persons that had a curriculum/syllabus for WIL or not. Therefore, statistically there are no significant differences between the mean scores. That means both persons that had a curriculum and those that had no curriculum scored the same for Q19 factor 2. The details of this may be found in Table 4.50 and Figure 4.13.

In open-ended question 20 of the questionnaire, students were asked to explain briefly why they had not been provided with experiences in their curricula, if that was the case. Consequently, 21.2% of students responded to this question and mentioned various reasons for this, which are reflected in section 4.1.9.2. Among them were points related to no curriculum, work not suitable for an engineer, very broad and unspecific industry experience, and companies or industries not having a proper structure for WIL. Many of these points could have been resolved if there had been a clear syllabus and guidelines for both students and employers.

Interview

During the interview, when lecturers were asked whether “any material was provided to students before placement”, the majority of lecturers (6 out of 7) mentioned that study material, a study guide or a syllabus had been provided and this was considered a very important aspect of WIL. However, the quality and type of these materials seem to have differed.

In sum, a curriculum or guide is required for the placement. It has to be flexible but specific on the professional/technical areas of learning and soft skills rather than in details. Its assessment has to be aligned with the curriculum. There must be a consistency in different disciplines with regard to WIL.

Our experience showed that assessment methods used for WIL were more appropriate for this kind of learning. However there was a lack of continuous assessment in some instances. This is different from the findings of Wellington, Thomas, Powell & Clarke (2002) that many institutions continue to use traditional assessment techniques, such as exams, as a preferred means of testing student learning in WIL programs. A similar view was confirmed by Hodges, Smith & Jones (2004) who reported a comparable scenario in most engineering courses.

5.1.4 Research Question 4 - Is the presence of a mentor or supervisor an important part of WIL?

Questionnaire

A comparison of the mean in question 19 factor 1 (satisfaction with WIL experience) and question 11 (having a mentor) indicates that since the *p*-value is smaller than 0.05 (> .0001), there are significant differences between the mean scores of factor 1 question 19 and persons that either had a mentor or not. This indicates that persons who had a mentor scored higher for question 19 factor1 than persons who had no mentor, as discussed in section 4.1.5.2.

A comparison of the mean of question 19 factor 1 (satisfaction with WIL experience) and question 12 (having a supervisor) indicates that since the *p*-value is smaller than 0.05 (> .0017), there are significant differences between the mean scores of factor 1 of question 19 and persons who either had a supervisor at the university or not. Therefore satisfaction with the WIL experience is dependent upon the presence or absence of both a supervisor and mentor.

Similar comparisons between the mean of question 19 factor 2 (Importance of WIL) and questions 11 and 12 produced *p*-values that were greater than 0.05 (0.8480 and 0.6553 respectively), therefore no significant differences exist between the mean scores of factor 2 of question 19 and persons who either had a mentor or supervisor in the industry or not. Hence, statistically there are no significant differences between the mean scores (see sections 4.1.5.7 and 4.1.5.8). Therefore, the importance of WIL is independent of factors such as the presence of a mentor or supervisor.

Question 21 factor 2, that is, “the challenges of university support for WIL placement”, has a mean of 3.33 which indicates that “sometimes” there is inadequate university support for the WIL placement of students. In this regard, the role of the supervisor is extremely important in improving university support.

One-way analysis of question 21 factor1 (challenges of inappropriate WIL placement) by question 14.3 produced a *p*-value of 0.0309. This indicates that there is a significant difference between students who had support from industry and those who did not have such support with regard to their challenges with inappropriate WIL. A main role player in this process is the industry mentor.

It is important to note that, in this sample, 85.7% of participants had had mentors and 73.6% had had supervisors. It is difficult, however, to imagine how those that did not have a specific mentor coped with their WIL period.

Interview

Question 17 of the interview asked: “Do the students have mentors in the industry? How is your liaison with them? Do you consider your liaison important? Please explain.” Accordingly, the responses from the lecturers show that all students had had mentors, but liaison with these mentors occurred mainly through visits, although contact was made in the case of difficulties. There is therefore room for improvement in the liaison between mentor and supervisor. This process could perhaps be formalised and regular monthly contact by email or telephone could become the norm.

In question 19, supervisors were asked whether all students received a similar kind of service from their mentors. The reply was that, in general, students do not receive the same service, because those in big companies generally receive better training than others. This would indicate that there is a need to provide the detailed minimum tasks for each experiential learning placement. In advance of placement, there has to be a round of visits to companies in order to ascertain whether they have the facilities needed to offer the experiential learning tasks. Only then should they be accredited for this purpose. Another option is for students to be placed in two different companies during the period of WIL so that they are able to meet the minimum requirements.

Similarly, when lecturers were asked in question 18 whether it is important to have mentors, the majority replied that the mentor has an important role to play in guiding students on a day-to-day basis.

In summary, the presence of a supervisor and mentor plays a very important role on the WIL satisfaction, experienced by students. At presence, some supervisors have hands off policy because it is believed that while students are in the industry, it is the mentor’s responsibility to provide the necessary learning opportunities and feedback to students. The study shows that this is a collaborative work and that students expect both the supervisor and mentor to support them during the WIL period.

Our research shows that in some universities there is a formal relationship between the academic supervisor and industry mentor. For example, in Murdoch university in Australia, the supervisor and mentor sign a pre-agreed work plan to be performed by the student and the roles and responsibilities of the two supervisors are clearly mapped out (Murdoch University, 2013)

5.1.5 Research Question 5- Is clear guidance for a WIL module necessary for learning?

Questionnaire

Responses to questions 24 to 29 are shown in section 4.1.8.4, with the details being included in Appendix J, part 4. These questions required the participants to identify the roles and responsibilities of each partner in WIL. A variety of responses were given to each question and it is obvious that students were not clear about the role and responsibilities of the different role players involved during the WIL period. This definitely needs clarification in the WIL guidelines.

In question 20, which was open-ended, students were asked to explain why they were not provided with the required experiences in the curriculum, if that was the case. The response rate here was only 21.2% and included a variety of answers. A summary of the responses regarding the absence of clear guidelines is given below:

- People who are responsible for training students in companies often do not know what to do.
- A problem I experienced was the lack of guidance on the way forward for completing my studies and experiential learning.
- To be notified of what is expected from me as a student and what the employer’s role is.
- Better description of experience required and report method.
- The expectations of what is expected from the student by the university should be better communicated.
- Study guidelines and training programme are required.

- Clarify the duties of the trainee and be specific on the tasks to be performed by students.
- The curriculum was based on a … engineering point of view and not in my field.
- Sometimes you spend the whole year on a project where you just repeat the same kind of work.
- The objectives for … students were not specified clearly.
- The work was not really for a … engineer.

It is important to note that these responses concerned isolated incidents and the majority of students, that is, 78.8%, seemed to be satisfied with the guidelines provided and were able to complete the curriculum. However, it is important to address concerns such as the ones mentioned here even if these are isolated cases.

Interview

In question 19, participants were asked whether all students received a similar kind of service from their mentors. The reply was that, in general, students do not receive the same service, as it was felt that those who were placed in big companies received better training than those in smaller firms. This indicates that detailed minimum tasks for each experiential learning placement have to be identified.

In the majority of cases students are provided with study material or guidelines, which lecturers considered to be very important. In one case, a three-month plan was also drawn up for each student, although no set curriculum was followed. In another case broad phases were introduced and the details were left to the company/industry to supply. Lecturers (6 out of 7) mentioned that students are provided with some sort of material before they start the WIL programme. However, the quality and nature of these materials seem to vary.

In summary, attention must be given to the quality and content of the materials that are supplied to students prior to and during their WIL. The minimum criteria required for the completion of WIL should be specified and the responsibilities of the role players, including the supervisor, student and mentor, should be clarified. We have noted that in certain *universities students sign a learning contract in conjunction with the academic supervisor and work place mentor (Martin & Hughes,2009).*

It was also noted that students receive different types of services from industry. Bigger companies provide broader experiences. It is important to specify the minimum learning required during the WIL period. This minimum requirement has to be communicated to the mentor which seems to be lacking in certain situations. In cases, where this minimum learning opportunity could not be made available in one company/industry, then students should be allowed to move to a different organisation to gain the experience. Comments made by students in the open-ended questions in the questionnaire are all legitimate and should be given enough attention.

5.1.6 Research Question 6 - Is continuous contact between institutions of higher learning, students, and industry crucial to WIL training?

Questionnaire

In question 14, students were asked whether improvement in any of the following areas would have helped them to receive better training. Among the seven options given, the one regarding “better liaison between university and industry” received the highest positive response. The response was even higher for female students.

Response	**No**	**Yes**	**Responses**
Q14.1: More appropriate work placement	0.7205	0.2795	254
Q14.2: More support from university	0.6339	0.3661	254
Q14.3: More support from industry	0.5945	0.4055	254
Q14.4:Better guidance from university	0.7283	0.2717	254
Q14.5: Better preparation such as induction course	0.8110	0.1890	254
Q14.6: Better theory course work at the university	0.8307	0.1693	254
Q14.7: Better liaison between university and industry	0.4685	0.5315	254
Q14.8: Other	0.9764	0.0236	254

In the open-ended question 15 in the questionnaire, students were asked to suggest areas for the improvement of WIL. Respondents identified a few areas for improvement, including "better liaison between university and industry". The points that were raised are discussed in section 4.1.9.1 and summarised as follows:

- Supervisor and mentor to communicate effectively on a weekly basis so that weaknesses can be dealt with in time.
- Good communication between the university mentor and industry mentor.
- To work hand in hand with the industry.
- Better liaison between mentor and supervisor.
- Better liaison with industry (government) about requirements of the WIL.
- University should get feedback from industry to fill any gap.
- Liaison between university and industry needs to be strengthened.
- Clear communication between institutions and industry.
- Tertiary institutions and the respective academic departments must liaise with industry and tell industry exactly what is required from the student during the WIL process, in order to achieve the desired outcomes.

Interview

In question 17 of the interview, lecturers were asked whether the students have mentors in the industry and, if so, what the lecturers' liaison with them was like. They were also asked whether they considered that this liaison was important. Their responses, as reflected in section 4.2.5, seem to indicate that all students had mentors but liaison with mentors took place mainly through visits, although contact was made if difficulties were experienced. This suggests that ongoing contact between these two important role players was missing.

Consequently, it would seem that there is room for improvement in the quality of the liaison between mentors and supervisors. This process could be formalised and regular monthly contact, at least by email or telephone, could become the norm. However, for the effective implementation of this process the lecturers in charge of experiential learning should be *given a lighter teaching load so that they can concentrate more on liaison with mentors and students, and visit and support those students.*

Special innovative methods of collaboration were noted in the Pulp and Paper Industry in South Africa with regard to specific programs that were run collaboratively for the labour force in this industry (Samadi, 2008)

5.1.7 Research Question 7 - Does the attitude of a student have any effect on his practical learning during the WIL period?

Questionnaire

Question 23 in the questionnaire highlights a number of attitudes and skills and asks the students which of these attitudes they consider to be important based on their own experience. Factor analysis identified only one factor for this question, which includes all attitudes mentioned in the questionnaire. Responses were indicative of the fact that all these attitudes are regarded as important in order to be satisfied with the WIL experience (see Table 4.25 in section 4.1.3). The mean for this factor is 4.54, which is very high and indicates that most respondents answered the questions pertaining to Question 23 factor1 with either "often important" or "almost always important".

Interview

In question 26, the lecturers were asked: "What is the students' attitude like during WIL? Please explain". From the responses given, the attitude of the majority of students seems to be good from the lecturers' point of view (see section 4.2.6).

In summary, the positive attitude that exists among the student with regard to their WIL training has been responsible for dealing positively with some of the challenges experienced during this period.

5.1.8 Research Question 8 - Is work integrated learning a very important part of the syllabus for the training of technicians and technologists?

Questionnaire

In question 10 of the questionnaire, students were asked about their expectations during the WIL period. Accordingly, the responses indicated a most frequent response of 10.2, that is, "to obtain practical experience during the placement". This confirms the importance of this part of training for technicians and technologists.

Share of responses – Q10

Response	**No**	**Yes**
Q10.1: To obtain a future employment opportunity	0.3465	0.6535
Q10.2: To obtain practical experience during the placement	0.2087	0.7913
Q10.3: To develop employment skills such as communication, team work and problem solving	0.2795	0.7205
Q10.4: No expectation	0.9961	0.0039
Q10.5: To pass the subject	0.7598	0.2402
Q10.6: Other	0.9921	0.0079

In a similar question, when students were asked whether they could receive this WIL at the university, a small minority, around 8.4%, replied "yes, I could receive it at the laboratory" which is the university laboratory. This is also indicative of the value placed on the WIL component by students because they believe that what is learnt in the industry cannot be learnt in the university laboratory. Therefore their learning in the industry is not just practical work but rather involves complex learning and a combination of activities. A study conducted by Freudenberg, Brimble & Vyvyan (2010) confirms the same finding in an Australian context. They argued that WIL presents a range of benefits to students in terms of their graduate attributes, confidence and efficacy, while improving their ability to transfer classroom skills to the workplace.

Interview

In question 21, lecturers were asked: “Is WIL an important part of the National Diploma? Could we do without it?” Accordingly, the following responses were given:

- It is a good thing. We cannot do without it. It can be done after the ND and before professional registration with the ECSA, because we have too little time for all subjects in the ND.
- It is important and cannot be replaced from a student point of view. They become more mature and practical after the experiential learning period. They learn how to apply theory. They think differently.
- Yes, it is a very important component of the National Diploma. If it is not possible to do it during the ND, then they have to get it afterwards. They should have hands-on experience.
- Yes. That is the reason for the existence of universities of technology. It is important but a better option for training of technicians is the Higher Certificate + Advanced Certificate + one year of experiential learning.
- It is very important, especially for universities of technology. Around 80% of our students get a job after WIL.
- Yes. It is a very important part.
- Yes, very important.

In summary, both students and lecturers agreed that WIL is an important part of the National Diploma and cannot be replaced with anything else. However, some lecturers recommended that WIL be done after the completion of the theoretical part of learning but before professional registration. The same sentiments were expressed by students, indicating that their expectation from the WIL period was to obtain practical experiences during the placement which is not possible to gain in the university.

5.1.9 Research Question 9 - What are the WIL requirements in the new HEQSF document?

According to the HEQSF (2013) document, "where WIL is a structured part of a qualification the volume of learning allocated to WIL should be appropriate to the purpose of the qualification and to the cognitive demands of the learning outcome and assessment criteria contained in the appropriate level descriptors". It also states that "where the entire WIL component or any part of it takes the form of workplace-based learning, it is the responsibility of institutions that offer programmes requiring credits for such learning to place students into appropriate workplaces. Such workplace-based learning must be appropriately structured, properly supervised and assessed".

According to this framework, institutions have to accept responsibility for WIL placement if the programme requires such placement. The HEQSF also emphasises that the volume of learning allocated to WIL should be appropriate to the purpose of the qualification.

HEQSF (2013) also indicates that:

> Some qualifications will be designed to integrate theory and practice through the incorporation of work-integrated learning (WIL) into the curriculum. WIL is characteristic of vocational and professionally-oriented qualifications, and may be incorporated into programmes at all levels of the HEQSF. WIL may take various forms including simulated learning, work-directed theoretical learning, problem-based learning, project-based learning and workplace learning. The selection of appropriate forms of work-integrated learning depends on the nature and purpose of the qualification type, programme objectives and outcomes, the HEQSF level at which the WIL component is pegged, institutional capacity to provide WIL opportunities, and the structures and systems that are in place within professional settings and sites of practice to support student learning.

> Where WIL takes the form of workplace learning, it is the responsibility of institutions that offer programmes requiring WIL credits to place students into WIL programs.

The HEQSF (2013) mentions different types of WIL and the appropriate form should depend on the nature and purpose of the qualification. The form of WIL should be specific to the type of qualification and its programme objectives, and all institutions that are planning to offer WIL must have the capacity to fulfil these requirements. For example, for some engineering or medical programmes, work placement seems to be important, therefore this cannot change, whether the institution has the capacity to provide it or not. If the required capacity does not exist, then the institution should not offer the given programme.

5.1.10 Research Question 10 - How can we use the outcome of our current research of present practices, in the restructuring of the WIL component, in light of the HEQSF document?

In this section we report solely on conclusions that are related to the HEQSF document. Other conclusions are provided in chapter 6.

From both the questionnaires and the interviews, and as a result of the interaction with both students and lecturers, it is clear that some of the engineering qualifications that have a professional or vocational orientation might need to include the type of practical experience that can only be gained through work placement. For the National Diploma, students and lecturers are of the opinion that one year is a suitable period for WIL training, but many have suggested the possibility of reducing this and doing part of the training at the universities, although this may not be possible in all disciplines of engineering. Nevertheless, six months of training might be an option for certain fields of engineering, provided that students are given sufficient time to find placements before their registration for the module.

According to the revised HEQSF document (HEQSF, 2013), "WIL may take various forms including simulated learning, work-directed theoretical learning, problem-based learning, project-based learning and workplace learning". If the period of work placement is reduced from one year to six months, then other forms of WIL as mentioned in the HEQSF document could be used to supplement WIL placements.

The student respondents included in this study seem to have the right attitude towards the WIL component and are excited about it. Moreover, they believe this WIL period will help them to gain practical experience for their future employment. We hope to sustain that enthusiasm.

There would seem to be good job opportunities for the majority of students and it is important that graduates are well prepared for future job opportunities as well. This WIL period helps many students to find a connection with the real-life work environment and eventually helping them to find job in industry.

One of the components that appears to be weak in the WIL offering, is the degree of collaboration between the university and industry, and industry support for this program. This collaboration needs to be strengthened and arrangements should be made for on-going contact between the students and their mentors. This has to be methodical and continuous and not a once-off exercise.

There has to be clear guidelines on the minimum requirements for WIL and what needs to be achieved. Moreover, the content of the learning must match the credits that are awarded to the components. Guidelines in this regard should specify the responsibilities of all the role players.

More energy and effort have to be dedicated to the work placement of students. According to the HEQSF document, institutions have to accept responsibility for this component of learning. Therefore, innovative arrangements have to be made between universities and industry, which will be beneficial to both sectors. The SETAs involved in this industry and the funding available through them could be of great support to those students who cannot find paid placements.

One potential special arrangement could be joint educational programmes between industry and institutions. This has already been organised between the Pulp and Paper industry and certain institutions. Other industries could initiate similar programmes within the areas of their sub-disciplines.

5.2 Discussion on Biographical Information

An analysis of students' biographical information revealed that 73.6% of those who responded to the questionnaire were male (see Table 4.1A – Q1). This distribution varies between the different engineering fields. For example, a higher percentage of female students were found to be studying chemical/metallurgical engineering compared to civil engineering.

The sample indicated that the highest qualification obtained by students was the National Diploma (94.5%). Nevertheless, students enjoyed an 80% employment rate during their experiential learning period and, at the time the questionnaire was administered, around 90.1% were employed. Only 1.2% had no work and also no opportunity to study (see frequency Table 4.1A-Q6.). This indicates a very high demand for engineering graduates. A fair percentage of these, around 35.5%, worked in consulting firms during their WIL period (see Table 4.1A – Q8), which is a reasonable distribution, considering the fact that the majority are civil engineers. A similar percentage, around 39.4%, continued to be employed in consulting firms beyond their WIL period. The rest are employed in other possible organisations such as industry, institutions of higher learning, etc.

An analysis of question 10, regarding students' expectations of WIL, shows that the majority of students wanted to obtain future employment opportunities, and/or to obtain practical experience during their placement and/or to develop employment skills, such as communication skills, team work and problem solving, rather than just passing the subject.

These points appeared among the general observations provided by study participants in this section.

5.3 Discussion of Information from Open-ended Questions 15, 20, and 22

There were three open-ended questions in the questionnaire. These were questions 15, 20 and 22.

5.3.1 Discussion - Question 15

As noted in section 4.1.9.1, in response to the question of improvements to WIL, some students indicated both its importance and the importance that it be continued. Others recommended a reflection on the curriculum involved, stating that it should be more relevant and better structured in terms of a training schedule; that the industries should be accredited to provide such training; and that it be more strictly monitored. They suggested that the universities should help with WIL placement, should organise placement before WIL registration, and should allow for the movement of students from one industry to another, while ensuring that the curriculum is covered.

Moreover, mentors should be qualified in the specific field of engineering. They also felt that the liaison between industry and university should be improved. Such liaison could take the form of regular visits to the industry or contact between mentor, supervisor and student, with topics for discussion that could include a schedule for the completion of the curriculum as well as discussions regarding the content of WIL.

Another focal point was the role that university supervisors should play in the monitoring of WIL and in the preparation of students before the start of their WIL period. Monitoring of students should be through regular visits and contact ensuring that the requirements have all been met. Communication with students and regular contact between supervisors and students was another area of focus.

A new point that was identified was the idea that the government should build a WIL facility for engineering students so that students could put theory into practice. For more details please see section 4.1.9.1.

In summary, as can be seen, the majority of improvements recommended are related to supervision by university supervisors. It was also recommended that communication and liaison, as well as curriculum setting and industry mentorship, be improved.

5.3.2 Discussion - Question 20

In answer to question 20, which explored the reasons for non-completion of the WIL curriculum, the responses indicated a few areas that need attention. One of the main reasons identified was inexperienced mentors or the complete absence of mentors. Another reason was the limited opportunities for learning in some companies or organisations, especially if they were very small or if they were involved only in a specific field and could not provide the full curriculum. Other issues included lack of trust and the poor attitudes displayed by employers. In addition, issues such as the lack of a curriculum, which is similar to the responses to question 15, were also brought up. For more details please see section 4.1.9.2.

5.3.3 Discussion - Question 22

In response to question 22, which dealt with additional challenges to those mentioned in question 21, respondents raised points similar to those raised in questions 15 and 20, especially regarding the liaison between the university, industry and students. In addition, they raised points such as the industry not following the guidelines provided, the racism experienced at work, the fact that some were not paid, and the lack of visits to the workplace by the university.

Comparing our findings to a study in Ontario, Canada by DeClou, Sattler and Peters (2013), for example, indicates the differences that exist between our issues and theirs with regard to the WIL component. They observed that the top-rated challenges experienced by *co-op students during their work placement were being bored at work, not having enough work and not having strong enough links between skills learned in university and workplace assignments. The top challenges for other WIL students were the inability to find appropriate placements, a lack of preparation prior to WIL, and insufficient payment. Some of these issues did not seem to pose any challenge at all or were not among the most significant challenges experienced by engineering students in our study and context.*

5.4 Discussion – Additional Information from Interview

The responses to the interviews questions that were directly related to the research questions were summarised in section 5.1 but the additional information will be summarised here under different topics. The details are reflected in section 4.2.

5.4.1 Importance of WIL in the Training of Technicians and Technologists

All the lecturers agreed that WIL is a very important part of the National Diploma and cannot be replaced with anything else. The lecturers were unanimous in their contention that it would not be possible to replace experiential learning with any kind of work at the university. However, there does seem to be room for doing some sections of the WIL syllabus at universities, thereby reducing the period of experiential learning. Nevertheless, this would seem to be easier in certain areas of engineering than in others.

5.4.2 Is Work Integrated Learning a Very Important Part of the Syllabus for the Training of Technicians and Technologists?

Generally, the placement of students did not seem to be a major problem in 2008 and 2009. However, it might become a problem in the future as the number of students registering is increasing. Two of the seven lecturers interviewed reported that between 5 and 30% of students in different disciplines were struggling with placement, while others reported finding placement for all their students.

Lecturers indicated that at present students find placement for themselves, although the institutions do support them in this process. However, if placement were to become an institutional responsibility, then an organisational structure would be required to support this process, or more lecturers would need to become involved in strengthening the ties between the universities of technology and the industry.

The majority of lecturers believe that it is possible to find placement for all students. However, a few lecturers mentioned their concerns relating to the need for support from the SETAs with funding for placement. There is also a need to increase the fees for experiential learning modules.

All the interview participants agreed that the three factors, that is, placement, supervision, and mentoring, are important aspects of training.

5.4.3 Is the Presence of a Mentor or Supervisor an Important Part of WIL?

In reply to the question "Do you visit all your students and how many times in a year?", it became clear that the best scenario is one visit per WIL module. Some students who do their WIL a long way from the university are not even visited. Therefore, this calls for better communication between students, universities and the industry, as well as increased visits. It was suggested that professional engineers or technologists be given short-term contracts and be asked to visit students at such places on behalf of the institution. This process could be formalised and regular monthly contact via email or telephone calls could become the norm, especially if the period of experiential learning is reduced.

It has been noted that there is no preparation for work placement in the majority of cases, although where students recruited for employment were given an induction. This could be expanded. A short course in report writing and CV preparation was offered in one case.

5.4.4 Other Learning

Report Writing and Assessment

The different disciplines would seem to have different requirements for report writing. Some disciplines require a very basic form such as a logbook, while others ask for a mini dissertation. A course, with 60 to 120 credits, must have certain exit level outcomes, and specific outcomes which could be assessed using different methods and means.

It was noticed that in some cases where there were many students and just a few lecturers for the same experiential learning module, the consistency of the marking became a challenge. In another case it was found that different mentors had used different marking methods. It is therefore recommended that a rubric with marking details be provided in order to harmonise the work of the evaluator, the student, the mentor and the supervisor.

According to Zegward and Coll (2003), most models for work-based learning assessment are linear. They indicate that "Whilst there are numerous methods of assessing Work Integrated Learning (WIL), finding one which delivers effective feedback is critical to motivate students".

In this study we found that the majority of WIL students are visited and there is some sort of face-to-face interview or presentation during this period. However, there is room for improvement in the quality of these interactions and delivery of effective feedback.

Reflection on WIL

Responses to the interviews demonstrate that there has been no formal reflection on the WIL experience. The best kind of reflection needs to be anonymous so that students can give their opinions freely without concerns about penalisation. Students could reflect on their own work in their final report, while also completing an anonymous questionnaire to provide feedback. The questionnaire could consider various aspects, such as reflections on the curriculum, the industry, the mentor, the supervisor, new learning, assessment, and suchlike.

In this chapter, the results from both the survey and interview were discussed. The research questions were individually analysed and all the related information and data from the quantitative and qualitative methods were brought together in this section. The results that were not directly related to the research questions but were conveying valuable information and reflection were also discussed in this chapter.

The research shows that there are visits and face-to-face meetings with diploma students during the WIL period but they are not usually conducted in a very reflective way and not in the format of a research study as explained by Foley and Valenzuela (2005). Their paper articulates the need for students to reflect beyond the work-based learning experience and projects towards future challenges.

CHAPTER 6

CONCLUSIONS AND RCOMMENDATIONS

In the previous chapter, we discussed the research questions and responses gathered during this study. Some additional points and themes were also emerged during the interviews. As indicated in the literature review there has been research works done on work integrated learning but there has been very limited information on the WIL programme for engineering students in South Africa. Our study shed lights on the importance of the WIL placement on the training of technicians and technologists as viewed by our participants in this study. It identified some challenges in this process and recommended ways of overcoming them. In this sections, a summary of some important points are indicated and the recommendations and conclusions are mentioned in italic.

In the process of this research work, I had the opportunity to hear and understand the students' point of view using the questionnaire and the lecturers' thoughts and comments by means of the interview process. The conclusions and recommendations made here are based on an analysis of the data as well as the research work carried out during this study.

6.1 General Conclusions and Recommendations

The data collected during the research work through the questionnaire confirmed that there were fewer female students in engineering fields than males. This ratio would seem to be even lower in fields such as Civil Engineering. *Marketing and bursary support for female students entering engineering programmes is recommended as incentive to attract more students to these fields.*

The data confirmed that, in our sample, the majority of students managed to find employment after their graduation and were permanently employed. Only a very small percentage of students were neither studying nor working (question 6). *The need for employing technicians/technologists could be used as a marketing tool for engineering faculties that are offering National Diploma/ Diploma programmes in this country.*

We found that the students were enthusiastic about their work placement and were not prepared to replace it with any other subject or module. It was also found that they usually had the right attitude towards the WIL period. This indicates the appreciation of students for their work placement in engineering fields and their interest in obtaining hands on experience.

Some institutions in South Africa are reconsidering the offering of Engineering Diploma because the new HEQSF proposes that the placement of students is the sole responsibility of the institutions. There is a fear that enough placements might not be available for all students in engineering. Our experience showed that only 10-15 percent of students in these two institutions in Gauteng could not find placement. As a result with less number of institutions offering Diploma, there will be a good possibility of finding placement for all students. *In addition innovative methods of collaboration could be initiated between industry and higher education institutions to provide and guarantee enough work placements. This is the case with the National Diploma and BTech Pulp and Paper at present because of the collaboration that exists between the Pulp and Paper industry and a couple of institutions in South Africa.*

Based on the students' responses to question 10, their main aim in doing their work placement was to obtain opportunities for future employment and/or to obtain practical experience. They were not doing it merely to pass the subject.

6.2 Research Questions – Conclusions and Recommendations

In this section, the conclusions and recommendations that are based on the research questions are discussed.

Research Question 1- *Does appropriate placement for WIL make any difference in the training of technicians?*

The information discussed in chapters 4 and 5 indicates that persons who received “more appropriate work placement” and “more support from industry” experienced fewer challenges with their WIL. In response to the question about the importance of WIL in the training of technicians, the majority responded that this is “often” important. They also indicated that if WIL had been optional, they would have still selected this module rather than any other. This is indicative of the importance students place on this part of their study.

During the interview the lecturers’ responses were very similar to the students’ inputs, indicating that WIL is a very important part of the National Diploma and cannot be replaced with anything else. This is very unique input by all involved in this process.

According to the HEQSF document, universities have to accept full responsibility for the placement of students. In our opinion, this placement could take place before the student register for this component because, in some cases, students have had to register several times for a WIL subject and subsequently cancel registration because placement could not be found.

We also recommend that students should not be allowed to do their WIL component of the programme at any other institution than their own, because the programme is organised in such a way that certain aspects will be covered in the WIL component and other aspects in the preparatory courses, which might differ from one institution to another.

Based on these inputs, more energy and effort has to be dedicated to the work placement of students. Therefore, innovative arrangements have to be made between universities and industry that are beneficial to both sectors. One potential special arrangement could be joint educational programmes between the industry and institutions. In addition, the work load of staff has to be arranged in such a way that it allows for creative collaborations.

Work Integrated Learning should be subsidised by government so that enough resources could be made available for this endeavour.

<u>Research Question 2</u> - *Does the duration of WIL have any effect on the training of technicians? If yes, what should be the minimum required period?*

In section 5.1.2, we gathered from the data that there were significant differences between the mean scores of the factor related to the "Importance of WIL" and different periods of WIL, with the mean score being highest for seven months to one year. This response was similar for both Chemical and Civil Engineering students.

The majority of participants felt that one year is a suitable period for WIL. However, some students, especially in the Civil Engineering field, felt that they could have done part of this training at university. A couple of students felt that WIL placement should be done before registering for this module at the university in order to avoid the need for re-registration in the case of non-placement.

In the interview, the lecturers felt that one year of experiential learning is satisfactory, but they mentioned that the period could be reduced to six months especially for the Civil Engineering programme.

In summary, based on our study, for the National Diploma programme, the seven months to one-year WIL period seems to be a better option from the students' and lecturers' point of view. It might be possible to reduce the period of placement for the National Diploma or Diploma from 12 months to shorter periods provided that other preparatory courses are offered by the institutions, or some aspects of WIL are offered in other forms such as simulation rather than placement. Student should register for the WIL only after a placement is secured. The SETAs and the funding that is available through them could be of great support to those students that cannot find paid placement.

It is also recommended that the institution of higher learning look into the possibility of offering a two year Diploma programme in engineering (HEQSF, 2013) and initiate a one year certificate programme for work integrated learning in the form of work placement. This could be done in collaboration with professional bodies and industry.

Research Question 3 - *Does having a strict syllabus for WIL have any effect on the training received?*

The discussion in section 5.1.3 indicates that there is a significant statistical difference with regard to WIL experience between those who were supplied with a syllabus and those who were not.

During the interview the majority of lecturers (6 out of 7) mentioned that all students were provided with study material or a study guide or a syllabus and that is considered to be a very important aspect of WIL. However, the quality and type of these materials seem to differ between the different disciplines and institutions. Despite the fact that students were provided with some sort of curriculum or syllabus, the curriculum was found to lack clarity with regard to the minimum requirements for training. In other cases the WIL tasks did not match the number of credits for the subject or the number of hours that had to be spent on these tasks.

During the interview it was indicated that students do not all receive the same service during their WIL placement. Those in big companies receive a better training than others who have been placed in smaller firms. This indicates that detailed minimum tasks for experiential learning for each programme should be identified.

Our recommendation is that special attention should be given to the content of the syllabus. It should not only contain the main areas of learning, but should also provide flexibility within each area so that the different companies or organisations are able to provide the content required. A round of visits to companies should take place by the supervisor and, if they have facilities to offer the experiential learning tasks, then they could be accredited for *this purpose. Otherwise, students could be placed in two different companies during the WIL period so that they obtain the minimum requirements.*

Research Question 4 - *Is the presence of a mentor or supervisor an important part of WIL?*

Discussion in section 5.1.4 indicates that there are significant differences between the mean scores of the factor related to 'satisfaction with WIL experience' and persons that had a mentor or not. Similar results were captured for those that had a supervisor or not. Therefore satisfaction with WIL experience is dependent on the presence or absence of suitable mentor and supervisor.

Although in our study the majority of students had a mentor or a supervisor or both, they were still not clear about the role and responsibility of these individuals. They were not sure about who would mark their reports or who should be concerned about their wellbeing during the WIL period. Although communication between supervisors and mentors was taking place, this was only happening in a limited way. This area of communication between supervisors, mentors and students needs improvement as far as the students were concerned.

The WIL supervisors had to visit and supervise the work of between 10 to 50 students every semester. It is clear that students would not receive the same level of support if the number of students increases beyond a certain limit. The visits usually happened around the end of the training and by then, if training was not going well, it would be already too late for intervention.

One of the lecturers recommended that supervisors should correspond with or make phone calls to students at least a couple of times in each month of training. It might be even possible to set up a Facebook page for contact with mentors and students or even create a special website or set up a Twitter feed for communication.

The research shows that supervision must be formal, continuous and innovative. It is usually easier to supervise between 10 to 20 engineering students each semester. If the number *increases, a second supervisor should be appointed. We also maintain that supervisors should be involved in teaching other subjects so that they will be in touch with the syllabus and the reality of student's life. The Government has to provide subsidy for this component of Diploma qualification so that enough resources could be allocated to supervision.*

<u>*Research Question 5*</u> *– Does WIL require a clear guidance for effective training?*

The responses to this question indicate that students are not very clear about the responsibilities of the different role players during the WIL period. This definitely needs clarification in the WIL guidelines. These guidelines should also clarify the exit level outcomes required after the completion of this training and they should match the number of credits assigned to it and time allocated. The assessment process should be clearly explained and rubrics for marking should be provided in order to harmonise the marking process.

In terms of question 3, the requirement for a clear syllabus for WIL was deemed necessary so that both big and small companies are able to offer at least the minimum requirement for WIL. It was also felt that it should be the supervisor's responsibility to monitor this.

Our recommendation is that the guidelines on the responsibilities of role players must be very clear and specific. They should indicate the minimum requirements for the fulfilment of this component of learning, matching the credits for WIL (60 or 120 as defined in the curriculum), covering the required areas of training, but also flexible enough to provide opportunities in both big and small companies. The methods of assessment for this module must be clearly included in the guide, and the minimum qualifications of the mentor should be specified. Moreover, the modes of communication should be clearly indicated.

<u>*Research Question 6*</u> *- Is continuous contact between institutions of higher learning, students, and industry crucial to WIL training?*

Students identified that "better liaison between university and industry" with regard to WIL training was an area that could improve WIL training. Arrangements should therefore be made for ongoing contact between the students and their mentors. This has to be methodical and continuous and not a once-off exercise.

In question 15, which was open ended, students made a few recommendations for the improvement of this on-going contact (details in section 5.1.6). These recommendations include the following:

- Tertiary institutions and academic departments should liaise with industry and identify exactly what outcomes are required of students during the WIL period.
- Supervisors and mentors should communicate with students effectively on (at least) a weekly basis so that weaknesses in the training can be dealt with in time.
- Universities should obtain feedback from industry about its requirements and the performance of the students.

In the interviews, lecturers indicated that all students had mentors but liaison with mentors took place mainly through visits. This suggests that on-going contact between these two role players was missing.

We firmly believe that there is room for improvement in liaison between mentor and supervisor. This process should be formalized and regular monthly contact via email or telephone call should become a norm. Students should be provided with details of their supervisors and mentors and their time availability. Reflection on the activities of students and their views with regard to the support received during the WIL period must be considered regularly for the improvement of the WIL offering.

<u>*Research Question 7*</u>*- Does the attitude of a student have any effect on his practical learning during the WIL period?*

Question 23 in the questionnaire explored a number of attitudes and skills that are considered important for WIL training. Factor analysis identified only one factor for this question although responses indicated that all these attitudes are important for the WIL experience. From the lecturers' point of view, the attitude of the majority of students seems to be good.

The students in this research seem to have the right attitude towards the WIL component and are excited about it. They believe this WIL period helped them to gain practical experience for future employment. It is hoped that this excitement will be sustained and will even increase. They co

Our study showed that students had positive attitude towards their WIL programme. This positive attitude towards WIL provides a right platform for practical learning but we need to monitor the situation continuously and keep it as a reflection point. They also identified good communication skills as a very important skill during the WIL period. Different aspects of technical and graphical communication could be learnt at the university before the first semester of WIL period.

<u>Research Question 8</u> - *Is work integrated learning a very important part of the syllabus for the training of technicians and technologists?*

In question 10 of the questionnaire students were asked about their expectations during the WIL period. Consequently, the responses indicated that they wished to obtain practical experience. They also stated that they wanted to develop employment skills such as communication, team work and problem solving, which could probably be offered by industry as well as the universities.

During the interview the lecturers indicated that WIL is a very important part of the National Diploma and cannot be replaced with anything else. It was thought that the students become more mature and practical after experiential learning. They learn how to apply theory and think differently after WIL. Therefore, responses from both lecturers and students indicated that WIL in the form of work placement is a very important part of the Diploma qualification in Engineering, is highly appreciated by students and should be continued.

There is a dialogue among academics regarding the sustainability of offering WIL modules in the Diploma qualification for engineers. It is difficult for institutions to provide WIL for all the students and accept responsibility for it, as indicated in the HEQSF document. We appreciate the difficulties that institutions might face but we need to appreciate that this period seems to play a major role in their training and in their employability.

Research Question 9 - *What are the WIL requirements in the new HEQSF document?*

According to the HEQSF in South Africa, institutions have to accept responsibility for placement and the WIL modules must be supervised properly and assessed appropriately. While different types of WIL are mentioned in the document, the engineering programmes already incorporate certain types of WIL, such as simulation, project-based learning, and design-based learning. However, according to this research, it seems that there is great merit in work placement for Diploma students.

WIL should be a structured part of a qualification and the volume of learning should be appropriate to the purpose of the qualification and the credits associated with it. On the basis of the framework document, placement of students will be the responsibility of the institution.

Research Question 10 - *How can we use the outcome of our current research of present practices, in the restructuring of the WIL component, in light of the HEQSF document?*

From the HEQSF it is clear that some of the engineering qualifications that have a professional or a vocational orientation, such as the Diploma, might need practical experiences that can only be gained through WIL. This was also the conclusion reached from information provided by the questionnaires and interviews in this research, indicating that WIL in the form of work placement is a very important part of the training for engineering technicians and technologists.

Many of the conclusions made from this research also conform to the fundamentals of the HEQSF document. For example, the period of WIL is currently one year for the National Diploma, but some lecturers have indicated the possibility of reducing this period to six months by doing part of the training at universities. While this may not be possible in all disciplines of engineering, it nevertheless conforms to the thinking in the HEQSF document. However, if the period of training were to be reduced to six months, then it would be advisable for students' placements to be organised before their registration in order to save time.

According to the HEQSF, institutions have to accept responsibility for placement of students. This is not the case at present. However our study showed that lecturers did not seem to have any problem with placement apart from a couple of them. The WIL programme must be supervised properly and assessed appropriately, according to this document. This is the area that needs some innovative thinking and flexibility. New cooperations and collaborations between university and industry must be established to improve the supervision situation.

6.3 Other Conclusions and Recommendations

The following additional recommendations were made during the interviews or given as a response to open-ended questions.

Report Writing and Assessment

Assessment of WIL must match the outcomes of this component of learning. The reports should not be a once-off final report, but rather should include regular progress reports and eventually a final report and a portfolio of activities. From the interview with lecturers, we realised that in one university, students had a presentation in the presence of mentor and supervisor as part of assessment in addition to their final report. This might be deemed a good practice.

Students should be provided with a rubric that indicates mark distribution for their WIL activities. Moreover, the role of both the mentor and the supervisor in marking the reports should be made clear, as a great deal of confusion seems to exist in this area.

Reflection

The interviews showed that reflection is lacking in the majority of cases. Students should be able both to reflect on their learning and be able to assess it. Based on the information obtained from the interviews, there is generally no arrangement for reflection and no questionnaire is provided to students after the completion of their WIL period. This could be done at certain point(s) during the training as the students' views may be very valuable for both the university and industry. This should not be considered as an avenue for criticism, but rather as a positive contribution for improving this component of learning.

Students should not only reflect on their own learning, but should also provide feedback to the university. This reflection could consider various aspects, including reflection on the curriculum, the industry, the mentor, the supervisor, new learning, assessment, and suchlike.

Funding

Complaints were made by lecturers regarding the lack of funding. In our opinion if WIL is considered to be an important component of learning, then it has to be properly funded. *Creative methodologies should be used to get industry involved in this process. In addition, the SETAs could play an important role in funding WIL, as is the case in some instances at present. Universities must also receive subsidy from government for this component of learning.*

Joint Educational Programmes between Universities and Industry

One special arrangement that could be made is to conduct joint educational programmes between industry and the institutions. *This has already been organised between the Pulp* *and Paper industry and certain institutions. Other industries could initiate similar programmes in their sub-discipline areas.*

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APPENDICES

APPENDIX LIST

APPENDIX **PAGE NO**

APPENDIX A

QUESTIONNAIRE FOR QUANTITATIVE ANALYSIS

QUESTIONNAIRE FOR
WORK INTEGRATED LEARNING (WIL) RESEARCH

All the questions are related to your period of Experiential Learning in the National Diploma qualification, which is specified as Work Integrated learning (WIL) in this document.

Please mark X on the appropriate number in the shaded area.

SECTION A: BIOGRAPHICAL INFORMATION

1. Please specify your gender.

Male	1
Female	2

2. Please specify the university where you obtained your National Diploma.

UNISA	1
TUT	2
UJ	3
VAAL University of Technology	4
CPUT	5
Others, specify	

3. In which year did you complete your Work Integrated Learning?

Before 2004	1
2004-2005	2
2006-2007	3
2008 -2009	4

4. What is your primary discipline in engineering?

Civil Engineering	1
Chemical Engineering	2
Others, specify………………	

5. What is your highest qualification in engineering field?

National Diploma	1
B-Tech	2
BSc	3
M-Tech/ MSc	4

6. Are you presently employed or doing further study?

Yes (employed)	1
Yes (further study)	2
No (no work and no further study)	3
Yes (both work and further study)	4

7. If you are employed, then please specify if it is employment in Engineering related field such as:

Industry	1
Consulting firm	2
Construction field	3
Company	4
Government	5
Have my own company	6
Education (any type)	7
Others, specify…………	

8. Please specify the location of your work integrated learning.

Industry	1
Consulting firm	2
Construction field	3
Company	4
Government	5
Have my own company	6
Education (any type)	7
Others, specify…………	

9. Please specify whether you were employed in the work integrated site or were placed there for a period.

Permanent employment	1
Contract employment	2
Experiential placement only	3

SECTION B: WORK INTEGRATED LEARNING QUESTIONS

10. What was your expectation of Work Integrated Learning? You can mark more than one answer.

To obtain a future employment opportunity	1
To obtain practical experience during the placement	2
To develop employment skills such as communication, team work and problem solving	3
No expectation	4
To pass the subject	5
Others, specify…………………………………………	

11. Did you have a mentor in the work place? Mentor is a person appointed by the industry who will support you in your work integrated learning.

Yes	1
No	2

12. Did you have a supervisor (Work Integrated Learning Lecturer) in the university for WIL period? The supervisor is a person who guide you academically, during the WIL period.

Yes	1
No	2

13. Have you been provided with a curriculum or syllabus for Work Integrated Learning?

Yes	1
No	2

14. Do you think improvement in any of the following areas would have helped you to receive a better training? You can mark more than one answer.

More appropriate work placement	1
More support from university	2
More support from industry	3
Better guidance from university	4
Better preparation such as induction course	5
Better theory course work at the university	6
Better liaison between university and industry	7
Others, specify	

15. Do you have any suggestion for the improvement of the work integrated learning?

…………………………………………………………………………….

…………………………………………………………………………….

…………………………………………………………………………….

16. If work integrated learning (WIL) was optional, and you could choose between being placed in industry or taking courses in other subjects, would you still choose WIL?

Yes	1
No	2

17. What do you think of the duration of WIL? How long did you need to

complete the curriculum?

7 months to 1 year	1
4 to 6 months	2
3 Months or less	3

18. Based on your judgment, could you have received this Work Integrated Learning (WIL) at the university?

Yes, in the laboratory	1
Not at all	2
Yes, I could have received part of it at the university but not all	3

19. Please mark (X) the number on the scale.

	Hardly ever	**Seldom**	**Some times**	**Often**	**Almost always**
19.1 Do you consider WIL as a very important component of the National Diploma?	0	1	2	3	4
19.2 Do you rate WIL as a valuable period in your training as a technician / technologist?	0	1	2	3	4
19.3 Were you excited about your WIL period before you started it?	0	1	2	3	4
19.4 Were you satisfied with your Work integrated Learning overall?	0	1	2	3	4
19.5 Were you provided with enough guidance by the university?	0	1	2	3	4
19.6 Were you provided with enough guidance by the industry?	0	1	2	3	4
19.7 How well has the present work placement met your expectations?	0	1	2	3	4
19.8 Do you think it is necessary to have a fixed curriculum for WIL?	0	1	2	3	4

	Hardly ever	Seldom	Some times	Often	Almost always
19.9 Have you been given engineering responsibilities, such as being in charge of a project or sub project during your WIL period?	0	1	2	3	4
19.10 Have you been given a hands-on experience during WIL?	0	1	2	3	4
19.11 Were you satisfied with your supervisor's support (work Integrated Learning Lecturer support) during WIL period?	0	1	2	3	4
19.12 Were you satisfied with your workplace mentor's support during the WIL period?	0	1	2	3	4
19.13 Has your Work Integrated Learning been able to provide you with experiences specified in your course curriculum?	0	1	2	3	4

20. If you were not provided with experiences required in your curriculum during the Work Integrated Learning, then explain briefly why.

……………………………………………………………………….

……………………………………………………………………….

……………………………………………………………………….

21. There are several challenges that work integrated learning students face in their work placements. In your opinion which are the main

challenges? Please rate them as they have impacted you in your placement. Mark X on the correct number that best describe your experience in your placement:

	Hardly ever	**Seldom**	**Some times**	**Often**	**Almost always**
21.1 The challenge of obtaining work placement in my discipline	0	1	2	3	4
21.2 The challenge of insufficient university support in finding placement	0	1	2	3	4
21.3 The challenge of insufficient university support after placement	0	1	2	3	4
21.4 The challenge of insufficient industry support for the placement students	0	1	2	3	4
21.5 The challenge of insufficient industry support after placement	0	1	2	3	4
21.6 The challenge of transition from university to the work place	0	1	2	3	4
21.7 The challenge of applying theory learned at university to applied problems	0	1	2	3	4
21.8 The challenge of unhelpful / inappropriate work experiences	0	1	2	3	4
21.9 The challenge of doing the same work every day and not learning any new things	0	1	2	3	4
21.10 The challenge of not being able to fulfill all the necessary work integrated curriculum	0	1	2	3	4

	Hardly ever	Seldom	Some times	Often	Almost always
21.11 The challenge of not knowing what was expected of me	0	1	2	3	4

22. Do you see any other challenges? Please specify.

………………………………………………………………………………..

…………………………………………………………………………………

23. There are certain attitudes that a WIL student must have during his / her training. Which of the following attitudes do you consider as important based on your experience? Mark (X) the number on the scale.

		Almost Always important	**Often** important	**Some times** important	**Seldom** important	**Hardly ever** important
23.1	Individual initiative	4	3	2	1	0
23.2	Ability and willingness to learn	4	3	2	1	0
23.3	Organisational skills	4	3	2	1	0
23.4	Personal planning	4	3	2	1	0
23.5	Good communication skills	4	3	2	1	0
23.6	Social skills	4	3	2	1	0
23.7	Team work ability	4	3	2	1	0
23.8	Perseverance at work	4	3	2	1	0
23.9	Understanding the work place culture	4	3	2	1	0
23.10	Emotional intelligence	4	3	2	1	0
23.11	Self confidence	4	3	2	1	0

24-29 WIL partners and their involvement

Using the following table, please identify the roles and responsibilities of each partner in Work Integrated Learning according to what you experienced during the WIL period. A responsibility may be shared among a few partners (you may select more than one option).

Definitions:

- WIL convener is the person that coordinates all WIL activities in the department or faculty. This person may or may not be a lecturer in the field.
- Academic supervisor is the person that deals with your academic queries during the WIL period. He/she might be the same person as the WIL convener.
- Industry Mentor is the person appointed at the industry to support you during the WIL period.
- Placement coordinator is the person who helped you to find a placement opportunity. He/she may or may not be your WIL convener.

* Mark (X) the right cell and complete in accordance to the course outline.

	Student	WIL convener	Academic supervisor	Industry Mentor	Placement coordinator
24. Who should initiate the WIL activity?					
25. Who, if anyone, is responsible for student induction of any kind prior to undertaking the WIL activity?					
26. Who is responsible for student supervision during the WIL activity?					
27. Who is responsible for evaluating the student's performance during the WIL activity?					
28. Who is responsible for student					

management and well-being during the WIL activity?					
29. Who is responsible for the student's final / formal assessment?					

* Question 24-28 was directly inspired by a survey conducted in Australia (RMIT report, 2008)

This concludes the questionnaire. Thank you for your participation in this survey.

Panel of Experts

1. Professor H I Atagana, Director: Institute for Science and Technology Education
2. Professor F A Otieno, Deputy Vice-Chancellor (Technology, Innovation & Partnership)
3. Dr C Ochonogor, Senior Lecturer, Institute for Science and Technology Education
4. Professor W A Hoffman, Chair: TUT Research Ethics Committee

APPENDIX B

COVER LETTERS FOR QUESTIONNAIRES

Cover letter for UNISA Students

UNISA college of science, engineering and technology

Dear past / present National Diploma Student,

<u>Experiential Learning Research</u>

We are forwarding this letter and questionnaire to you because you have studied towards your National Diploma at one of the Universities of Technology or Technikons in South Africa.

As you are aware, experiential learning is a major part of the curriculum for the National Diploma qualification and carries 120 credits. Students who register for experiential learning courses spend the equivalent of one year of their studies in the industry in order to learn the application of theory in the work environment.

We are conducting research into the effect of this portion of the syllabus on the training of our technicians and technologists in South Africa and hope to determine what changes could be made to improve the effectiveness of this portion of the curriculum. The present study is initiated by UNISA and is supported by some other institutions.

We would like to invite you to participate in this research by completing the attached questionnaire.

Returning the questionnaire: For confidentiality reasons, please put the questionnaire in the self-stamped envelope provided and seal it. You can hand in your envelope to the person distributing it or mail it to the following address:

Research Team, P. O. Box 75348, Lynnwood Ridge, 0040

Consent terms: By completing this questionnaire, you agree that your answers can be recorded for use in this study. There are no foreseeable risks to you from participating in this research.

Benefits: Your participation in this research would help us to make use of your past experiences and could lead to suggestions for the improvement of this part of the National Diploma Qualification.

Voluntary participation: Your participation in this research is completely voluntary. *All responses to this survey are anonymous and will not be used in any way that can identify you*. The results of the survey will be reported in aggregate, across participants. We appreciate your participation in this research and your commitment to the improvement of workforce training and education.

Yours respectfully,
Research Team

Cover letter for Tshwane University of Technology Students

UNISA | college of science, engineering and technology

Dear present or past TUT Student,

<u>Experiential Learning Research</u>

We are forwarding this letter to you because you have studied your National Diploma with one of the Universities of Technology in South Africa. *Your participation will take approximately 10-15 minutes.*

As you are aware experiential learning is a major part of the curriculum for the National Diploma qualification and it has 120 credits. The respective students, who register for these subjects, spend equivalent of one year of their study in the industry in order to learn the application of theory in the work environment.

The purpose of this research is to investigate the effect of the Work Integrated Learning of the National Diploma on the training of our technicians and technologists in South Africa and find out what changes could be made to improve the effectiveness of this portion of the study. The present study is initiated by UNISA and is supported by some other institutions.

Mailing Direction: For confidentiality reasons, please put the questionnaire in the envelope provided and seal it. You can hand in your envelope to the person distributing it or mail it to

Research Team
P. O. Box 75348,
Lynnwood Ridge, 0040

You can also fax it to (011) 471 2220.

Consent terms: By completing this questionnaire, you agree that your answers can be recorded for use in research. There are no foreseeable risks to you from participating in this research

Benefits: Your participation in this research would help us to make use of your experience in the improvement of this part of the study in the National Diploma Qualification.

Voluntary participation: Your participation in this research is completely voluntary, and *all responses to this survey are anonymous and will not be used in any way that can identify you*. The results of the survey will be reported in aggregate, across participants. We appreciate your participation in this research and your commitment to the improvement of the work force training and education.

Research Title: The title of this research project is "The impact of the Work Integrated Learning and its present practices on the education of the engineering technicians and technologists and the new HEQF document in South Africa".

Research Team: The main researcher in this project is Mrs. Ferie Samadi from UNISA and the other researchers, who are supervisors of the project, are Prof Atagana, Director of the Institute for Science and Technology Education at UNISA and Prof Otieno, Executive Dean of the Faculty of Engineering and the Built Environment at TUT.

Further Enquiries: For additional information on this project, please contact Ferie Samadi at 012 429 6786 or send an e-mail to fsamadi@unisa.ac.za. The detail of this questionnaire has been approved by the Ethics Committees of the institutions involved. For any ethics related enquiries at TUT please contact the Chairman of the Ethics Committee, Dr WA Hoffmann at 012- 382 6246/65 or e-mail hoffmannwa@tut.ac.za

Yours respectfully,
Research Team

APPENDIX C

INTERVIEW GUIDE

Interview Guide for Work Integrated Learning (WIL)

Supervisor's Interview

A. <u>Background</u>

We will explain the purpose of this research and its benefits. Also explain that by participating in this interview, individual allows his/her answers to be recorded for use in research. The interview will remain anonymous and confidential.

B. <u>Consent</u>

Are you willing to participate in this interview? Yes or No recorded

C. <u>Interview questions</u>

1. Are you supervising Work Integrated Learning students? If not, then what is your role (coordinator, lecturer in charge, etc) with regard to WIL students?

2. How many years have you been involved in WIL?

Student no

3. How many students did you supervise in 2009?

4. How many students were not able to find placement in the year 2009? How many couldn't find the placement in 2008?

5. Are you the only supervisor for all students in this field?

Placement

6. How do the students find their placements?

7. Do you support them in finding placements? If yes, how?

8. Do you visit all your students? How many times in a year?

9. What do you think of the period of placement? 1yr, 6months, 3 months,

Materials and guidance

10. What do you do with your students before placement? Any induction courses?

11. Do you provide them with any material before going to industry? Do you think that is important? Please explain.

12. What are they expected to do in the industry? Do you give them any curriculum or guidelines? Please specify in which form is it?

13. Do you think we can do part of this training at the universities? If yes, what can we do?

Reports

14. What is the format of the WIL final report?

15. Do the students reflect on what they have done (and their experiences and learning) during their placement period?

16. Who marks the WIL report?
    - Supervisor,
    - Mentor from industry or
    - All lecturers,
    - Others, specify

Supervision

17. Do the students have mentors in the industry? How is your liaison with them? Do you consider your liaison important? Please explain.

18. What is their role? Is it important to have mentors?

19. Do you think all students receive a similar kind of service from their mentors? If not, what is the reason and what can we do about it?

General questions

20. What do you think of the period of WIL? Is it too long or too short?

21. Is WIL an important part of the National Diploma? Can we do without it?

22. Do appropriate placement, supervision and mentoring have affect on the value of the WIL?

23. Any challenges with WIL?

24. Do you have any suggestions for the improvement of WIL?

25. What do you think of the future of WIL?

26. How is the attitude of students during WIL? Please explain.

HEQF

27. Are you familiar with HEQF document? Are universities equipped to find placement for all Diploma students?

28. Is your university planning to offer the new Diploma qualification (HEQF)?

Thanks for your participation in this interview.

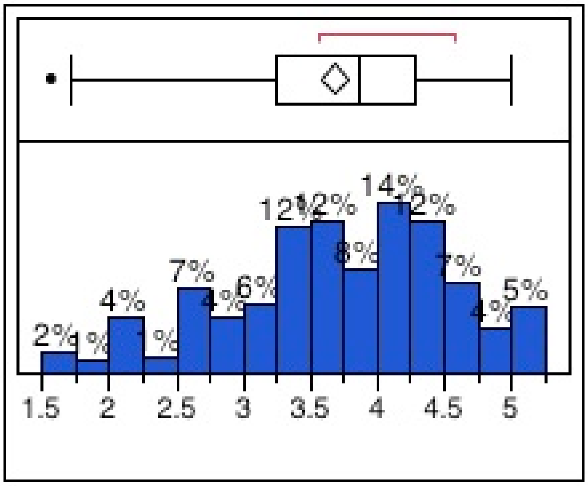
END

APPENDIX D

DISTRIBUTION SCORES

Distributions

<u>Q19 Factor1: variables 4,5,6,7,11,12,13</u>



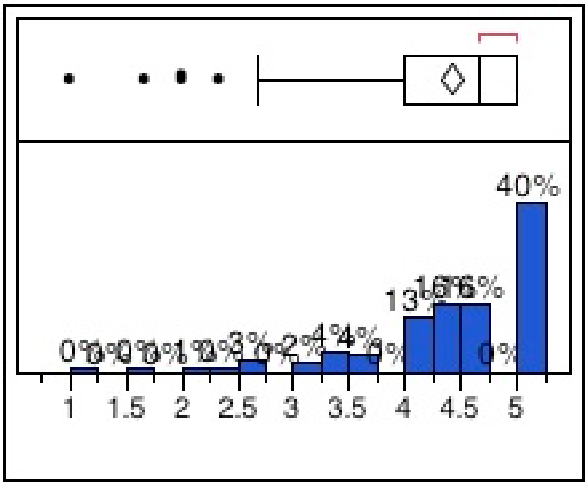
Quantiles

100.0%	maximum	5
99.5%		5
97.5%		5
90.0%		4.71429
75.0%	quartile	4.28571
50.0%	median	3.85714
25.0%	quartile	3.25
10.0%		2.57143
2.5%		1.89643
0.5%		1.60786
0.0%	minimum	1.57143

Summary Statistics

Mean	3.690981
Std Dev	0.8117222
Std Err Mean	0.0513378
Upper 95% Mean	3.7920927
Lower 95% Mean	3.5898692
N	250

Q19 Factor2: Variables 1,2,3



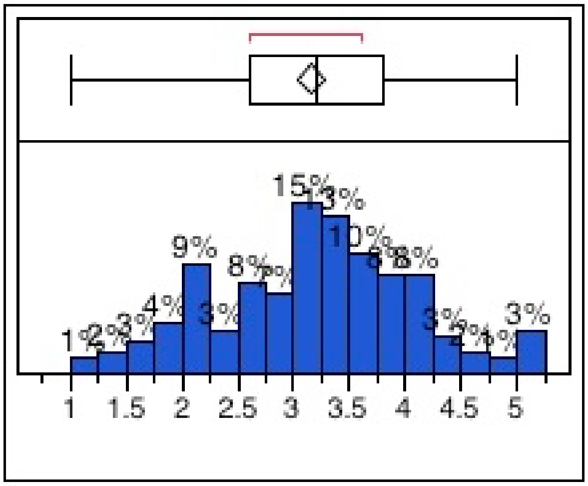
Quantiles

100.0%	maximum	5
99.5%		5
97.5%		5
90.0%		5
75.0%	quartile	5
50.0%	median	4.66667
25.0%	quartile	4
10.0%		3.33333
2.5%		2.66667
0.5%		1.17333
0.0%	minimum	1

Summary Statistics

Mean	4.4169987
Std Dev	0.716996
Std Err Mean	0.0452564
Upper 95% Mean	4.506131
Lower 95% Mean	4.3278663
N	251

Q21 Factor1: Variables 7-11



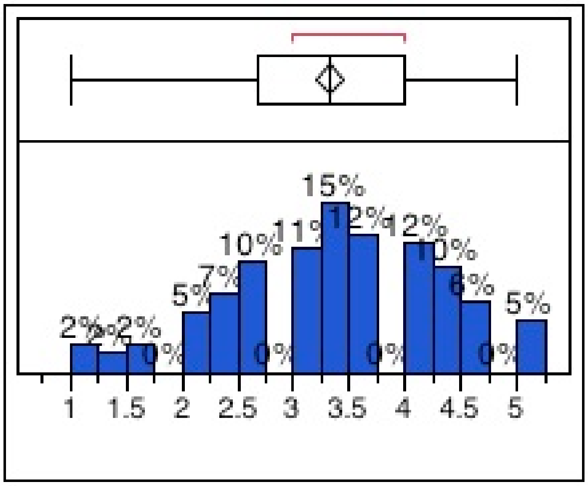
Quantiles

100.0%	maximum	5
99.5%		5
97.5%		5
90.0%		4.2
75.0%	quartile	3.8
50.0%	median	3.2
25.0%	quartile	2.6
10.0%		2
2.5%		1.4
0.5%		1
0.0%	minimum	1

Summary Statistics

Mean	3.1563889
Std Dev	0.8714469
Std Err Mean	0.0562517
Upper 95% Mean	3.2672012
Lower 95% Mean	3.0455765
N	240

Q21 Factor2: Variables 1-3



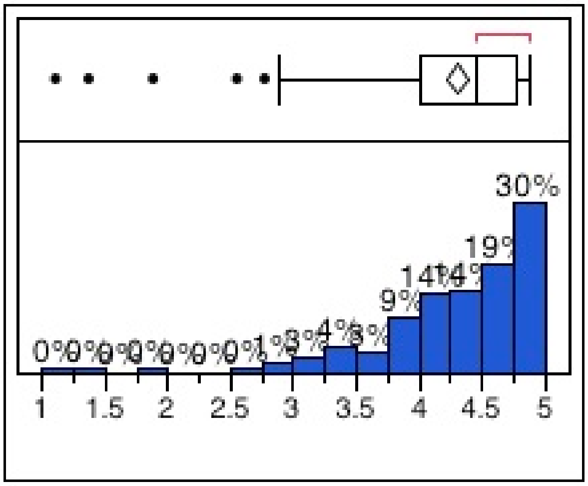
Quantiles

100.0%	maximum	5
99.5%		5
97.5%		5
90.0%		4.66667
75.0%	quartile	4
50.0%	median	3.33333
25.0%	quartile	2.66667
10.0%		2
2.5%		1.01667
0.5%		1
0.0%	minimum	1

Summary Statistics

Mean	3.3264177
Std Dev	0.9470706
Std Err Mean	0.0610062
Upper 95% Mean	3.4465936
Lower 95% Mean	3.2062418
N	241

Q23 Factor1: Variables 3-11



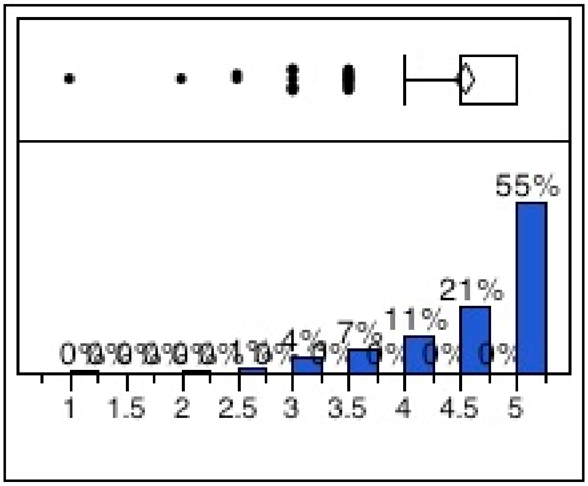
Quantiles

100.0%	maximum	4.88889
99.5%		4.88889
97.5%		4.88889
90.0%		4.88889
75.0%	quartile	4.77778
50.0%	median	4.44444
25.0%	quartile	4
10.0%		3.46111
2.5%		2.86944
0.5%		1.15465
0.0%	minimum	1.11111

Summary Statistics

Mean	4.3102422
Std Dev	0.6123668
Std Err Mean	0.0402038
Upper 95% Mean	4.3894553
Lower 95% Mean	4.2310291
N	232

Q23 Factor2: Variables 1-2



Quantiles

100.0%	maximum	5
99.5%		5
97.5%		5
90.0%		5
75.0%	quartile	5
50.0%	median	5
25.0%	quartile	4.5
10.0%		3.5
2.5%		3
0.5%		1.165
0.0%	minimum	1

Summary Statistics

Mean	4.5366379
Std Dev	0.6707835
Std Err Mean	0.0440391
Upper 95% Mean	4.6234076
Lower 95% Mean	4.4498683
N	232

APPENDIX E

RELIABILITY - FOR ALL FACTORS IN LIKERT-TYPE QUESTIONS 19, 21 AND 23

Appendix E1: Reliability – Factor 1 and 2 in Q19

One common way of computing correlation values among the questions in our instruments is the usage of Cronbach's alpha. In short, Cronbach's alpha splits all the questions on our instrument every possible way and computes correlation values for them all (we use a computer programme for this part). In the end, the computer output generates one number for Cronbach's alpha - and just like a correlation coefficient, the closer it is to one, the higher the reliability estimate of the instrument.

FACTOR 1- QUESTION 19

Multivariate

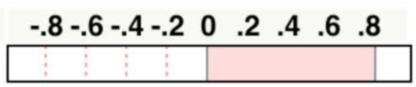
Correlations

	ReC19.4	ReC19.5	ReC19.6	ReC19.7	ReC19.11	ReC19.12	ReC19.13
ReC19.4	1.0000	0.2735	0.6284	0.5509	0.3892	0.5399	0.4749
ReC19.5	0.2735	1.0000	0.2942	0.1733	0.3775	0.1838	0.2127
ReC19.6	0.6284	0.2942	1.0000	0.4714	0.4159	0.5801	0.4672
ReC19.7	0.5509	0.1733	0.4714	1.0000	0.4978	0.5232	0.4505
ReC19.11	0.3892	0.3775	0.4159	0.4978	1.0000	0.6075	0.4531
ReC19.12	0.5399	0.1838	0.5801	0.5232	0.6075	1.0000	0.4925
ReC19.13	0.4749	0.2127	0.4672	0.4505	0.4531	0.4925	1.0000

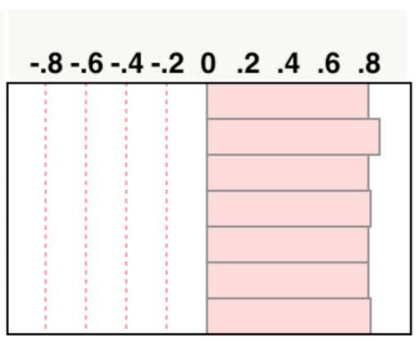
There are 15 missing values. The correlations are estimated by REML method.

Cronbach's α

	α
Entire set	0.8390



Excluded Col	α
ReC19.4	0.8060
ReC19.5	0.8580
ReC19.6	0.8054
ReC19.7	0.8144
ReC19.11	0.8094
ReC19.12	0.8018
ReC19.13	0.8186



FACTOR 2 - QUESTION 19

Multivariate

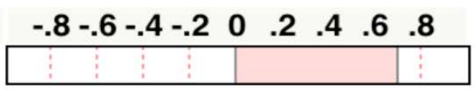
Correlations

	ReC19.1	ReC19.2	ReC19.3
ReC19.1	1.0000	0.6598	0.3601
ReC19.2	0.6598	1.0000	0.3879
ReC19.3	0.3601	0.3879	1.0000

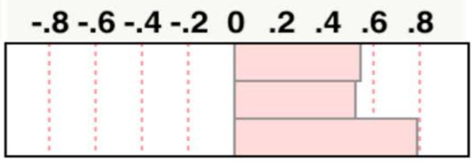
There are 4 missing values. The correlations are estimated by REML method.

Cronbach's α

	α
Entire set	0.7091



Excluded Col	α
ReC19.1	0.5498
ReC19.2	0.5201
ReC19.3	0.7951



Appendix E2: Reliability – Factor 1 and 2 in Q21

FACTOR 1- QUESTION 21

Multivariate

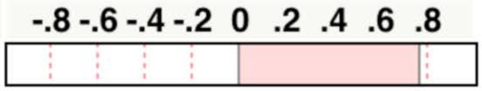
Correlations

	ReC21.7	ReC21.8	ReC21.9	ReC21.10	ReC21.11
ReC21.7	1.0000	0.4329	0.2204	0.3359	0.2672
ReC21.8	0.4329	1.0000	0.4407	0.5212	0.3732
ReC21.9	0.2204	0.4407	1.0000	0.6476	0.3981
ReC21.10	0.3359	0.5212	0.6476	1.0000	0.4648
ReC21.11	0.2672	0.3732	0.3981	0.4648	1.0000

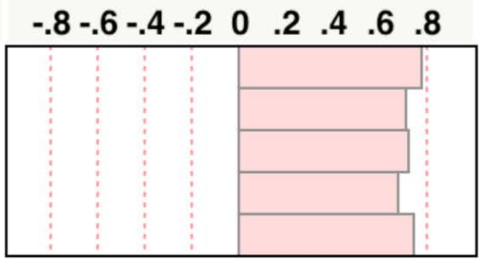
There are 6 missing values. The correlations are estimated by REML method.

Cronbach's α

	α
Entire set	0.7765



Excluded Col	α
ReC21.7	0.7823
ReC21.8	0.7199
ReC21.9	0.7257
ReC21.10	0.6863
ReC21.11	0.7535



FACTOR 2-QUESTION 21

Multivariate

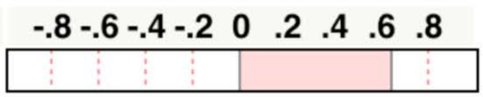
Correlations

	ReC21.1	ReC21.2	ReC21.3
ReC21.1	1.0000	0.3805	0.2253
ReC21.2	0.3805	1.0000	0.5452
ReC21.3	0.2253	0.5452	1.0000

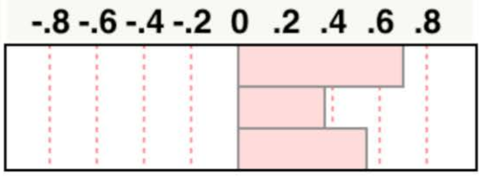
There are 6 missing values. The correlations are estimated by REML method.

Cronbach's α

	α
Entire set	0.6531



Excluded Col	α
ReC21.1	0.7053
ReC21.2	0.3677
ReC21.3	0.5509



Appendix E3: Reliability – Factor 1 and 2 in Q23

FACTOR 1- QUESTION 23

Multivariate

Correlations

	ReC23.3	ReC23.4	ReC23.5	ReC23.6	ReC23.7	ReC23.8	ReC23.9	ReC23.10	ReC23.11
ReC23.3	1.0000	0.6070	0.5915	0.4532	0.5605	0.4829	0.5172	0.5287	0.4997
ReC23.4	0.6070	1.0000	0.5603	0.4445	0.5276	0.4686	0.4520	0.5538	0.5489
ReC23.5	0.5915	0.5603	1.0000	0.4964	0.6442	0.5121	0.4624	0.5541	0.6293
ReC23.6	0.4532	0.4445	0.4964	1.0000	0.5787	0.2773	0.3613	0.3969	0.4201
ReC23.7	0.5605	0.5276	0.6442	0.5787	1.0000	0.5466	0.5232	0.4739	0.5086
ReC23.8	0.4829	0.4686	0.5121	0.2773	0.5466	1.0000	0.5501	0.5272	0.5597
ReC23.9	0.5172	0.4520	0.4624	0.3613	0.5232	0.5501	1.0000	0.5369	0.5403
ReC23.10	0.5287	0.5538	0.5541	0.3969	0.4739	0.5272	0.5369	1.0000	0.5615
ReC23.11	0.4997	0.5489	0.6293	0.4201	0.5086	0.5597	0.5403	0.5615	1.0000

There are 6 missing values. The correlations are estimated by REML method.

Cronbach's α

	α	-.8 -.6 -.4 -.2 0 .2 .4 .6 .8
Entire set	0.9031	

Excluded Col	α	-.8 -.6 -.4 -.2 0 .2 .4 .6 .8
ReC23.3	0.8900	
ReC23.4	0.8911	
ReC23.5	0.8873	
ReC23.6	0.9014	
ReC23.7	0.8887	
ReC23.8	0.8947	
ReC23.9	0.8947	
ReC23.10	0.8917	
ReC23.11	0.8902	

FACTOR 2_QUESTION 23

Multivariate

Correlations

	ReC23.1	ReC23.2
ReC23.1	1.0000	0.4674
ReC23.2	0.4674	1.0000

There are 2 missing values. The correlations are estimated by REML method.

Cronbach's α

	α	-.8 -.6 -.4 -.2 0 .2 .4 .6 .8
Entire set	0.6227	

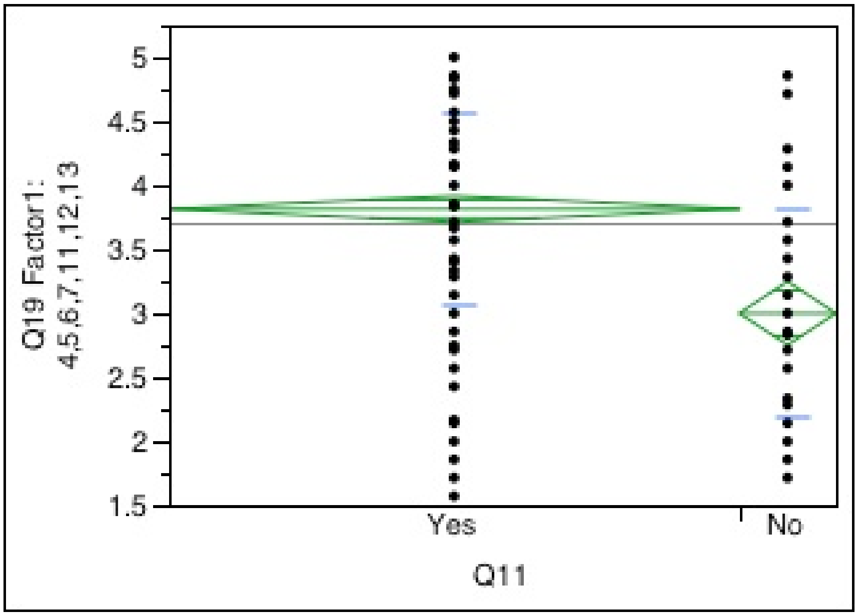
Excluded Col	α	-.8 -.6 -.4 -.2 0 .2 .4 .6 .8
ReC23.1	.	
ReC23.2	.	

APPENDIX F

CHI_ SQUARE TEST AND ANOVA TEST
FOR LIKERT-SCALE QUESTIONS (COMPARABILITY WITH OTHERS)

F1: CHI-SQUARE AND ANOVA TEST FOR QUESTION 19_FACTOR 1 WITH OHER QUESTIONS

F1.1 Oneway Analysis of Q19 Factor1: Variables 4,5,6,7,11,12,13 By Q11



Missing Rows
16

Oneway ANOVA
Summary of Fit

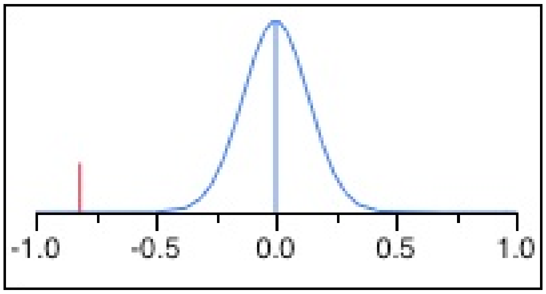
Rsquare	0.126876
Adj Rsquare	0.123341
Root Mean Square Error	0.754854
Mean of Response	3.697772
Observations (or Sum Wgts)	249

t Test
No-Yes

Assuming equal variances

Difference	-0.8149	t Ratio	-5.991
Std Err Dif	0.1360	DF	247
Upper CL Dif	-0.5470	Prob > |t|	<.0001*

Lower CL Dif	-1.0829	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001*



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q11	1	20.45153	20.4515	35.8921	<.0001*
Error	247	140.74190	0.5698		
C. Total	248	161.19343			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Yes	213	3.81559	0.05172	3.7137	3.9175
No	36	3.00066	0.12581	2.7529	3.2485

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
Yes	213	28728.5	26625.0	134.876	5.269
No	36	2396.50	4500.00	66.569	-5.269

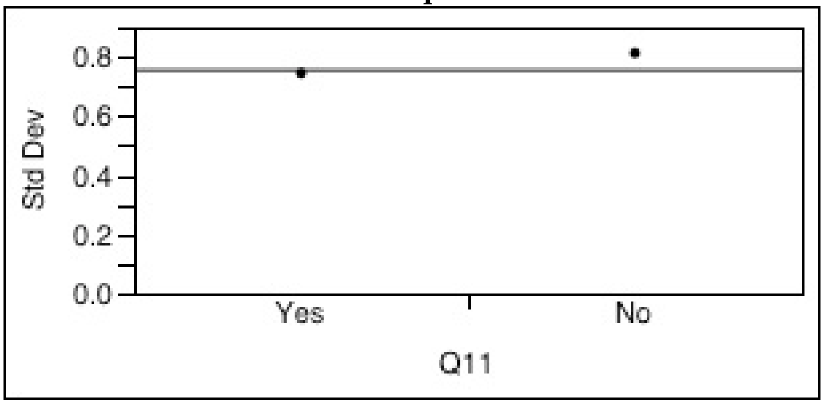
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
2396.5	-5.26895	<.0001*

1-way Test, Chi Square Approximation

Chi Square(χ^2)	DF	Prob>ChiSq
27.7750	1	<.0001*

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Yes	213	0.7448459	0.5907442	0.5849206
No	36	0.8128480	0.6581423	0.6580688

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.5359	1	247	0.4648
Brown-Forsythe	0.7703	1	247	0.3810
Levene	0.6799	1	247	0.4104
Bartlett	0.4734	1	.	0.4914
F Test 2-sided	1.1909	35	212	0.4526

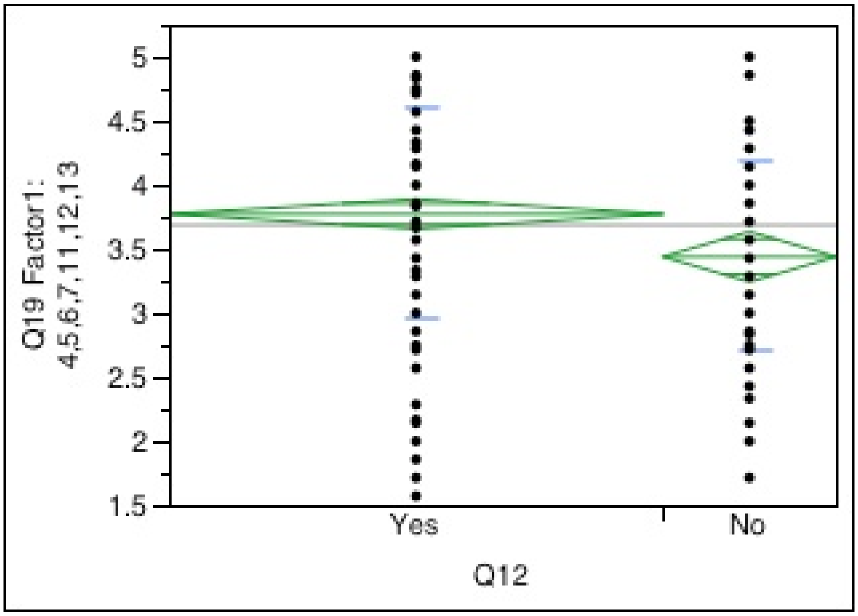
Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
31.6878	1	45.488	<.0001*

t Test
5.6292

F1.2 Oneway Analysis of Q19 Factor1: Variables 4,5,6,7,11,12,13 By Q12



Missing Rows
18

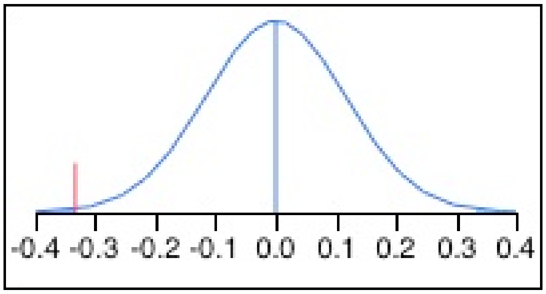
Oneway ANOVA
Summary of Fit

Rsquare	0.032537
Adj Rsquare	0.028588
Root Mean Square Error	0.800463
Mean of Response	3.686765
Observations (or Sum Wgts)	247

t Test
No-Yes

Assuming equal variances

Difference	-0.33368	t Ratio	-2.87047
Std Err Dif	0.11625	DF	245
Upper CL Dif	-0.10471	Prob > |t|	0.0045*
Lower CL Dif	-0.56265	Prob > t	0.9978
Confidence	0.95	Prob < t	0.0022*



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q12	1	5.27945	5.27945	8.2396	0.0045*
Error	245	156.98174	0.64074		
C. Total	246	162.26120			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Yes	183	3.77322	0.05917	3.6567	3.8898
No	64	3.43955	0.10006	3.2425	3.6366

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
Yes	183	24233.5	22692.0	132.423	3.137
No	64	6394.50	7936.00	99.914	-3.137

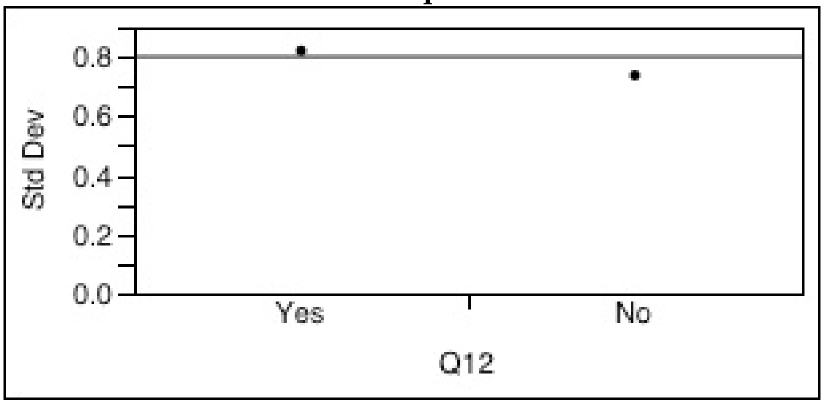
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
6394.5	-3.13660	0.0017*

1-way Test, Chi Square Approximation

Chi Square(χ^2)	DF	Prob>ChiSq(χ^2)
9.8446	1	0.0017*

Tests that the Variances are Equal



Level	**Count**	**Std Dev**	**MeanAbsDif to Mean**	**MeanAbsDif to Median**
Yes	183	0.8210296	0.6636955	0.6515743
No	64	0.7378371	0.5760789	0.5760789

Test	**F Ratio**	**DFNum**	**DFDen**	**p-Value**
O'Brien[.5]	1.1226	1	245	0.2904
Brown-Forsythe	1.1115	1	245	0.2928
Levene	1.6176	1	245	0.2046
Bartlett	1.0250	1	.	0.3113
F Test 2-sided	1.2382	182	63	0.3273

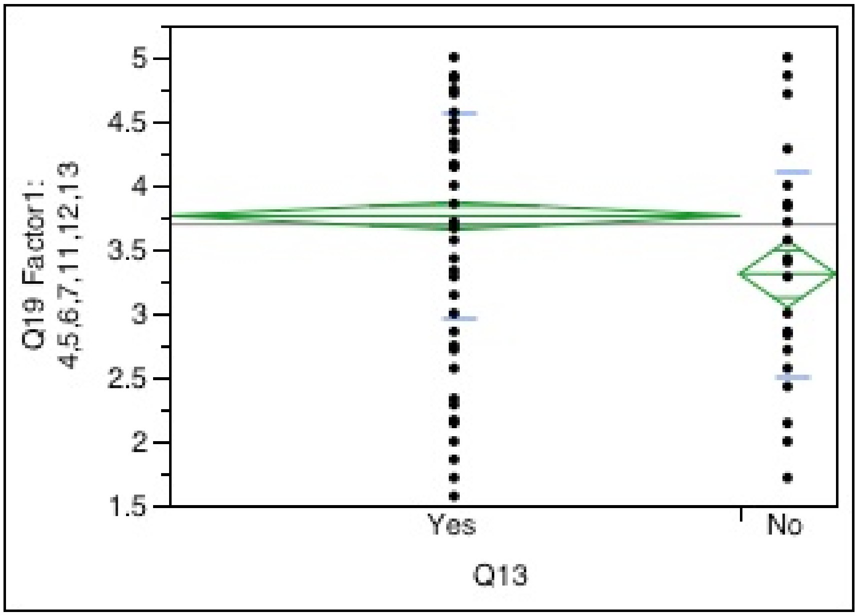
Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	**DFNum**	**DFDen**	**Prob > F**
9.1339	1	121.49	0.0031*

t Test
3.0222

F1.3 Oneway Analysis of Q19 Factor1: Variables 4,5,6,7,11,12,13 By Q13



Missing Rows
16

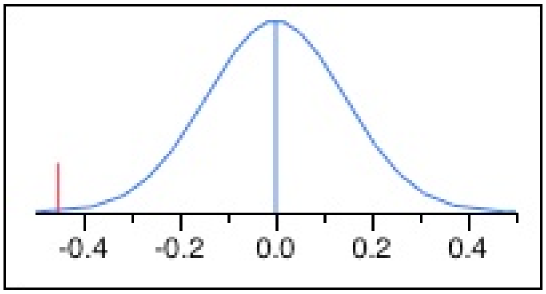
Oneway ANOVA
Summary of Fit

Rsquare	0.038929
Adj Rsquare	0.035038
Root Mean Square Error	0.795911
Mean of Response	3.695477
Observations (or Sum Wgts)	249

t Test
No-Yes

Assuming equal variances

Difference	-0.45366	t Ratio	-3.16305
Std Err Dif	0.14342	DF	247
Upper CL Dif	-0.17117	Prob > |t|	0.0018*
Lower CL Dif	-0.73615	Prob > t	0.9991
Confidence	0.95	Prob < t	0.0009*



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q13	1	6.33785	6.33785	10.0049	0.0018*
Error	247	156.46805	0.63347		
C. Total	248	162.80590			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Yes	213	3.76107	0.05453	3.6537	3.8685
No	36	3.30741	0.13265	3.0461	3.5687

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
Yes	213	27952.5	26625.0	131.232	3.325
No	36	3172.50	4500.00	88.125	-3.325

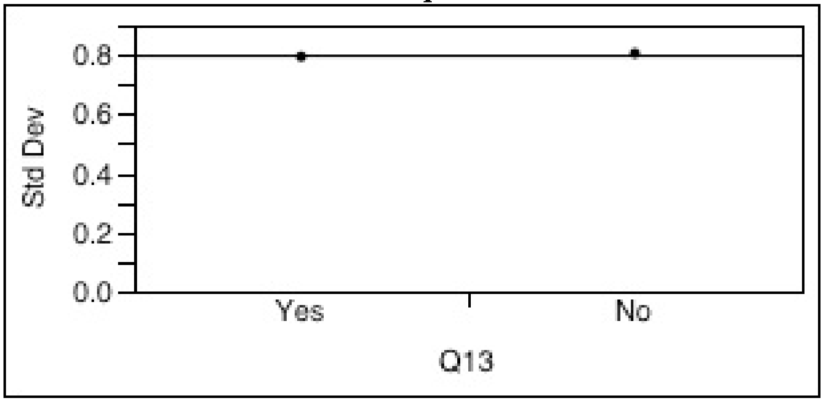
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
3172.5	-3.32471	0.0009*

1-way Test, Chi Square Approximation

Chi Square(χ^2)	DF	Prob>ChiSq(χ^2)
11.0620	1	0.0009*

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Yes	213	0.7943293	0.6381891	0.6287167
No	36	0.8054233	0.6194591	0.6182540

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.0134	1	247	0.9079
Brown-Forsythe	0.0138	1	247	0.9067
Levene	0.0477	1	247	0.8272
Bartlett	0.0115	1	.	0.9145
F Test 2-sided	1.0281	35	212	0.8656

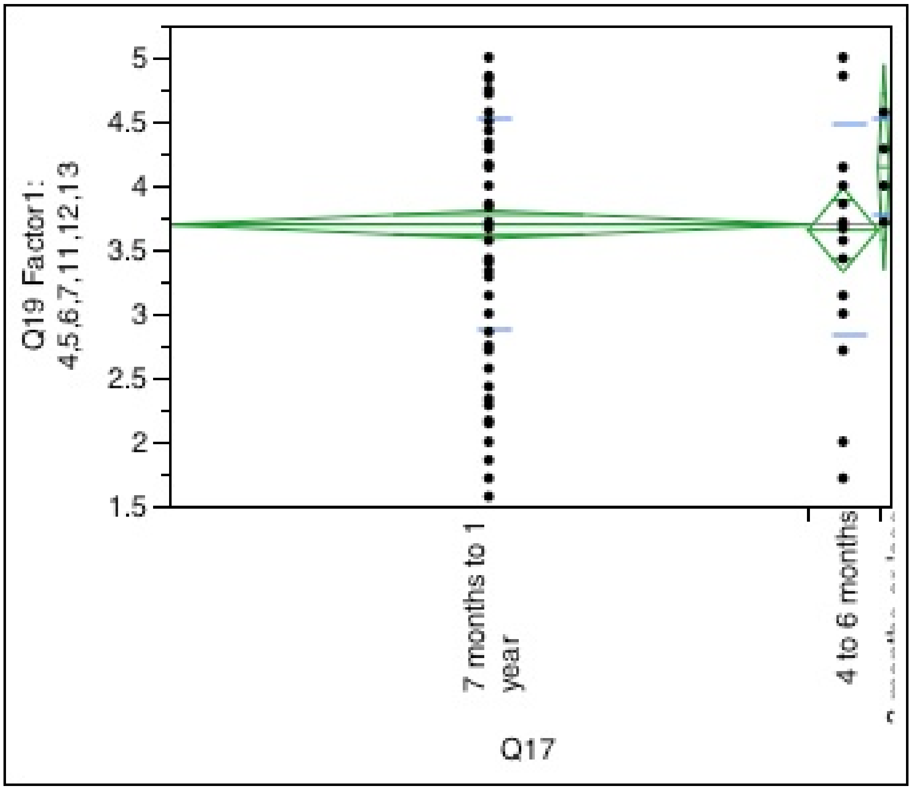
Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
9.8088	1	47.242	0.0030*

t Test
3.1319

F1.4 Oneway Analysis of Q19 Factor1: Variables 4,5,6,7,11,12,13 By Q17



Missing Rows
18

Oneway ANOVA
Summary of Fit

Rsquare	0.005174
Adj Rsquare	-0.00298
Root Mean Square Error	0.815188
Mean of Response	3.697735
Observations (or Sum Wgts)	247

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q17	2	0.84329	0.421645	0.6345	0.5311
Error	244	162.14573	0.664532		
C. Total	246	162.98902			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
7 months to 1 year	219	3.69453	0.05509	3.5860	3.8030
4 to 6 months	24	3.65278	0.16640	3.3250	3.9805
3 months or less	4	4.14286	0.40759	3.3400	4.9457

Std Error uses a pooled estimate of error variance

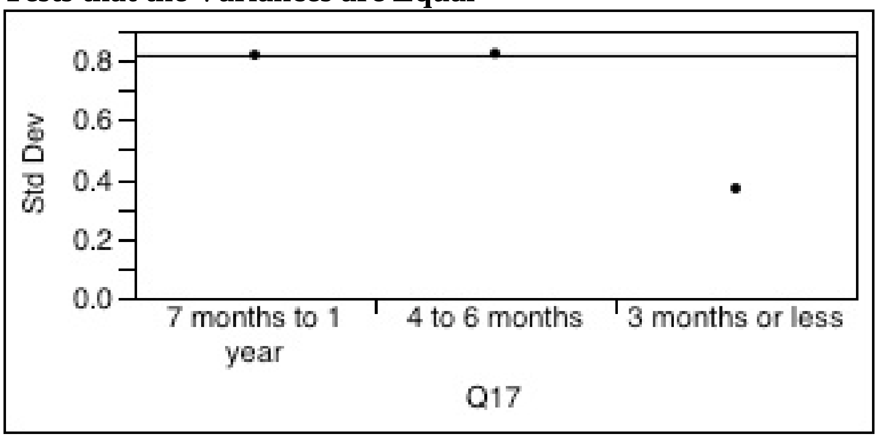
Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
7 months to 1 year	219	27168.5	27156.0	124.057	0.034
4 to 6 months	24	2798.50	2976.00	116.604	-0.533
3 months or less	4	661.000	496.000	165.250	1.162

1-way Test, Chi Square (χ^2)Approximation

Chi Square(χ^2)	DF	Prob>ChiSq(χ^2)
1.5951	2	0.4504

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
7 months to 1 year	219	0.8186804	0.6684148	0.6584801
4 to 6 months	24	0.8242455	0.5813492	0.5813492
3 months or less	4	0.3688556	0.2857143	0.2857143

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	0.7698	2	244	0.4642
Brown-Forsythe	1.2345	2	244	0.2928
Levene	1.5608	2	244	0.2120
Bartlett	1.1224	2	.	0.3255

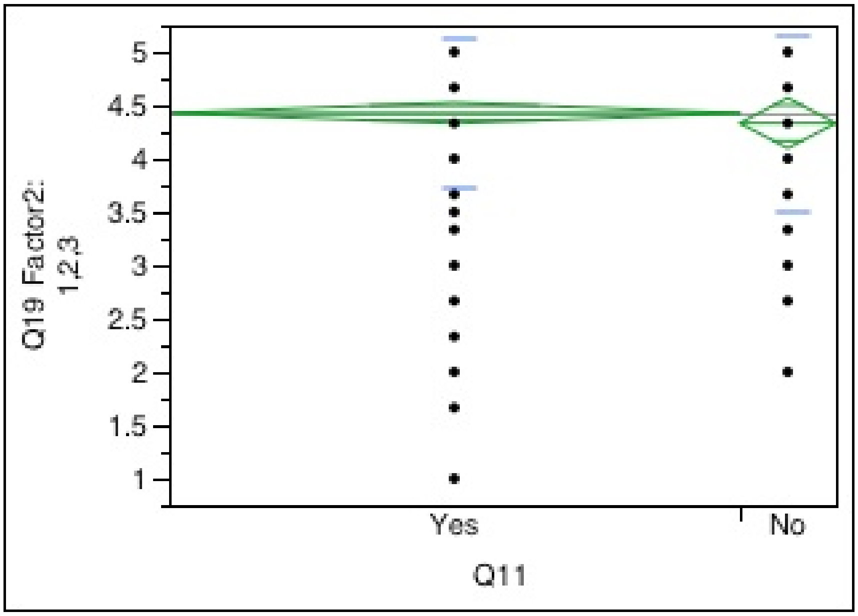
Warning: Small sample sizes. Use Caution.

Welch's Test
Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
2.6015	2	8.3007	0.1327

F2: CHI-SQUARE AND ANOVA TEST FOR QUESTION 19_FACTOR 2 WITH OHER QUESTIONS

F2.1 Oneway Analysis of Q19 Factor2: Variables 1,2,3 By Q11



Missing Rows
15

Oneway ANOVA
Summary of Fit

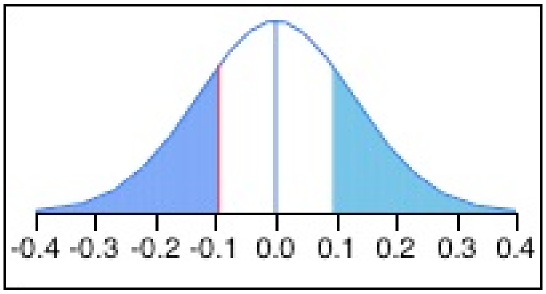
Rsquare	0.00217
Adj Rsquare	-0.00185
Root Mean Square Error	0.718144
Mean of Response	4.414667
Observations (or Sum Wgts)	250

t Test
No-Yes

Assuming equal variances

Difference	-0.09502	t Ratio	-0.73447
Std Err Dif	0.12937	DF	248
Upper CL Dif	0.15978	Prob > |t|	0.4634
Lower CL Dif	-0.34981	Prob > t	0.7683

Confidence	0.95	Prob < t	0.2317



Analysis of Variance

Source	**DF**	**Sum of Squares**	**Mean Square**	**F Ratio**	**Prob > F**
Q11	1	0.27821	0.278206	0.5394	0.4634
Error	248	127.90135	0.515731		
C. Total	249	128.17956			

Means for Oneway ANOVA

Level	**Number**	**Mean**	**Std Error**	**Lower 95%**	**Upper 95%**
Yes	214	4.42835	0.04909	4.3317	4.5250
No	36	4.33333	0.11969	4.0976	4.5691

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	**Count**	**Score Sum**	**Expected Score**	**Score Mean**	**(Mean-Mean0)/Std0**
Yes	214	26931.0	26857.0	125.846	0.190
No	36	4444.00	4518.00	123.444	-0.190

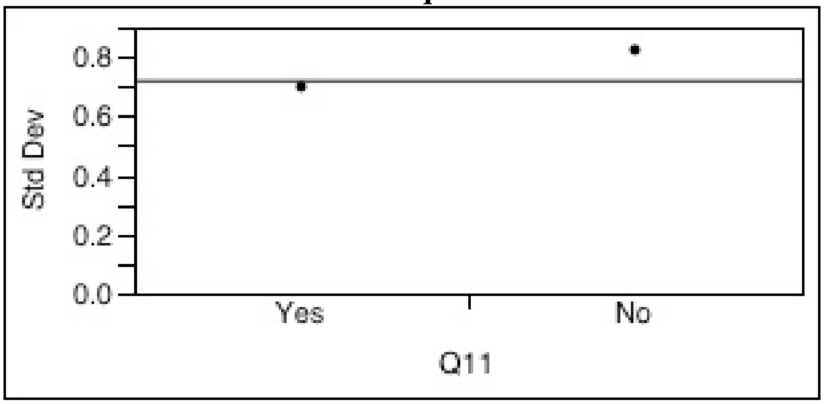
2-Sample Test, Normal Approximation

S	**Z**	**Prob>|Z|**
4444	-0.19032	0.8491

1-way Test, Chi Square Approximation

Chi Square(χ^2)	**DF**	**Prob>ChiSq(χ^2)**
0.0367	1	0.8480

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Yes	214	0.6991731	0.5311818	0.5000000
No	36	0.8242361	0.6481481	0.6296296

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.8241	1	248	0.3649
Brown-Forsythe	1.6835	1	248	0.1957
Levene	1.9955	1	248	0.1590
Bartlett	1.7429	1	.	0.1868
F Test 2-sided	1.3897	35	213	0.1662

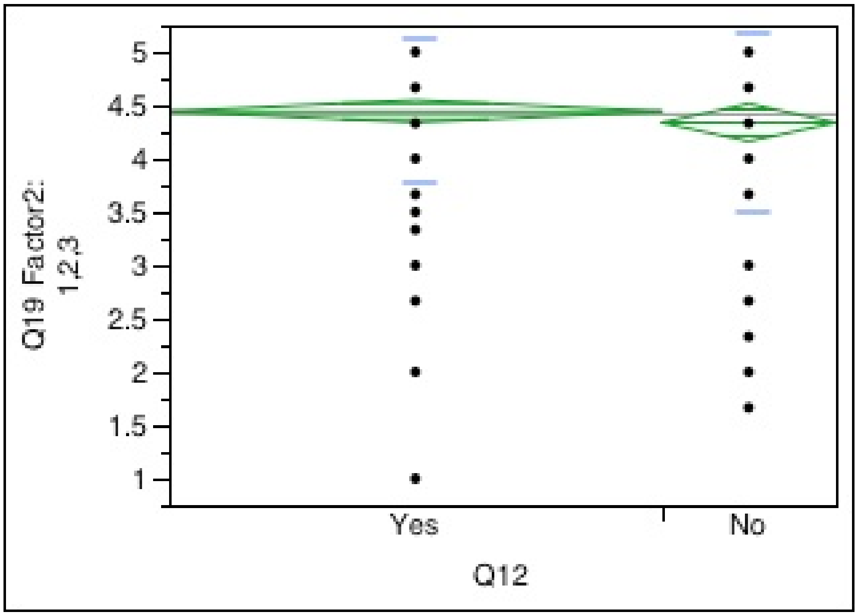
Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
0.4267	1	43.88	0.5170

t Test
0.6533

F2.2 Oneway Analysis of Q19 Factor2: Variables 1,2,3 By Q12



Missing Rows
16

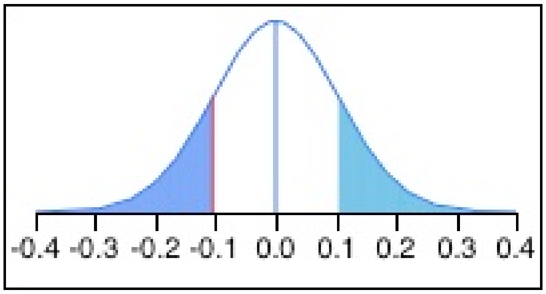
Oneway ANOVA
Summary of Fit

Rsquare	0.004152
Adj Rsquare	0.000121
Root Mean Square Error	0.719643
Mean of Response	4.416332
Observations (or Sum Wgts)	249

t Test
No-Yes

Assuming equal variances

Difference	-0.10538	t Ratio	-1.01485
Std Err Dif	0.10384	DF	247
Upper CL Dif	0.09914	Prob > |t|	0.3112
Lower CL Dif	-0.30990	Prob > t	0.8444
Confidence	0.95	Prob < t	0.1556



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q12	1	0.53338	0.533384	1.0299	0.3112
Error	247	127.91798	0.517887		
C. Total	248	128.45136			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Yes	184	4.44384	0.05305	4.3393	4.5483
No	65	4.33846	0.08926	4.1627	4.5143

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
Yes	184	23214.0	23000.0	126.163	0.445
No	65	7911.00	8125.00	121.708	-0.445

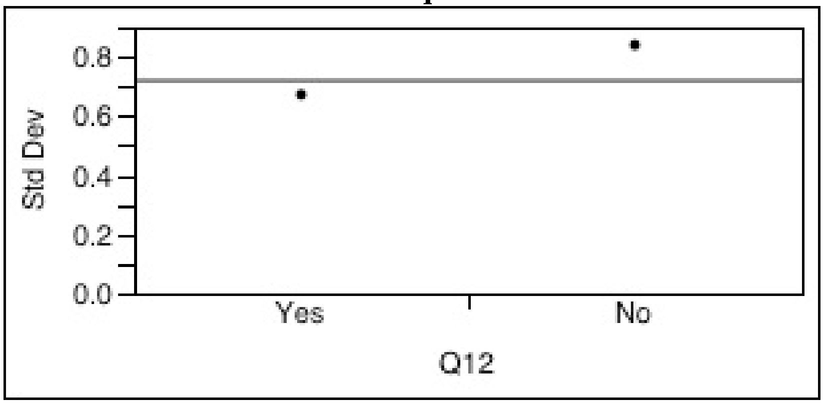
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
7911	-0.44512	0.6562

1-way Test, Chi Square Approximation

Chi Square(χ^2)	DF	Prob>ChiSq(χ^2)
0.1991	1	0.6555

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Yes	184	0.6722341	0.5272527	0.4981884
No	65	0.8405775	0.6199606	0.5846154

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	2.3439	1	247	0.1271
Brown-Forsythe	1.1634	1	247	0.2818
Levene	1.9691	1	247	0.1618
Bartlett	5.0313	1	.	0.0249*
F Test 2-sided	1.5636	64	183	0.0228*

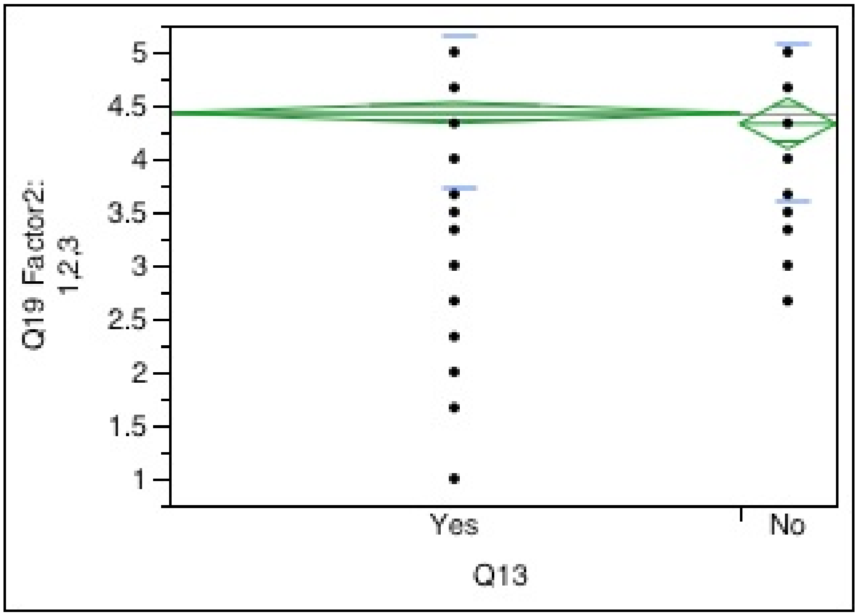
Welch's Test

Welch ANOVA Testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
0.8333	1	94.499	0.3636

t Test
0.9129

F2.3 Oneway Analysis of Q19 Factor2: Variables 1,2,3 By Q13



Missing Rows
15

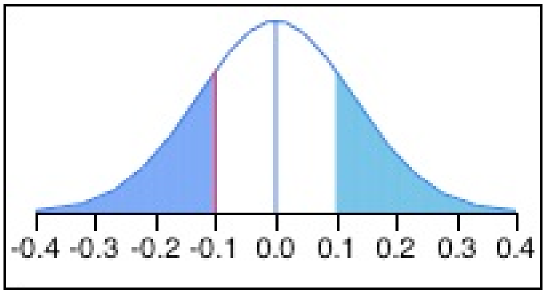
Oneway ANOVA
Summary of Fit

Rsquare	0.002425
Adj Rsquare	-0.0016
Root Mean Square Error	0.718053
Mean of Response	4.414667
Observations (or Sum Wgts)	250

t Test
No-Yes

Assuming equal variances

Difference	-0.10042	t Ratio	-0.77637
Std Err Dif	0.12935	DF	248
Upper CL Dif	0.15434	Prob > |t|	0.4383
Lower CL Dif	-0.35519	Prob > t	0.7809
Confidence	0.95	Prob < t	0.2191



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q13	1	0.31078	0.310779	0.6028	0.4383
Error	248	127.86878	0.515600		
C. Total	249	128.17956			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Yes	214	4.42913	0.04909	4.3325	4.5258
No	36	4.32870	0.11968	4.0930	4.5644

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
Yes	214	27201.5	26857.0	127.110	0.891
No	36	4173.50	4518.00	115.931	-0.891

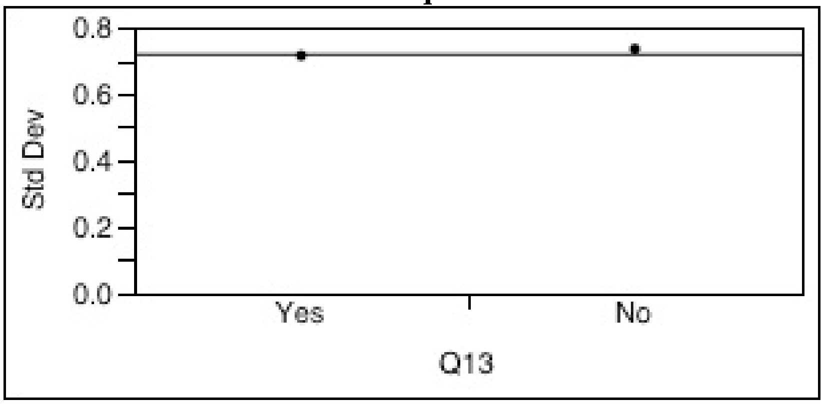
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
4173.5	-0.89073	0.3731

1-way Test, Chi Square Approximation

Chi Square(χ^2)	DF	Prob>ChiSq(χ^2)
0.7957	1	0.3724

Tests that the Variances are Equal



Level	**Count**	**Std Dev**	**MeanAbsDif to Mean**	**MeanAbsDif to Median**
Yes	214	0.7152034	0.5427621	0.5116822
No	36	0.7351559	0.5802469	0.5601852

Test	**F Ratio**	**DFNum**	**DFDen**	**p-Value**
O'Brien[.5]	0.0188	1	248	0.8909
Brown-Forsythe	0.2343	1	248	0.6288
Levene	0.2037	1	248	0.6521
Bartlett	0.0457	1	.	0.8308
F Test 2-sided	1.0566	35	213	0.7826

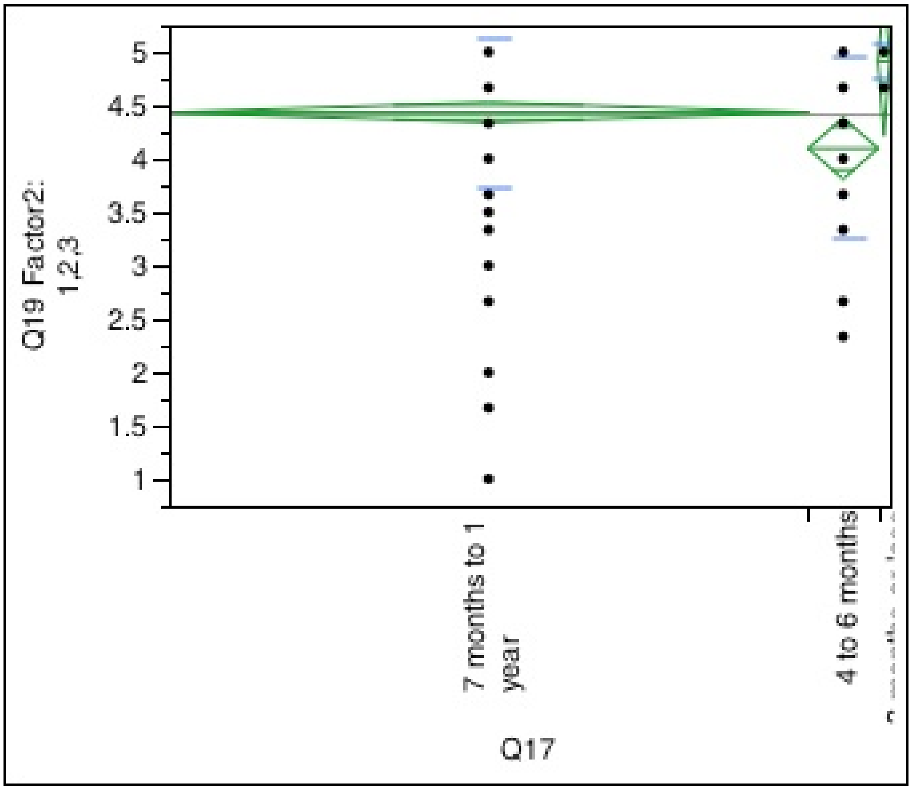
Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	**DFNum**	**DFDen**	**Prob > F**
0.5795	1	46.837	0.4503

t Test
0.7612

F2.4 Oneway Analysis of Q19 Factor2: Variables 1,2,3 By Q17



Missing Rows
18

Oneway ANOVA
Summary of Fit

Rsquare	0.027573
Adj Rsquare	0.019602
Root Mean Square Error	0.712787
Mean of Response	4.410256
Observations (or Sum Wgts)	247

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q17	2	3.51506	1.75753	3.4593	0.0330*
Error	244	123.96785	0.50806		
C. Total	246	127.48291			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
7 months to 1 year	219	4.43531	0.04817	4.3404	4.5302
4 to 6 months	24	4.09722	0.14550	3.8106	4.3838
3 months or less	4	4.91667	0.35639	4.2147	5.6187

Std Error uses a pooled estimate of error variance

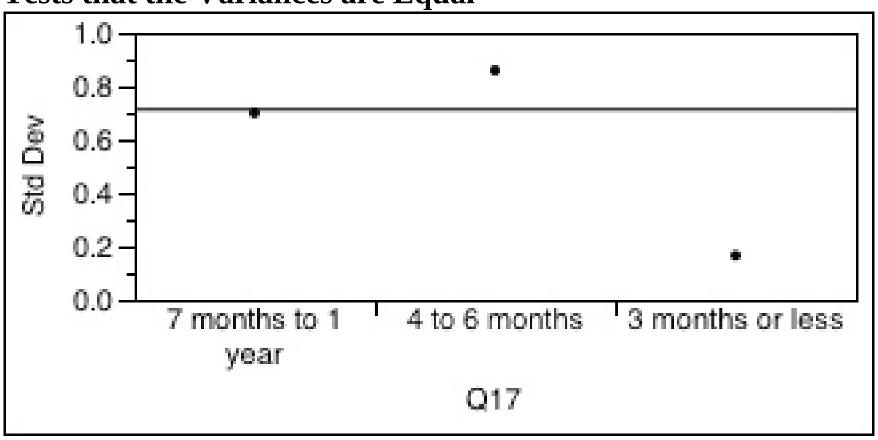
Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
7 months to 1 year	219	27558.0	27156.0	125.836	1.171
4 to 6 months	24	2345.00	2976.00	97.708	-1.969
3 months or less	4	725.000	496.000	181.250	1.674

1-way Test, Chi Square Approximation

Chi Square(χ^2)	DF	Prob>ChiSq(χ^2)
6.4321	2	0.0401*

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
7 months to 1 year	219	0.7002265	0.5277621	0.4992390
4 to 6 months	24	0.8596099	0.7361111	0.7361111
3 months or less	4	0.1666667	0.1250000	0.0833333

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	0.8421	2	244	0.4321
Brown-Forsythe	3.5286	2	244	0.0309*
Levene	4.0197	2	244	0.0192*
Bartlett	3.6951	2	.	0.0248*

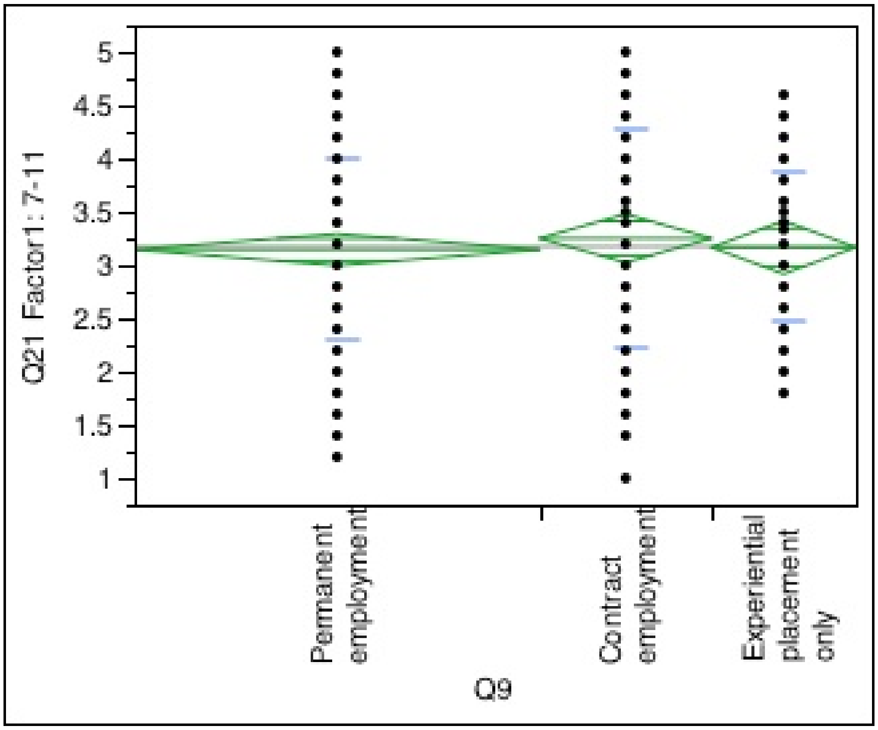
Warning: Small sample sizes. Use Caution.

Welch's Test
Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
14.9259	2	11.275	0.0007*

F3: CHI-SQUARE AND ANOVA TEST FOR QUESTION 21_FACTOR 1 BY QUESTION 9

Oneway Analysis of Q21 Factor1: Variables 7-11 By Q9



Missing Rows
30

Oneway Anova
Summary of Fit

Rsquare	0.00257
Adj Rsquare	-0.00603
Root Mean Square Error	0.866331
Mean of Response	3.175035
Observations (or Sum Wgts)	235

Analysis of Variance

Source	**DF**	**Sum of Squares**	**Mean Square**	**F Ratio**	**Prob > F**
Q9	2	0.44867	0.224335	0.2989	0.7419
Error	232	174.12265	0.750529		
C. Total	234	174.57132			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Permanent employment	132	3.14545	0.07540	2.9969	3.2940
Contract employment	56	3.25179	0.11577	3.0237	3.4799
Experiential placement only	47	3.16667	0.12637	2.9177	3.4156

Std Error uses a pooled estimate of error variance

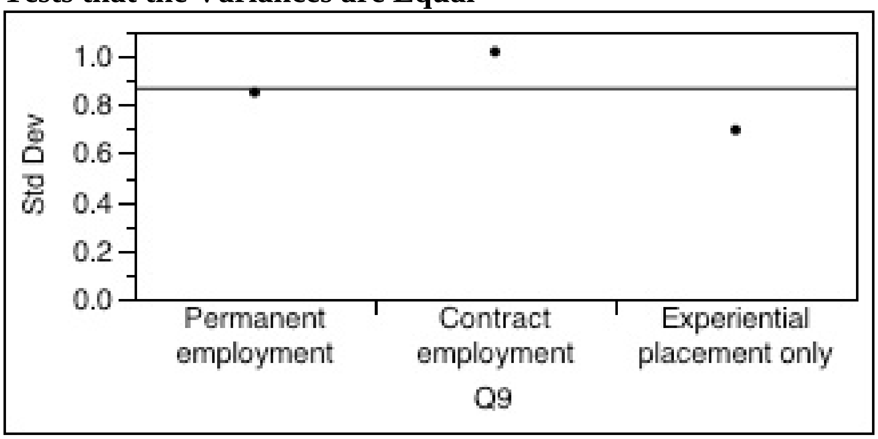
Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
Permanent employment	132	15251.0	15576.0	115.538	-0.629
Contract employment	56	6965.00	6608.00	124.375	0.805
Experiential placement only	47	5514.00	5546.00	117.319	-0.076

1-way Test, ChiSquare Approximation

ChiSquare	DF	Prob>ChiSq
0.6741	2	0.7139

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Permanent employment	132	0.850717	0.6928375	0.6878788
Contract employment	56	1.018196	0.8213648	0.8160714
Experiential placement only	47	0.696194	0.5517730	0.5439716

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	4.3667	2	232	0.0138*
Brown-Forsythe	3.4636	2	232	0.0329*
Levene	3.6755	2	232	0.0268*

Test	F Ratio	DFNum	DFDen	Prob > F
Bartlett	3.5307	2	.	0.0293*

Welch's Test

Welch Anova testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
0.2344	2	105.55	0.7914

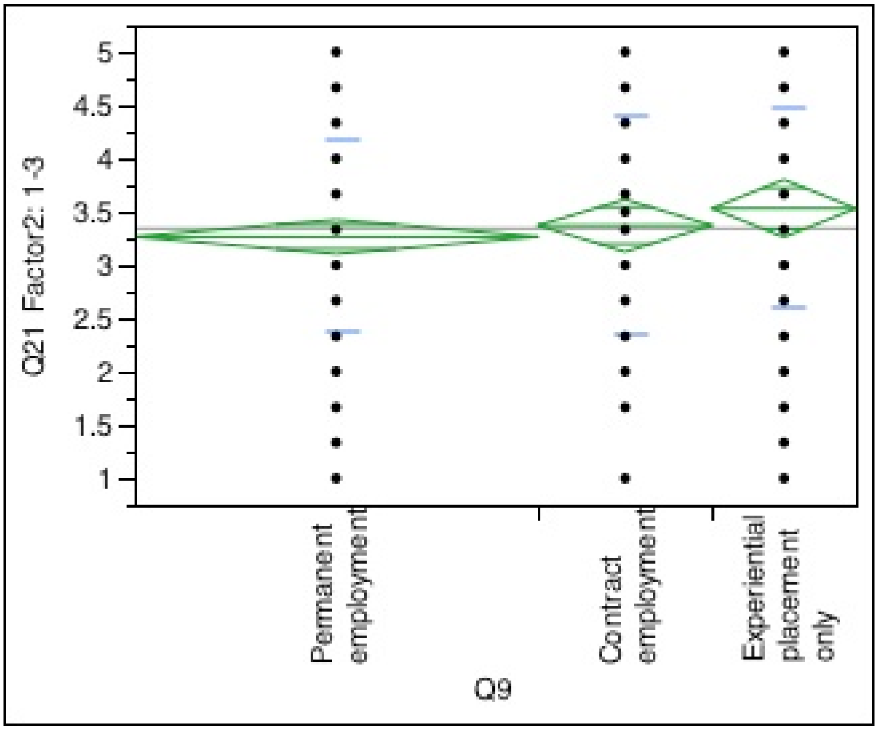
Nonparametric Comparisons For Each Pair Using Wilcoxon Method

q*	Alpha
1.95996	0.05

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value	Hodges-Lehmann	Lower CL	Upper CL
Contract employment	Permanent employ	6.93047	8.654653	0.800779	0.4233	0.200000	-0.200000	0.4000000
Experiential placement only	Permanent employ	1.48590	8.771295	0.169404	0.8655	0.000000	-0.200000	0.2000000
Experiential placement only	Contract employ	-3.26767	5.895807	-0.554236	0.5794	-0.083333	-0.400000	0.2000000

F4: CHI-SQUARE AND ANOVA TEST FOR QUESTION 21_FACTOR 2 BY QUESTION 9

Oneway Analysis of Q21 Factor2: Variables 1-3 By Q9



Missing Rows
29

Oneway ANOVA
Summary of Fit

Rsquare	0.012123
Adj Rsquare	0.003643
Root Mean Square Error	0.939339
Mean of Response	3.343927
Observations (or Sum Wgts)	236

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q9	2	2.52294	1.26147	1.4297	0.2415
Error	233	205.58947	0.88236		
C. Total	235	208.11241			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Permanent employment	132	3.26515	0.08176	3.1041	3.4262
Contract employment	57	3.37135	0.12442	3.1262	3.6165
Experiential placement only	47	3.53191	0.13702	3.2620	3.8019

Std Error uses a pooled estimate of error variance

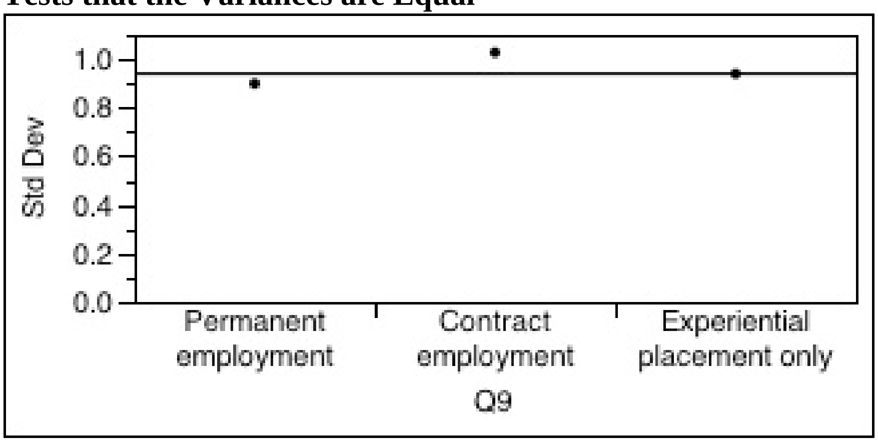
Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
Permanent employment	132	14719.0	15642.0	111.508	-1.781
Contract employment	57	7009.50	6754.50	122.974	0.570
Experiential placement only	47	6237.50	5569.50	132.713	1.602

1-way Test, Chi Square (χ^2)Approximation

Chi Square(χ^2)	DF	Prob>ChiSq(χ^2)
3.7071	2	0.1567

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Permanent employment	132	0.899287	0.7087925	0.6994949
Contract employment	57	1.026928	0.8637529	0.8333333
Experiential placement only	47	0.939369	0.7306474	0.7163121

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	0.8837	2	233	0.4146
Brown-Forsythe	1.0211	2	233	0.3618

Test	F Ratio	DFNum	DFDen	Prob > F
Levene	1.5920	2	233	0.2057
Bartlett	0.7093	2	.	0.4920

Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
1.4548	2	100.03	0.2383

Nonparametric Comparisons For Each Pair Using Wilcoxon Method

q*	Alpha
1.95996	0.05

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value	Hodges-Lehmann	Lower CL	Upper CL
Experiential placement only	Permanent employment	16.60453	8.743026	1.899174	0.0575	0.3333333	0.000000	0.6666667
Contract employment	Permanent employment	8.70395	8.622795	1.009411	0.3128	0.3333333	-0.333333	0.3333333
Experiential placement only	Contract employment	3.55207	5.909932	0.601034	0.5478	0.0000000	-0.333333	0.6666667

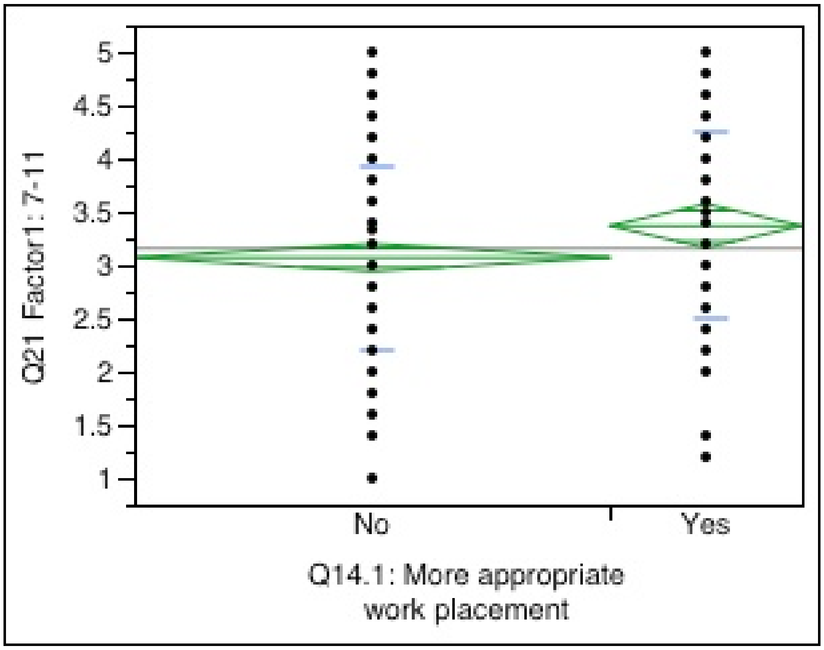
APPENDIX G

ANOVA TEST FOR FACTOR 1 AND 2 OF QUETSION 21

BY QUSTION 14

G1: ANOVA TEST FOR FACTOR 1 OF QUETSION 21 BY QUSTION 14

G1.1 Oneway Analysis of Q21 Factor1: 7-11 By Q14.1: More appropriate work placement



Missing Rows
25

Oneway ANOVA
Summary of Fit

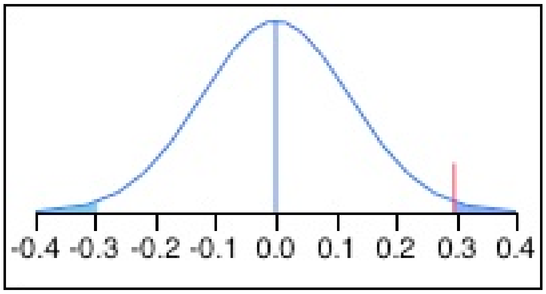
Rsquare	0.023919
Adj Rsquare	0.019817
Root Mean Square Error	0.862769
Mean of Response	3.156389
Observations (or Sum Wgts)	240

t Test
Yes-No

Assuming equal variances

Difference	0.297161	t Ratio	2.414983
Std Err Dif	0.123049	DF	238

Upper CL Dif	0.539565	Prob > |t|	0.0165*
Lower CL Dif	0.054757	Prob > t	0.0082*
Confidence	0.95	Prob < t	0.9918



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q14.1: More appropriate work placement	1	4.34127	4.34127	5.8321	0.0165*
Error	238	177.16004	0.74437		
C. Total	239	181.50131			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	171	3.07096	0.06598	2.9410	3.2009
Yes	69	3.36812	0.10387	3.1635	3.5727

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	171	19484.0	20605.5	113.942	-2.309
Yes	69	9436.00	8314.50	136.754	2.309

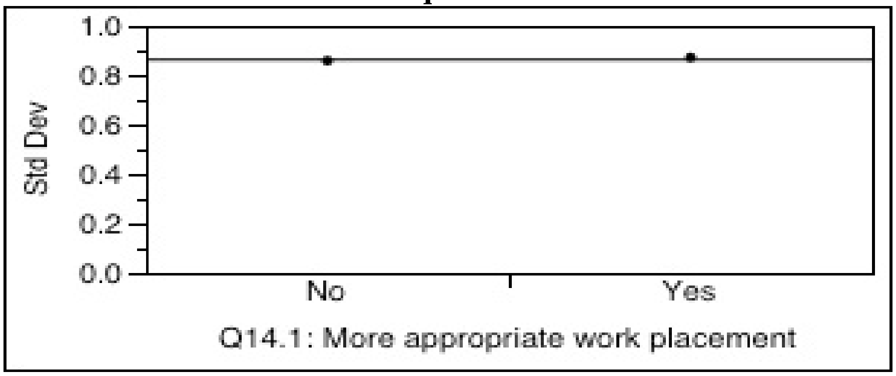
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
9436	2.30933	0.0209*

1-way Test, Chi Square (χ^2)Approximation

Chi Square(χ^2)	DF	Prob>ChiSq(χ^2)
5.3378	1	0.0209*

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	171	0.8590357	0.6951016	0.6943470
Yes	69	0.8720316	0.6795211	0.6753623

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.0266	1	238	0.8706
Brown-Forsythe	0.0637	1	238	0.8009
Levene	0.0453	1	238	0.8316
Bartlett	0.0219	1	.	0.8824
F Test 2-sided	1.0305	68	170	0.8595

Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

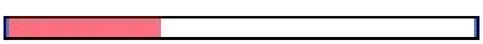
F Ratio	DFNum	DFDen	Prob > F
5.7579	1	124.07	0.0179*

t Test
2.3996

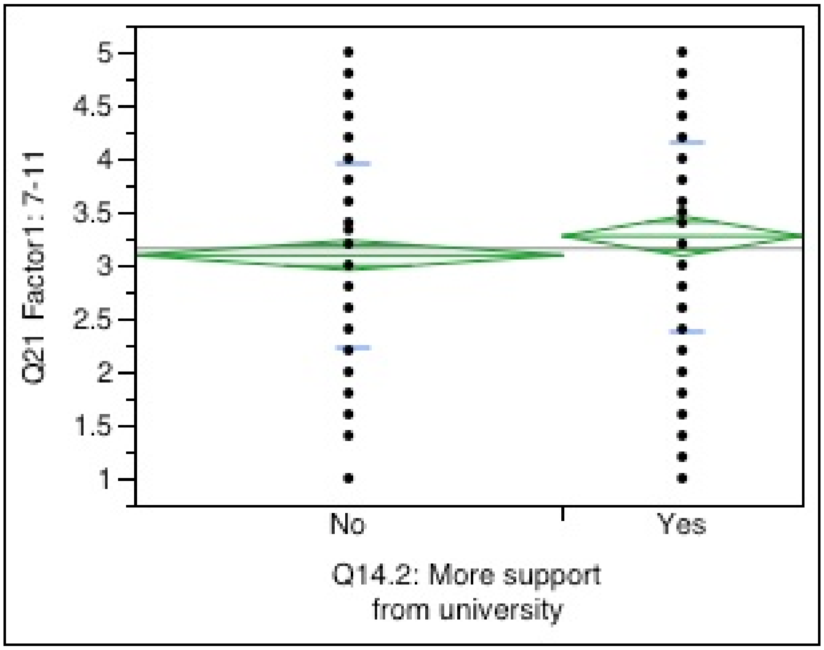
Nonparametric Comparisons For Each Pair Using Wilcoxon Method

q*	Alpha
1.95996	0.05

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value	Hodges-Lehmann	Lower CL	Upper CL
Yes	No	22.80193	9.873822	2.309332	0.0209*	0.2000000	0	0.6000000



G1.2 Oneway Analysis of Q21 Factor1: 7-11 By Q14.2: More support from university



Missing Rows
25

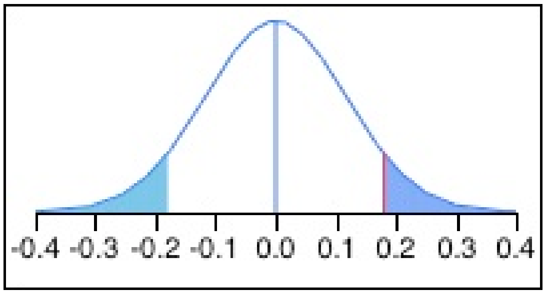
Oneway ANOVA
Summary of Fit

Rsquare	0.009886
Adj Rsquare	0.005726
Root Mean Square Error	0.868949
Mean of Response	3.156389
Observations (or Sum Wgts)	240

t Test
Yes-No

Assuming equal variances

Difference	0.18032	t Ratio	1.54152
Std Err Dif	0.11697	DF	238
Upper CL Dif	0.41076	Prob > |t|	0.1245
Lower CL Dif	-0.05012	Prob > t	0.0623
Confidence	0.95	Prob < t	0.9377



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q14.2: More support from university	1	1.79427	1.79427	2.3763	0.1245
Error	238	179.70705	0.75507		
C. Total	239	181.50131			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	154	3.09177	0.07002	2.9538	3.2297
Yes	86	3.27209	0.09370	3.0875	3.4567

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	154	17827.0	18557.0	115.760	-1.418
Yes	86	11093.0	10363.0	128.988	1.418

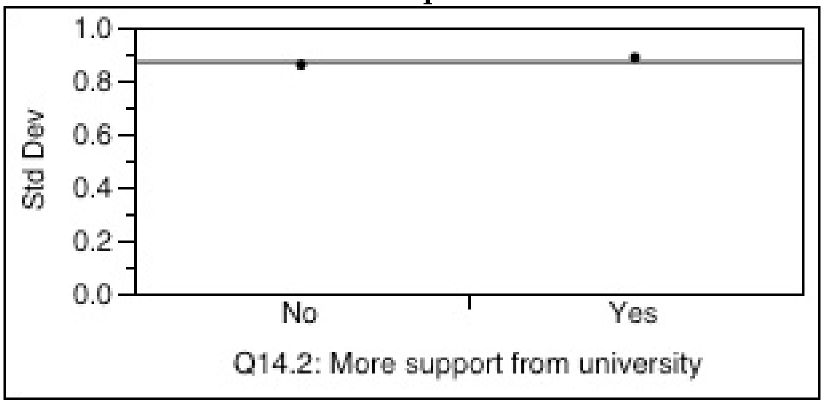
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
11093	1.41847	0.1561

1-way Test, Chi Square (χ^2)Approximation

Chi Square(χ^2)	DF	Prob>ChiSq(χ^2)
2.0148	1	0.1558

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	154	0.8588411	0.7013999	0.6943723
Yes	86	0.8868518	0.6949703	0.6860465

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.1364	1	238	0.7122
Brown-Forsythe	0.0134	1	238	0.9081
Levene	0.0087	1	238	0.9258
Bartlett	0.1127	1	.	0.7371
F Test 2-sided	1.0663	85	153	0.7233

Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
2.3333	1	171.25	0.1285

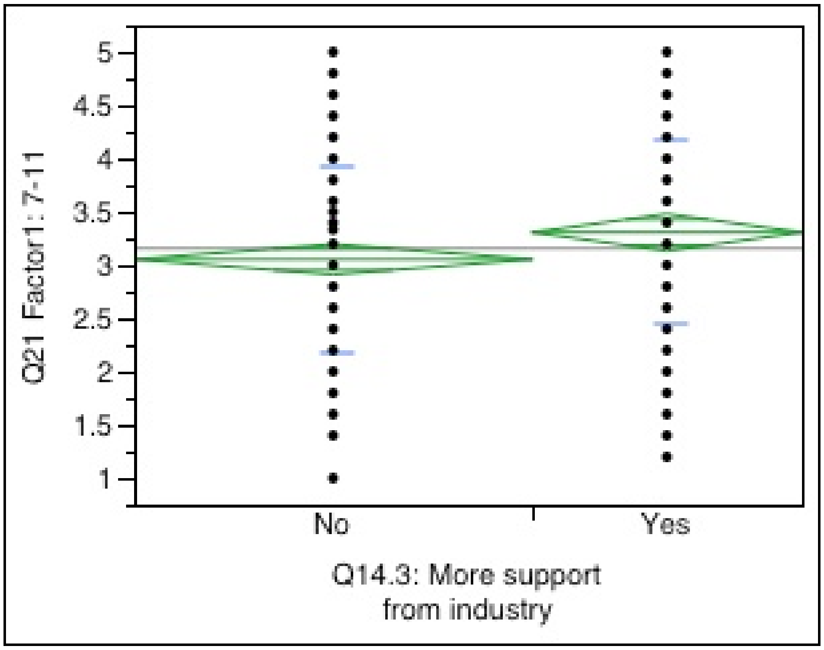
t Test
1.5275

Nonparametric Comparisons For Each Pair Using Wilcoxon Method

q*	Alpha
1.95996	0.05

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value	Hodges-Lehmann	Lower CL	Upper CL
Yes	No	13.21957	9.319623	1.418466	0.1561	0.2000000	0	0.4000000

G1.3 Oneway Analysis of Q21 Factor1: 7-11 By Q14.3: More support from industry



Missing Rows
25

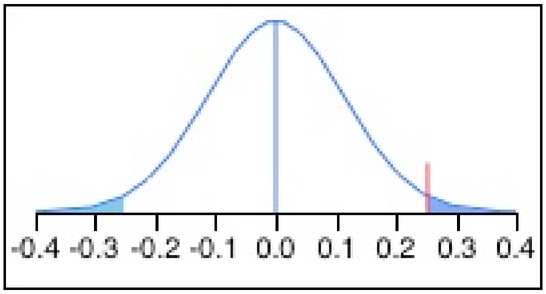
Oneway ANOVA
Summary of Fit

Rsquare	0.020405
Adj Rsquare	0.016289
Root Mean Square Error	0.86432
Mean of Response	3.156389
Observations (or Sum Wgts)	240

t Test
Yes-No

Assuming equal variances

Difference	0.253137	t Ratio	2.226535
Std Err Dif	0.113691	DF	238
Upper CL Dif	0.477107	Prob > |t|	0.0269*
Lower CL Dif	0.029168	Prob > t	0.0135*
Confidence	0.95	Prob < t	0.9865



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q14.3: More support from industry	1	3.70347	3.70347	4.9575	0.0269*
Error	238	177.79785	0.74705		
C. Total	239	181.50131			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	143	3.05408	0.07228	2.9117	3.1965
Yes	97	3.30722	0.08776	3.1343	3.4801

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	143	16095.5	17231.5	112.556	-2.157
Yes	97	12824.5	11688.5	132.211	2.157

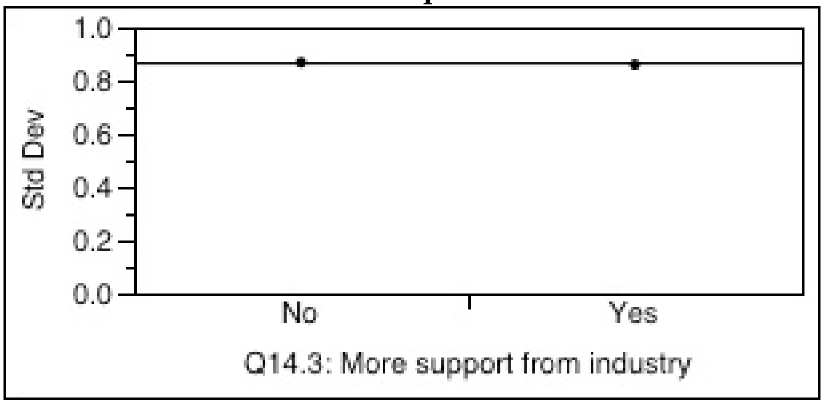
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
12824.5	2.15743	0.0310*

1-way Test, Chi Square (χ^2)Approximation

Chi Square(χ^2)	DF	Prob>ChiSq
4.6586	1	0.0309*

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	143	0.8677026	0.7054493	0.7044289
Yes	97	0.8592932	0.6723775	0.6618557

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.0129	1	238	0.9098
Brown-Forsythe	0.3654	1	238	0.5461
Levene	0.2396	1	238	0.6249
Bartlett	0.0108	1	.	0.9172
F Test 2-sided	1.0197	142	96	0.9268

Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
4.9761	1	207.59	0.0268*

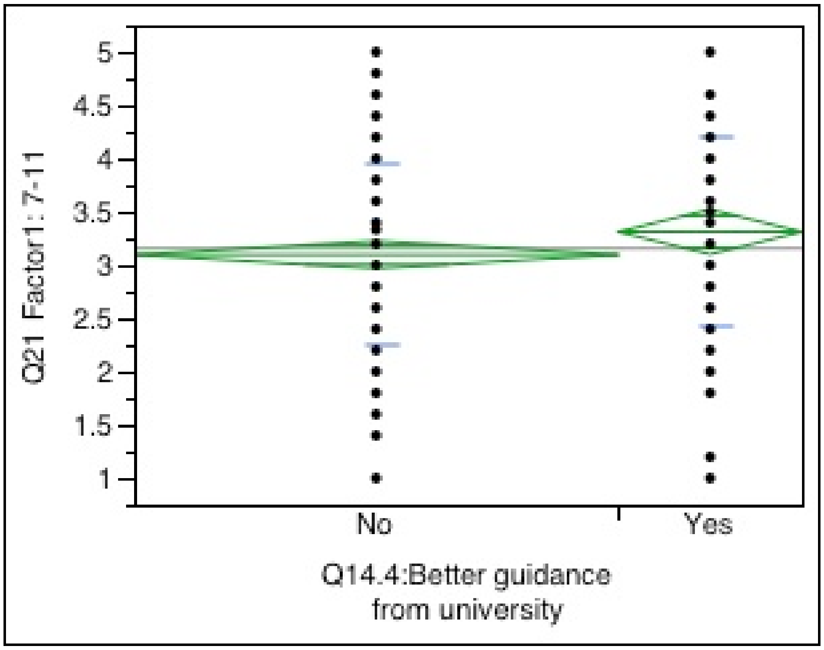
t Test
2.2307

Nonparametric Comparisons For Each Pair Using Wilcoxon Method

q*	Alpha
1.95996	0.05

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value	Hodges-Lehmann	Lower CL	Upper CL
Yes	No	19.64675	9.106553	2.157429	0.0310*	0.2000000	0	0.4000000

G1.4 Oneway Analysis of Q21 Factor1: 7-11 By Q14.4:Better guidance from university



Missing Rows
25

Oneway ANOVA
Summary of Fit

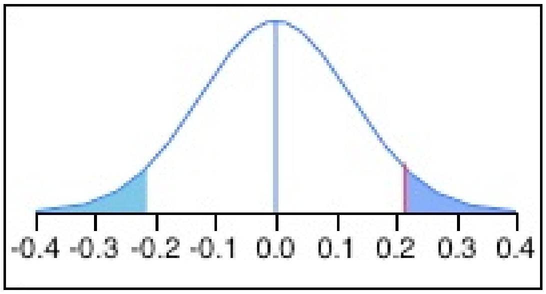
Rsquare	0.012164
Adj Rsquare	0.008014
Root Mean Square Error	0.867948
Mean of Response	3.156389
Observations (or Sum Wgts)	240

t Test
Yes-No

Assuming equal variances

Difference	0.21480	t Ratio	1.711938
Std Err Dif	0.12547	DF	238
Upper CL Dif	0.46198	Prob > |t|	0.0882

Lower CL Dif	-0.03238	Prob > t	0.0441*
Confidence	0.95	Prob < t	0.9559



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q14.4:Better guidance from university	1	2.20782	2.20782	2.9307	0.0882
Error	238	179.29350	0.75333		
C. Total	239	181.50131			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	174	3.09732	0.06580	2.9677	3.2269
Yes	66	3.31212	0.10684	3.1017	3.5226

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	174	20069.0	20967.0	115.339	-1.874
Yes	66	8851.00	7953.00	134.106	1.874

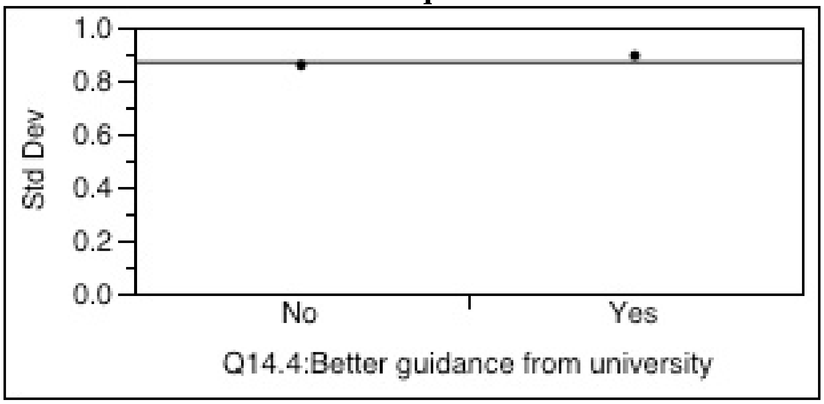
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
8851	1.87409	0.0609

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
3.5161	1	0.0608

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	174	0.8580903	0.6927820	0.6904215
Yes	66	0.8936554	0.6951331	0.6818182

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.1875	1	238	0.6654
Brown-Forsythe	0.0124	1	238	0.9115
Levene	0.0010	1	238	0.9750
Bartlett	0.1569	1	.	0.6921
F Test 2-sided	1.0846	65	173	0.6691

Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

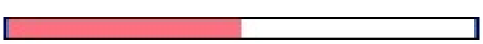
F Ratio	DFNum	DFDen	Prob > F
2.8252	1	113.21	0.0956

t Test
1.6808

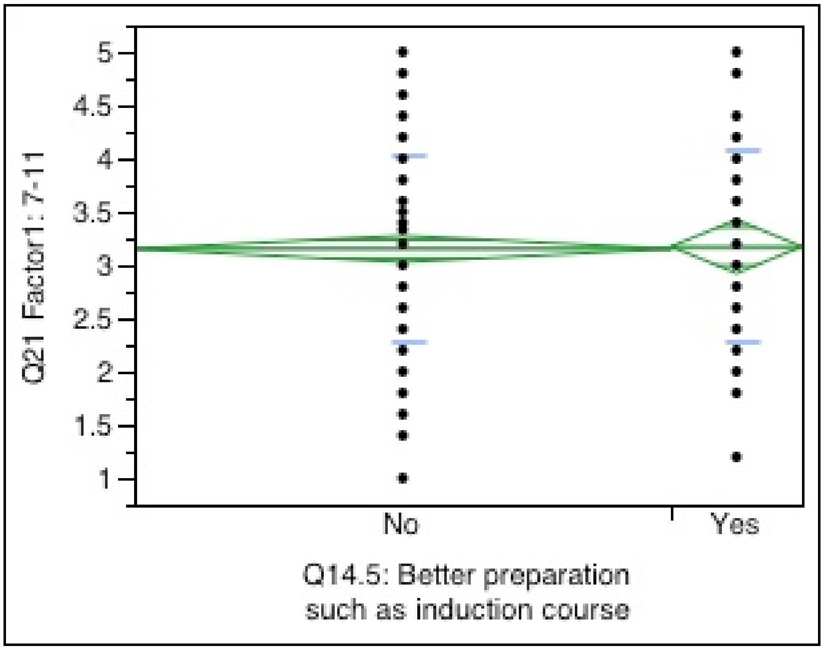
Nonparametric Comparisons For Each Pair Using Wilcoxon Method

q*	Alpha
1.95996	0.05

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value	Hodges-Lehmann	Lower CL	Upper CL
Yes	No	18.75653	10.00832	1.874093	0.0609	0.2000000	0	0.4000000



G1.5 Oneway Analysis of Q21 Factor1: 7-11 By Q14.5: Better preparation such as induction course



Missing Rows
25

Oneway ANOVA
Summary of Fit

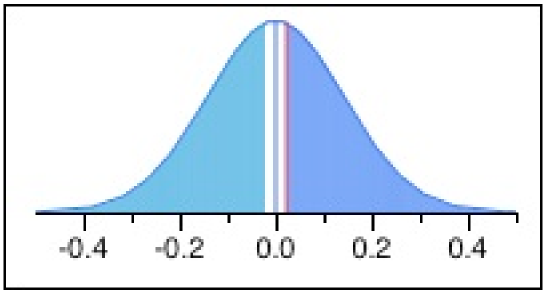
Rsquare	0.000105
Adj Rsquare	-0.0041
Root Mean Square Error	0.87323
Mean of Response	3.156389
Observations (or Sum Wgts)	240

t Test
Yes-No

Assuming equal variances

Difference	0.02248	t Ratio	0.15828
Std Err Dif	0.14204	DF	238
Upper CL Dif	0.30230	Prob > |t|	0.8744

Lower CL Dif	-0.25733	Prob > t	0.4372
Confidence	0.95	Prob < t	0.5628



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q14.5: Better preparation such as induction course	1	0.01910	0.019103	0.0251	0.8744
Error	238	181.48221	0.762530		
C. Total	239	181.50131			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	193	3.15199	0.06286	3.0282	3.2758
Yes	47	3.17447	0.12737	2.9235	3.4254

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	193	23292.0	23256.5	120.684	0.082
Yes	47	5628.00	5663.50	119.745	-0.082

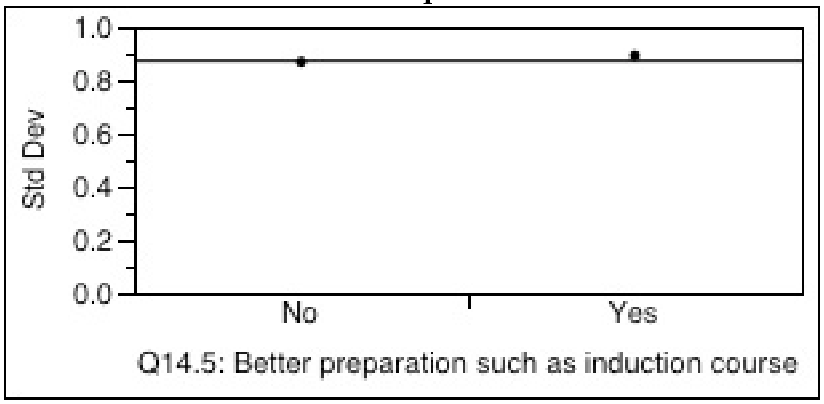
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
5628	-0.08223	0.9345

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
0.0070	1	0.9335

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	193	0.8684063	0.6991794	0.6936097
Yes	47	0.8930816	0.7090991	0.7063830

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.0729	1	238	0.7874
Brown-Forsythe	0.0205	1	238	0.8862
Levene	0.0139	1	238	0.9061
Bartlett	0.0585	1	.	0.8089
F Test 2-sided	1.0576	46	192	0.7721

Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
0.0242	1	68.749	0.8768

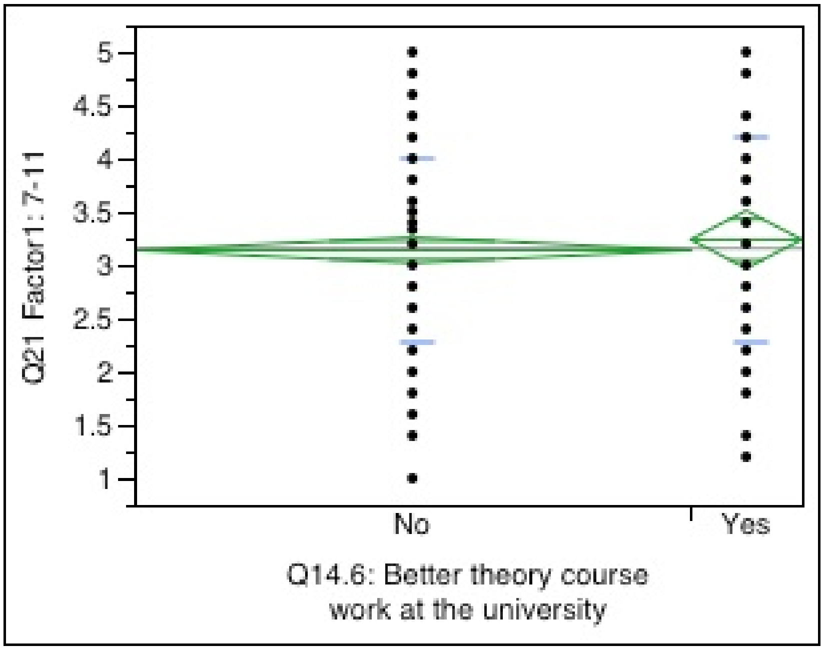
t Test
0.1556

Nonparametric Comparisons For Each Pair Using Wilcoxon Method

q*	Alpha
1.95996	0.05

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value	Hodges-Lehmann	Lower CL	Upper CL
Yes	No	-0.926028	11.26109	-0.082233	0.9345	0	-0.200000	0.2000000

G1.6 Oneway Analysis of Q21 Factor1: 7-11 By Q14.6: Better theory course work at the university



Missing Rows
25

Oneway ANOVA
Summary of Fit

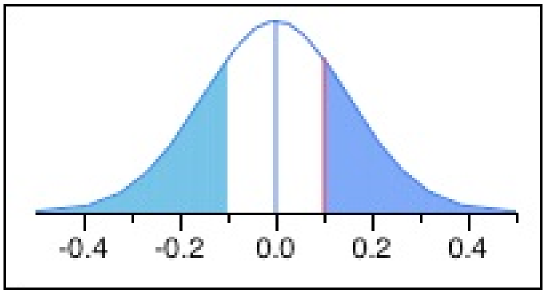
Rsquare	0.001849
Adj Rsquare	-0.00235
Root Mean Square Error	0.872468
Mean of Response	3.156389
Observations (or Sum Wgts)	240

t Test
Yes-No

Assuming equal variances

Difference	0.10033	t Ratio	0.663949
Std Err Dif	0.15112	DF	238
Upper CL Dif	0.39803	Prob > |t|	0.5074
Lower CL Dif	-0.19736	Prob > t	0.2537

Confidence	0.95 Prob < t	0.7463



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q14.6: Better theory course work at the university	1	0.33556	0.335559	0.4408	0.5074
Error	238	181.16576	0.761201		
C. Total	239	181.50131			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	200	3.13967	0.06169	3.0181	3.2612
Yes	40	3.24000	0.13795	2.9682	3.5118

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	200	23772.5	24100.0	118.863	-0.818
Yes	40	5147.50	4820.00	128.688	0.818

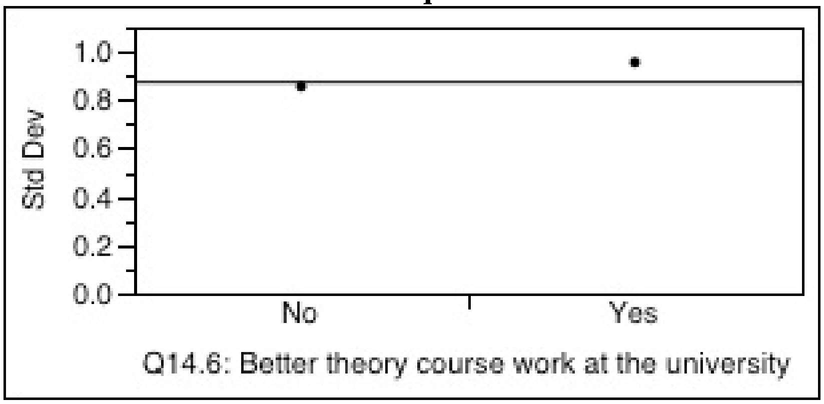
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
5147.5	0.81810	0.4133

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
0.6713	1	0.4126

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	200	0.8554577	0.6864933	0.6816667
Yes	40	0.9545572	0.7700000	0.7700000

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	1.0919	1	238	0.2971
Brown-Forsythe	0.9467	1	238	0.3316
Levene	0.8754	1	238	0.3504
Bartlett	0.8154	1	.	0.3665
F Test 2-sided	1.2451	39	199	0.3371

Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
0.3808	1	52.271	0.5399

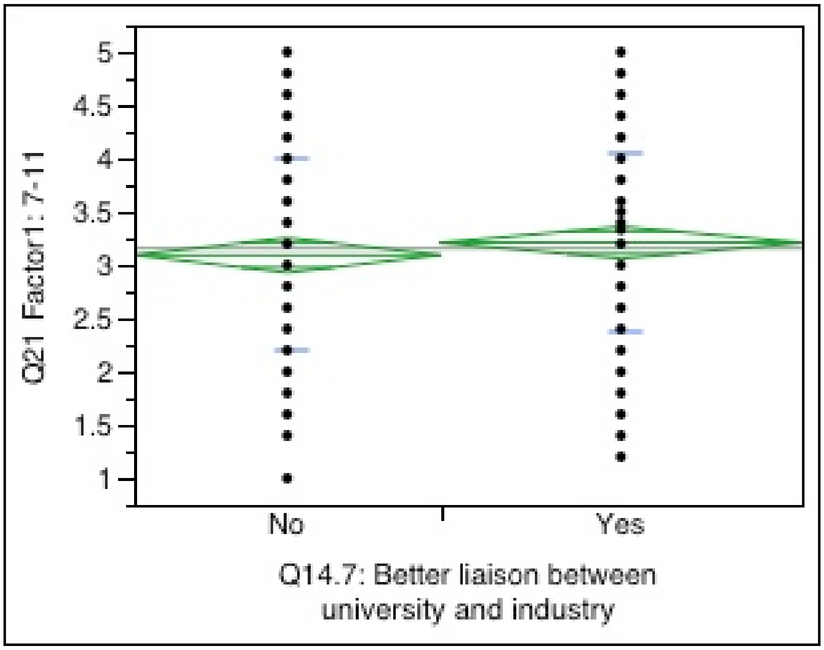
t Test
0.6171

Nonparametric Comparisons For Each Pair Using Wilcoxon Method

q*	Alpha
1.95996	0.05

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value	Hodges-Lehmann	Lower CL	Upper CL
Yes	No	9.810000	11.99121	0.8180994	0.4133	0.2000000	-0.200000	0.4000000

G1.7 Oneway Analysis of Q21 Factor1: 7-11 By Q14.7: Better liaison between university and industry



Missing Rows
25

Oneway ANOVA
Summary of Fit

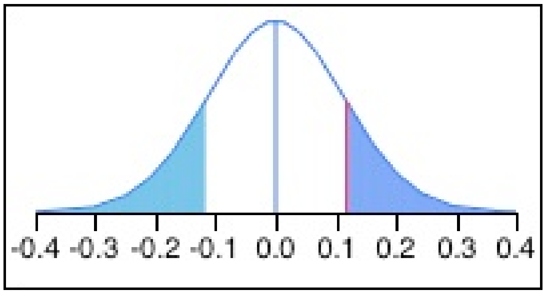
Rsquare	0.004535
Adj Rsquare	0.000352
Root Mean Square Error	0.871294
Mean of Response	3.156389
Observations (or Sum Wgts)	240

t Test
Yes-No

Assuming equal variances

Difference	0.11753	t Ratio	1.041222
Std Err Dif	0.11288	DF	238
Upper CL Dif	0.33989	Prob > |t|	0.2988
Lower CL Dif	-0.10483	Prob > t	0.1494

Confidence	0.95 Prob < t	0.8506



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q14.7: Better liaison between university and industry	1	0.82303	0.823030	1.0841	0.2988
Error	238	180.67828	0.759152		
C. Total	239	181.50131			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	110	3.09273	0.08307	2.9291	3.2564
Yes	130	3.21026	0.07642	3.0597	3.3608

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	110	12699.5	13255.0	115.450	-1.039
Yes	130	16220.5	15665.0	124.773	1.039

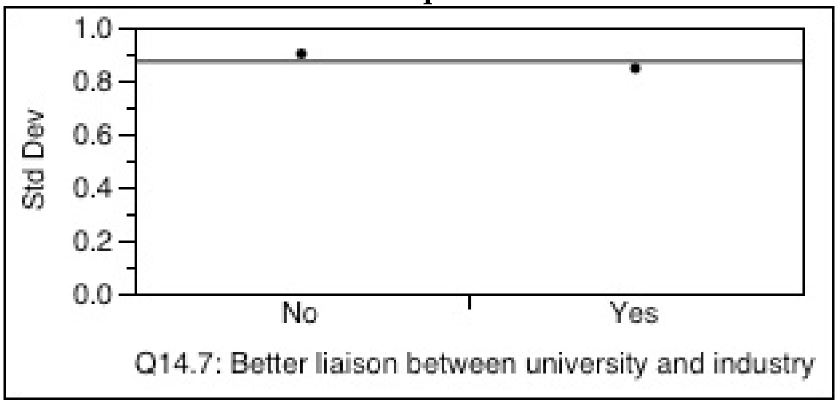
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
12699.5	-1.03855	0.2990

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
1.0805	1	0.2986

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	110	0.9004290	0.7240331	0.7181818
Yes	130	0.8458934	0.6777909	0.6758974

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.5538	1	238	0.4575
Brown-Forsythe	0.3675	1	238	0.5450
Levene	0.4791	1	238	0.4895
Bartlett	0.4606	1	.	0.4973
F Test 2-sided	1.1331	109	129	0.4941

Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
1.0729	1	226.06	0.3014

t Test
1.0358

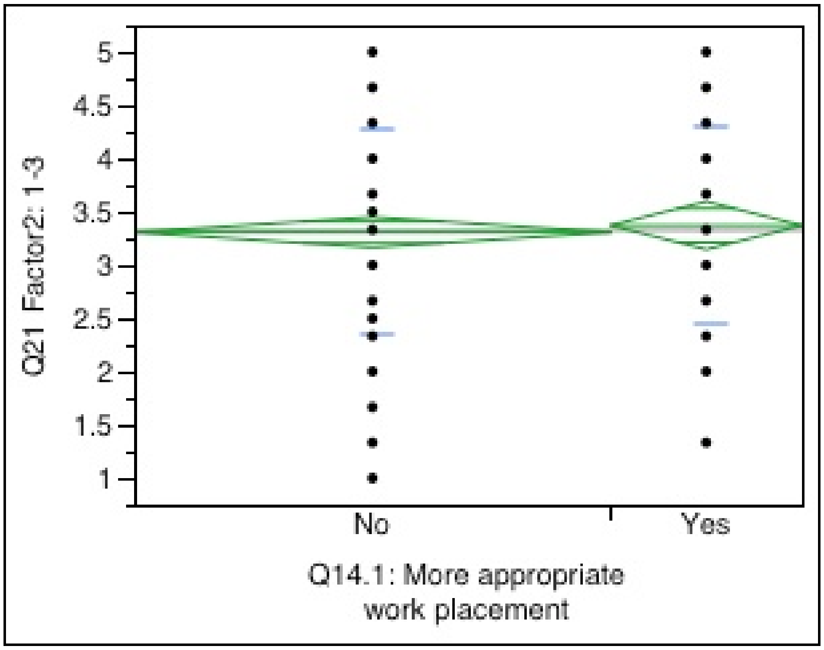
Nonparametric Comparisons For Each Pair Using Wilcoxon Method

q*	Alpha
1.95996	0.05

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value	Hodges-Lehmann	Lower CL	Upper CL
Yes	No	9.314685	8.968915	1.038552	0.2990	0.2000000	-0.100000	0.4000000

G2: ANOVA TEST FOR FACTOR 2 OF QUETSION 21 BY QUSTION 14

<u>G2.1 Oneway Analysis of Q21 Factor2: 1-3 By Q14.1: More appropriate work placement</u>



Missing Rows
24

Oneway ANOVA
Summary of Fit

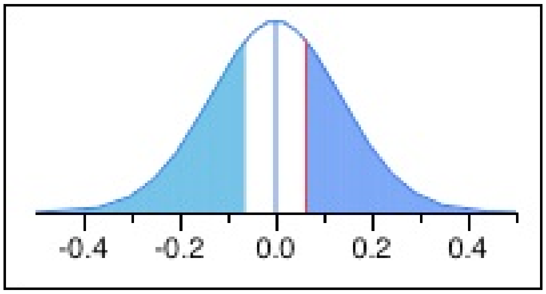
Rsquare	0.000932
Adj Rsquare	-0.00325
Root Mean Square Error	0.948607
Mean of Response	3.326418
Observations (or Sum Wgts)	241

t Test
Yes-No

Assuming equal variances

Difference	0.06384	t Ratio	0.472274
Std Err Dif	0.13518	DF	239

Upper CL Dif	0.33013	Prob > |t|	0.6372
Lower CL Dif	-0.20245	Prob > t	0.3186
Confidence	0.95	Prob < t	0.6814



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q14.1: More appropriate work placement	1	0.20071	0.200707	0.2230	0.6372
Error	239	215.06555	0.899856		
C. Total	240	215.26625			

Means for One-way ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	172	3.30814	0.07233	3.1657	3.4506
Yes	69	3.37198	0.11420	3.1470	3.5969

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	172	20601.5	20812.0	119.776	-0.432
Yes	69	8559.50	8349.00	124.051	0.432

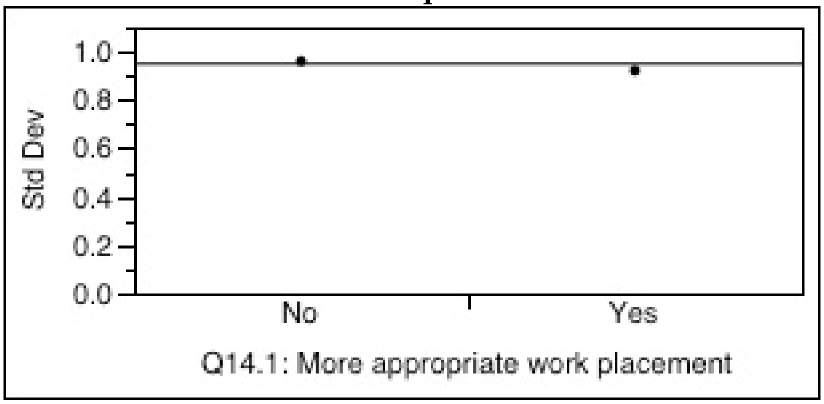
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
8559.5	0.43162	0.6660

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
0.1872	1	0.6653

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	172	0.9593822	0.7640842	0.7596899
Yes	69	0.9209547	0.7371000	0.7342995

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.1896	1	239	0.6636
Brown-Forsythe	0.0963	1	239	0.7566
Levene	0.1111	1	239	0.7392
Bartlett	0.1598	1	.	0.6893
F Test 2-sided	1.0852	171	68	0.7108

Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
0.2310	1	130.28	0.6316

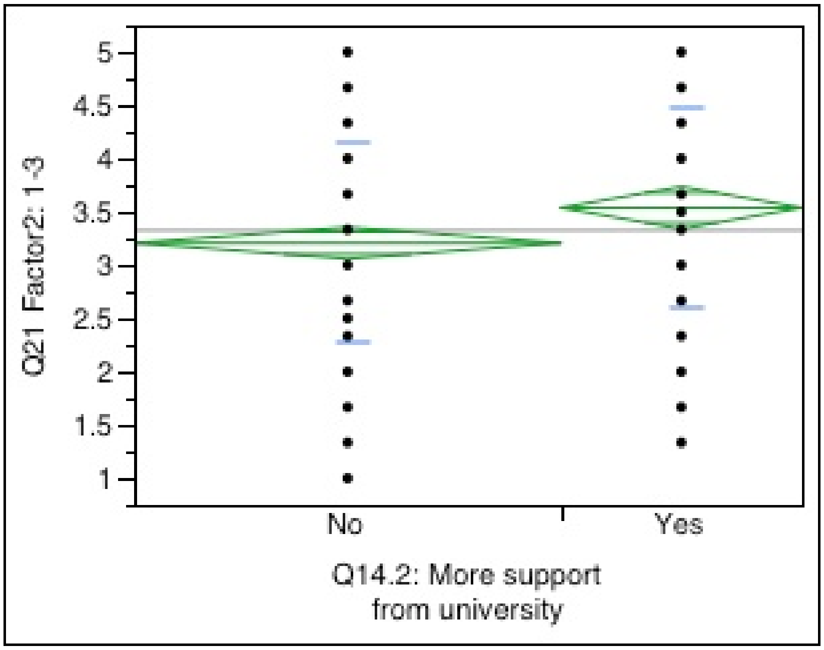
t Test
0.4806

Nonparametric Comparisons For Each Pair Using Wilcoxon Method

q*	Alpha
1.95996	0.05

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value	Hodges-Lehmann	Lower CL	Upper CL
Yes	No	4.264408	9.880010	0.4316199	0.6660	0	-0.333333	0.3333333

G2.2 Oneway Analysis of Q21 Factor2: 1-3 By Q14.2: More support from university



Missing Rows
24

Oneway ANOVA
Summary of Fit

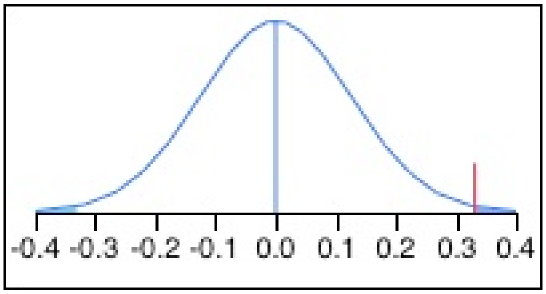
Rsquare	0.028398
Adj Rsquare	0.024333
Root Mean Square Error	0.935477
Mean of Response	3.326418
Observations (or Sum Wgts)	241

t Test
Yes-No

Assuming equal variances

Difference	0.331604	t Ratio	2.643007
Std Err Dif	0.125465	DF	239
Upper CL Dif	0.578762	Prob > |t|	0.0088*
Lower CL Dif	0.084446	Prob > t	0.0044*

Confidence	0.95	Prob < t	0.9956



Analysis of Variance

Source	**DF**	**Sum of Squares**	**Mean Square**	**F Ratio**	**Prob > F**
Q14.2: More support from university	1	6.11312	6.11312	6.9855	0.0088*
Error	239	209.15313	0.87512		
C. Total	240	215.26625			

Means for Oneway ANOVA

Level	**Number**	**Mean**	**Std Error**	**Lower 95%**	**Upper 95%**
No	154	3.20671	0.07538	3.0582	3.3552
Yes	87	3.53831	0.10029	3.3407	3.7359

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	**Count**	**Score Sum**	**Expected Score**	**Score Mean**	**(Mean-Mean0)/Std0**
No	154	17206.5	18634.0	111.731	-2.760
Yes	87	11954.5	10527.0	137.408	2.760

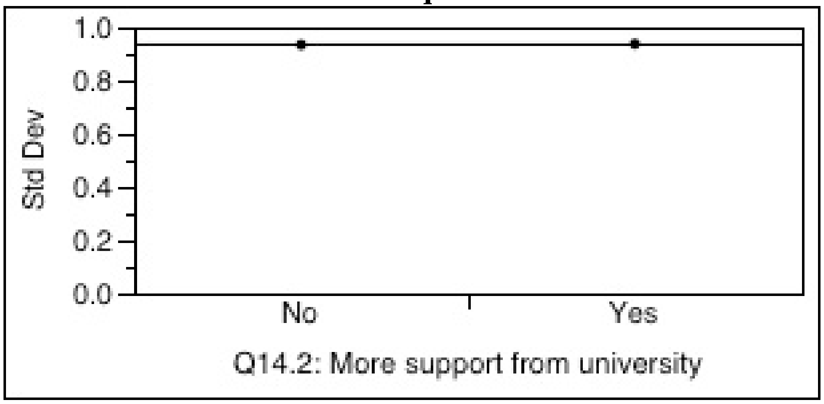
2-Sample Test, Normal Approximation

S	**Z**	**Prob>|Z|**
11954.5	2.76042	0.0058*

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	**DF**	**Prob>ChiSq**
7.6252	1	0.0058*

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	154	0.9343084	0.7506044	0.7456710
Yes	87	0.9375532	0.7346193	0.7183908

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.0015	1	239	0.9687
Brown-Forsythe	0.1198	1	239	0.7295
Levene	0.0450	1	239	0.8322
Bartlett	0.0013	1	.	0.9710
F Test 2-sided	1.0070	86	153	0.9568

Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
6.9720	1	178.06	0.0090*

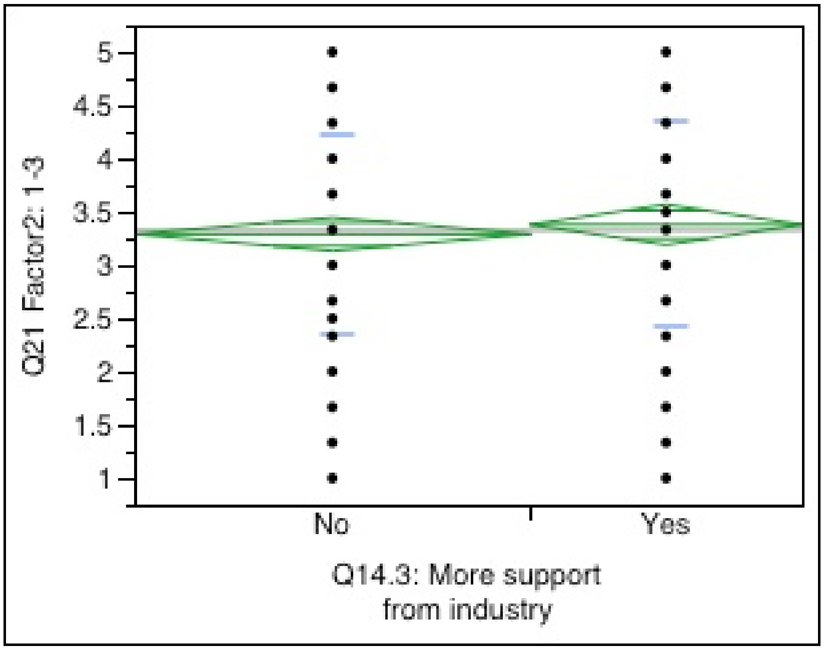
t Test
2.6404

Nonparametric Comparisons For Each Pair Using Wilcoxon Method

q*	Alpha
1.95996	0.05

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value	Hodges-Lehmann	Lower CL	Upper CL
Yes	No	25.66853	9.298784	2.760418	0.0058*	0.3333333	0	0.6666667

G2.3 Oneway Analysis of Q21 Factor2: 1-3 By Q14.3: More support from industry



Missing Rows
24

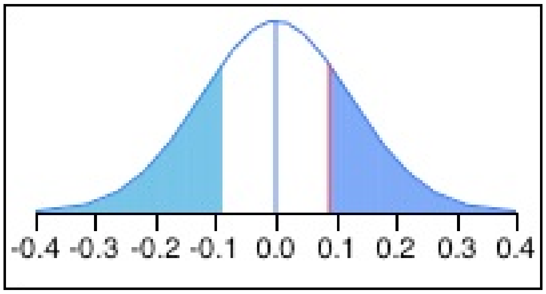
Oneway ANOVA
Summary of Fit

Rsquare	0.002142
Adj Rsquare	-0.00203
Root Mean Square Error	0.948033
Mean of Response	3.326418
Observations (or Sum Wgts)	241

t Test
Yes-No

Assuming equal variances

Difference	0.08904	t Ratio	0.716215
Std Err Dif	0.12432	DF	239
Upper CL Dif	0.33395	Prob > |t|	0.4746
Lower CL Dif	-0.15587	Prob > t	0.2373
Confidence	0.95	Prob < t	0.7627



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q14.3: More support from industry	1	0.46104	0.461035	0.5130	0.4746
Error	239	214.80522	0.898767		
C. Total	240	215.26625			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	143	3.29021	0.07928	3.1340	3.4464
Yes	98	3.37925	0.09577	3.1906	3.5679

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	143	16976.0	17303.0	118.713	-0.618
Yes	98	12185.0	11858.0	124.337	0.618

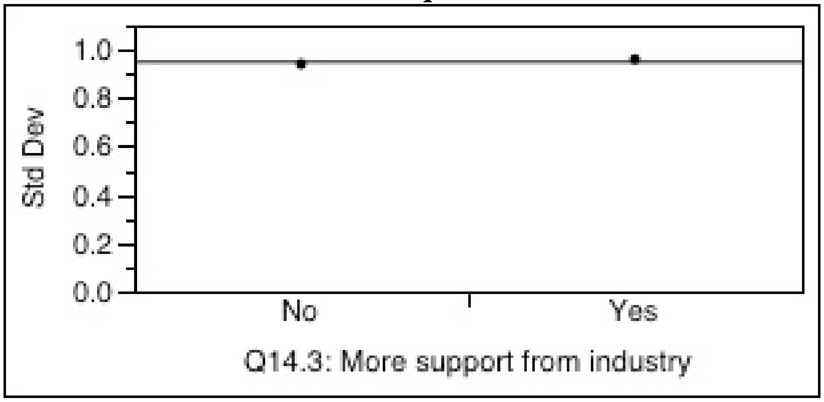
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
12185	0.61755	0.5369

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
0.3825	1	0.5362

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	143	0.9402563	0.7365804	0.7284382
Yes	98	0.9593038	0.7883521	0.7874150

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.0567	1	239	0.8120
Brown-Forsythe	0.6147	1	239	0.4338
Levene	0.4881	1	239	0.4854
Bartlett	0.0463	1	.	0.8297
F Test 2-sided	1.0409	97	142	0.8206

Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
0.5091	1	205.83	0.4763

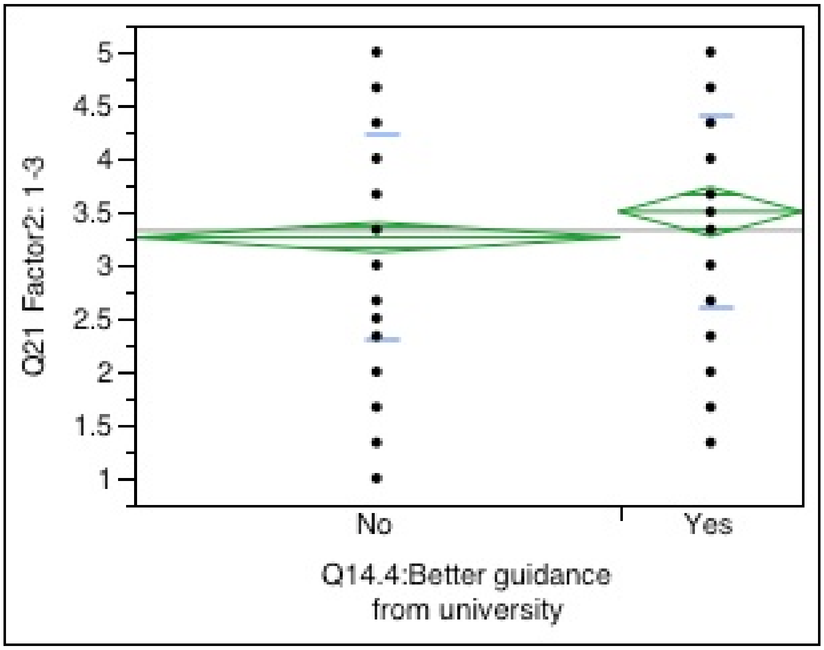
t Test
0.7135

Nonparametric Comparisons For Each Pair Using Wilcoxon Method

q*	Alpha
1.95996	0.05

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value	Hodges-Lehmann	Lower CL	Upper CL
Yes	No	5.614849	9.092119	0.6175513	0.5369	0	-0.333333	0.3333333

G2.4 Oneway Analysis of Q21 Factor2: 1-3 By Q14.4:Better guidance from university



Missing Rows
24

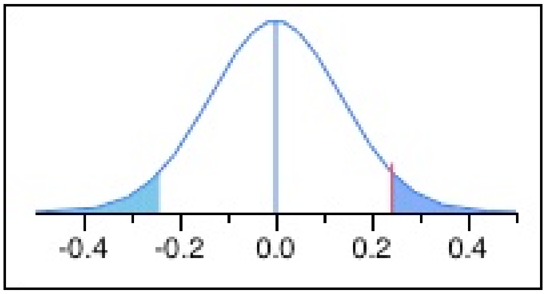
Oneway ANOVA
Summary of Fit

Rsquare	0.013095
Adj Rsquare	0.008966
Root Mean Square Error	0.942816
Mean of Response	3.326418
Observations (or Sum Wgts)	241

t Test
Yes-No

Assuming equal variances

Difference	0.24253	t Ratio	1.78079
Std Err Dif	0.13619	DF	239
Upper CL Dif	0.51081	Prob > |t|	0.0762
Lower CL Dif	-0.02576	Prob > t	0.0381*
Confidence	0.95	Prob < t	0.9619



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q14.4:Better guidance from university	1	2.81889	2.81889	3.1712	0.0762
Error	239	212.44736	0.88890		
C. Total	240	215.26625			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	175	3.26000	0.07127	3.1196	3.4004
Yes	66	3.50253	0.11605	3.2739	3.7311

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	175	20323.0	21175.0	116.131	-1.774
Yes	66	8838.00	7986.00	133.909	1.774

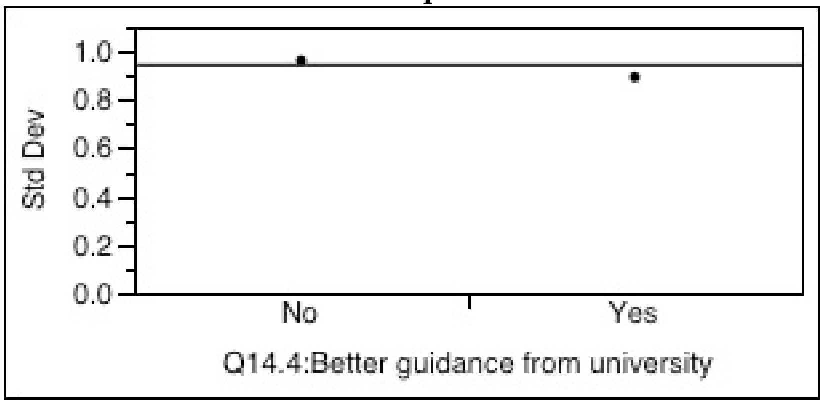
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
8838	1.77404	0.0761

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
3.1509	1	0.0759

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	175	0.9608492	0.7716571	0.7628571
Yes	66	0.8927497	0.7145699	0.7095960

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.5784	1	239	0.4477
Brown-Forsythe	0.4057	1	239	0.5248
Levene	0.5008	1	239	0.4799
Bartlett	0.4971	1	.	0.4808
F Test 2-sided	1.1584	174	65	0.5003

Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
3.3898	1	125.27	0.0680

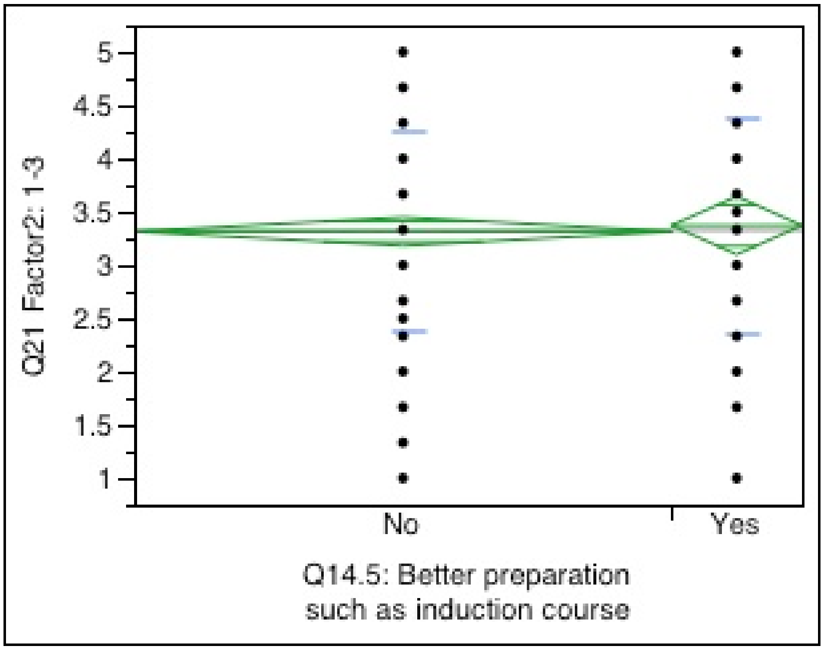
t Test
1.8412

Nonparametric Comparisons For Each Pair Using Wilcoxon Method

q*	Alpha
1.95996	0.05

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value	Hodges-Lehmann	Lower CL	Upper CL
Yes	No	17.76723	10.01510	1.774045	0.0761	0.3333333	0	0.6666667

G2.5 Oneway Analysis of Q21 Factor2: 1-3 By Q14.5: Better preparation such as induction course



Missing Rows
24

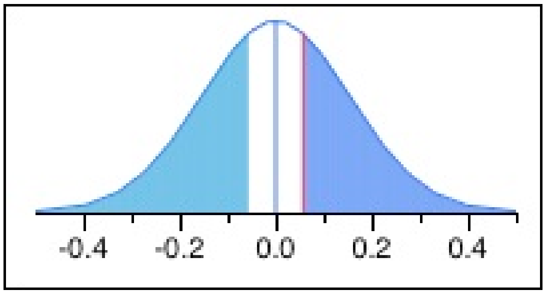
Oneway ANOVA
Summary of Fit

Rsquare	0.000572
Adj Rsquare	-0.00361
Root Mean Square Error	0.948778
Mean of Response	3.326418
Observations (or Sum Wgts)	241

t Test
Yes-No

Assuming equal variances

Difference	0.05705	t Ratio	0.369845
Std Err Dif	0.15425	DF	239
Upper CL Dif	0.36091	Prob > |t|	0.7118
Lower CL Dif	-0.24681	Prob > t	0.3559
Confidence	0.95	Prob < t	0.6441



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q14.5: Better preparation such as induction course	1	0.12313	0.123131	0.1368	0.7118
Error	239	215.14312	0.900180		
C. Total	240	215.26625			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	194	3.31529	0.06812	3.1811	3.4495
Yes	47	3.37234	0.13839	3.0997	3.6450

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	194	23387.5	23474.0	120.554	-0.202
Yes	47	5773.50	5687.00	122.840	0.202

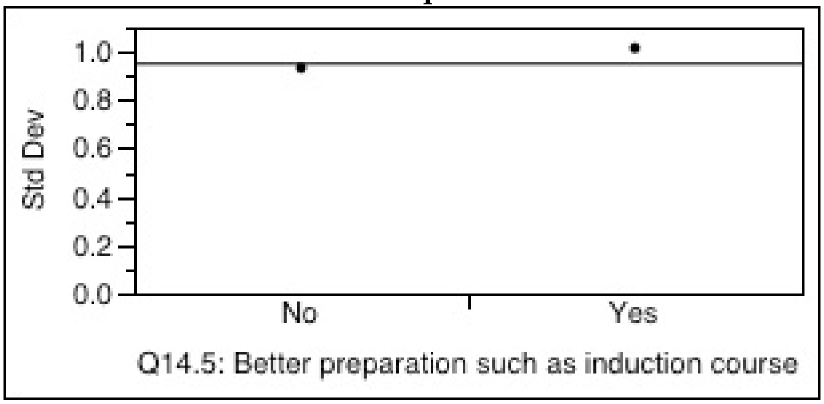
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
5773.5	0.20166	0.8402

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
0.0411	1	0.8393

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	194	0.932272	0.7363517	0.7328179
Yes	47	1.015111	0.8358231	0.8333333

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.7291	1	239	0.3940
Brown-Forsythe	1.1644	1	239	0.2816
Levene	1.1601	1	239	0.2825
Bartlett	0.5531	1	.	0.4571
F Test 2-sided	1.1856	46	193	0.4283

Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
0.1233	1	66.063	0.7266

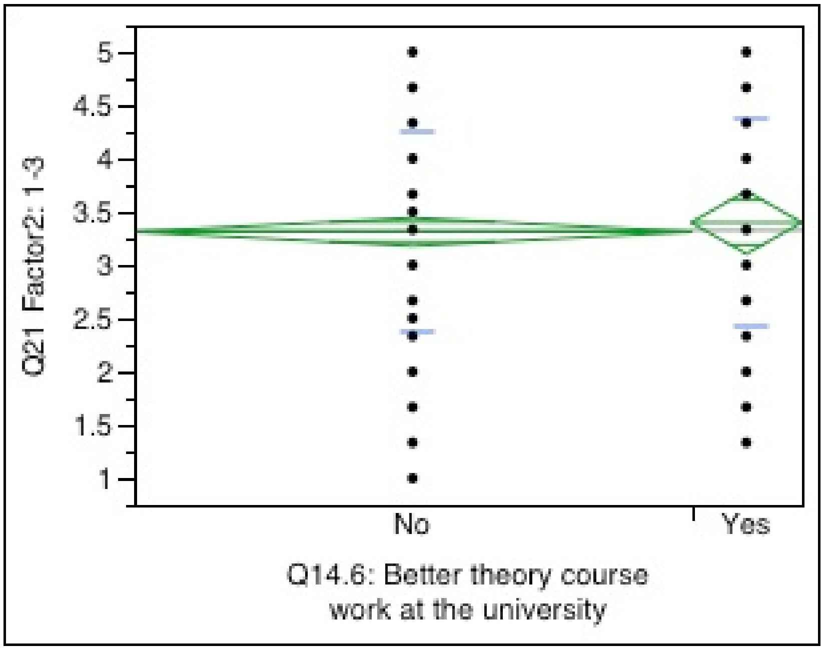
t Test
0.3511

Nonparametric Comparisons For Each Pair Using Wilcoxon Method

q*	Alpha
1.95996	0.05

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value	Hodges-Lehmann	Lower CL	Upper CL
Yes	No	2.273086	11.27188	0.2016599	0.8402	0	-0.333333	0.3333333

G2.6 Oneway Analysis of Q21 Factor2: 1-3 By Q14.6: Better theory course work at the university



Missing Rows
24

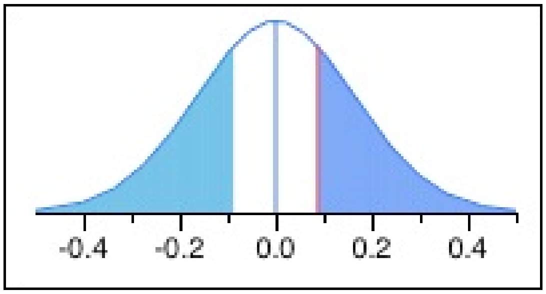
Oneway ANOVA
Summary of Fit

Rsquare	0.001206
Adj Rsquare	-0.00297
Root Mean Square Error	0.948477
Mean of Response	3.326418
Observations (or Sum Wgts)	241

t Test
Yes-No

Assuming equal variances

Difference	0.08823	t Ratio	0.537263
Std Err Dif	0.16421	DF	239
Upper CL Dif	0.41172	Prob > |t|	0.5916
Lower CL Dif	-0.23526	Prob > t	0.2958
Confidence	0.95	Prob < t	0.7042



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q14.6: Better theory course work at the university	1	0.25967	0.259674	0.2887	0.5916
Error	239	215.00658	0.899609		
C. Total	240	215.26625			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	201	3.31177	0.06690	3.1800	3.4436
Yes	40	3.40000	0.14997	3.1046	3.6954

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	201	24099.0	24321.0	119.896	-0.553
Yes	40	5062.00	4840.00	126.550	0.553

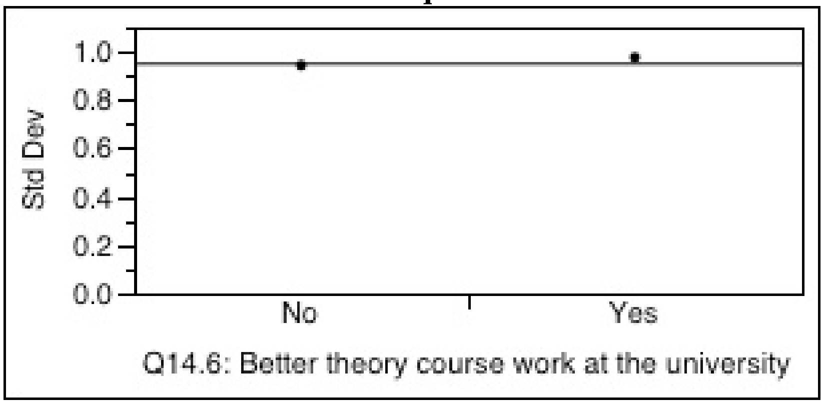
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
5062	0.55312	0.5802

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
0.3073	1	0.5793

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	201	0.9430032	0.7500227	0.7462687
Yes	40	0.9760669	0.7833333	0.7833333

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.0989	1	239	0.7534
Brown-Forsythe	0.1386	1	239	0.7100
Levene	0.1143	1	239	0.7356
Bartlett	0.0780	1	.	0.7800
F Test 2-sided	1.0714	39	200	0.7373

Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
0.2756	1	54.468	0.6017

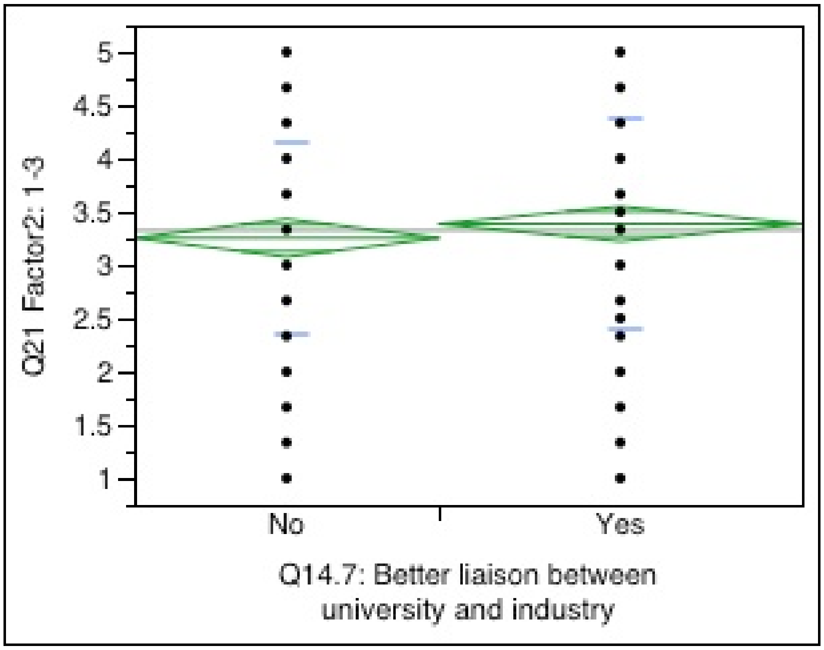
t Test
0.5250

Nonparametric Comparisons For Each Pair Using Wilcoxon Method

q*	Alpha
1.95996	0.05

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value	Hodges-Lehmann	Lower CL	Upper CL
Yes	No	6.639490	12.00378	0.5531165	0.5802	0	-0.333333	0.3333333

G2.7 Oneway Analysis of Q21 Factor2: 1-3 By Q14.7: Better liaison between university and industry



Missing Rows
24

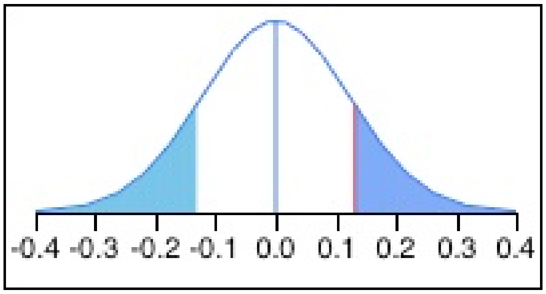
Oneway ANOVA
Summary of Fit

Rsquare	0.004856
Adj Rsquare	0.000692
Root Mean Square Error	0.946743
Mean of Response	3.326418
Observations (or Sum Wgts)	241

t Test
Yes-No

Assuming equal variances

Difference	0.13222	t Ratio	1.079937
Std Err Dif	0.12244	DF	239
Upper CL Dif	0.37341	Prob > |t|	0.2813
Lower CL Dif	-0.10897	Prob > t	0.1406
Confidence	0.95	Prob < t	0.8594



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q14.7: Better liaison between university and industry	1	1.04535	1.04535	1.1663	0.2813
Error	239	214.22090	0.89632		
C. Total	240	215.26625			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	110	3.25455	0.09027	3.0767	3.4324
Yes	131	3.38677	0.08272	3.2238	3.5497

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	110	12631.0	13310.0	114.827	-1.266
Yes	131	16530.0	15851.0	126.183	1.266

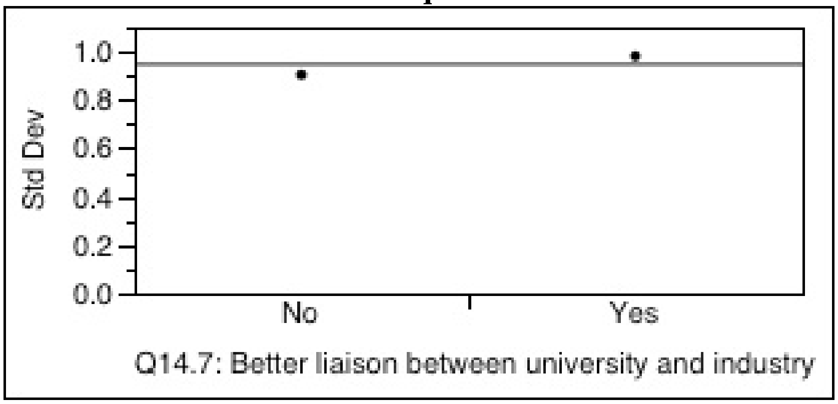
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
12631	-1.26558	0.2057

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
1.6040	1	0.2053

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	110	0.9040934	0.7419284	0.7333333
Yes	131	0.9810746	0.7713031	0.7684478

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.9110	1	239	0.3408
Brown-Forsythe	0.2237	1	239	0.6367
Levene	0.1628	1	239	0.6869
Bartlett	0.7838	1	.	0.3760
F Test 2-sided	1.1775	130	109	0.3789

Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
1.1830	1	236.91	0.2778

t Test
1.0877

Nonparametric Comparisons For Each Pair Using Wilcoxon Method

q*	Alpha
1.95996	0.05

Level	- Level	Score Mean Difference	Std Err Dif	Z	p-Value	Hodges-Lehmann	Lower CL	Upper CL
Yes	No	11.34757	8.966318	1.265578	0.2057	0	0	0.3333333

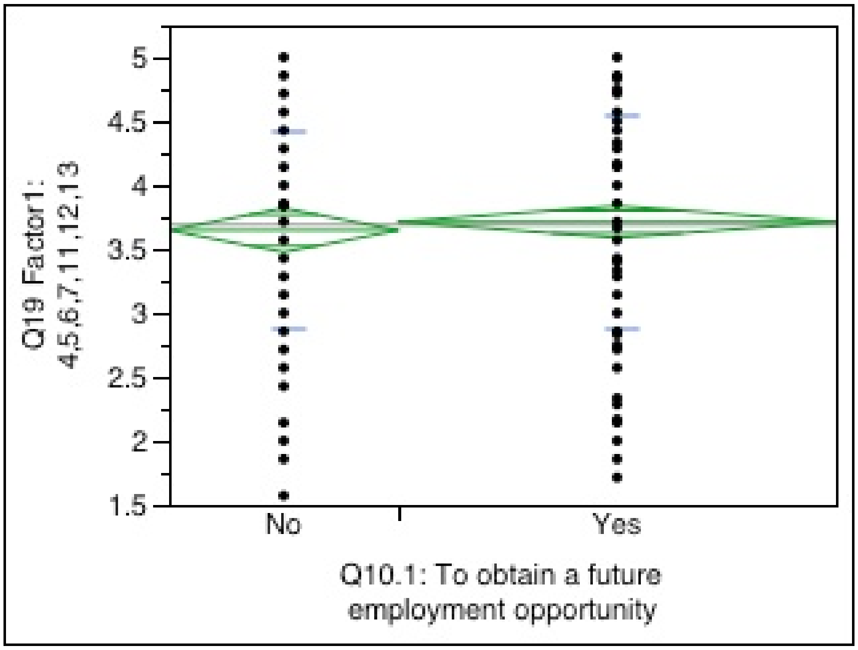
APPENDIX H

ANOVA TEST FOR FACTOR 1 & 2 OF QUESTION 19

BY QUESTION 10

H1: ANOVA TEST FOR FACTOR 1 & 2 OF QUESTION 19 BY QUESTION 10.1

H1.1 Oneway Analysis of Q19 Factor1: 4,5,6,7,11,12,13 By Q10.1: To obtain a future employment opportunity



Missing Rows
15

Oneway ANOVA
Summary of Fit

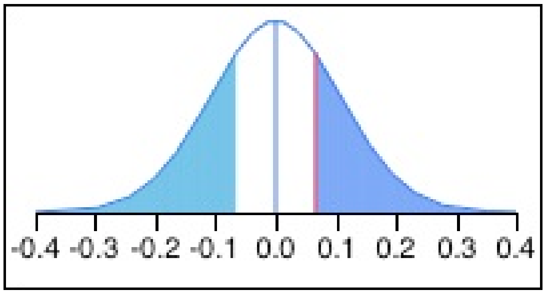
Rsquare	0.001506
Adj Rsquare	-0.00252
Root Mean Square Error	0.812744
Mean of Response	3.690981
Observations (or Sum Wgts)	250

t Test
Yes-No

Assuming equal variances

Difference	0.06618	t Ratio	0.611654

Std Err Dif	0.10821	DF	248
Upper CL Dif	0.27931	Prob > |t|	0.5413
Lower CL Dif	-0.14694	Prob > t	0.2707
Confidence	0.95	Prob < t	0.7293



Analysis of Variance

Source	**DF**	**Sum of Squares**	**Mean Square**	**F Ratio**	**Prob > F**
Q10.1: To obtain a future employment opportunity	1	0.24713	0.247127	0.3741	0.5413
Error	248	163.81720	0.660553		
C. Total	249	164.06433			

Means for Oneway ANOVA

Level	**Number**	**Mean**	**Std Error**	**Lower 95%**	**Upper 95%**
No	86	3.64756	0.08764	3.4749	3.8202
Yes	164	3.71375	0.06346	3.5888	3.8387

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	**Count**	**Score Sum**	**Expected Score**	**Score Mean**	**(Mean-Mean0)/Std0**
No	86	10333.5	10793.0	120.157	-0.846
Yes	164	21041.5	20582.0	128.302	0.846

2-Sample Test, Normal Approximation

S	**Z**	**Prob>|Z|**
10333.5	-0.84624	0.3974

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	**DF**	**Prob>ChiSq**
0.7177	1	0.3969

Tests that the Variances are Equal

Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	86	0.7708579	0.6207667	0.6176633
Yes	164	0.8337525	0.6715058	0.6609611

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.7951	1	248	0.3734
Brown-Forsythe	0.4156	1	248	0.5198
Levene	0.6350	1	248	0.4263
Bartlett	0.6725	1	.	0.4122
F Test 2-sided	1.1698	163	85	0.4235

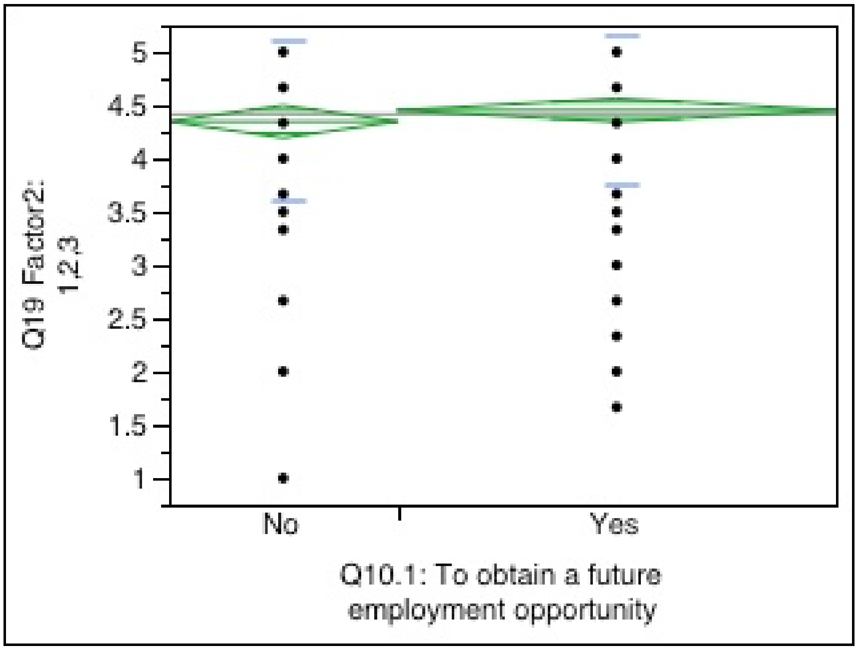
Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
0.3929	1	184.97	0.5315

t Test
0.6268

H1.2 Oneway Analysis of Q19 Factor2: 1,2,3 By Q10.1: To obtain a future employment opportunity



Missing Rows
14

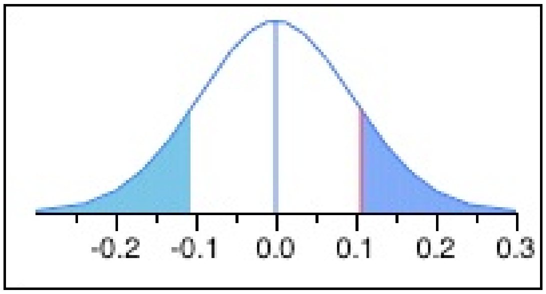
Oneway ANOVA
Summary of Fit

Rsquare	0.005002
Adj Rsquare	0.001006
Root Mean Square Error	0.716635
Mean of Response	4.416999
Observations (or Sum Wgts)	251

t Test
Yes-No

Assuming equal variances

Difference	0.10664	t Ratio	1.118821
Std Err Dif	0.09531	DF	249
Upper CL Dif	0.29435	Prob > |t|	0.2643
Lower CL Dif	-0.08108	Prob > t	0.1321
Confidence	0.95	Prob < t	0.8679



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q10.1: To obtain a future employment opportunity	1	0.64286	0.642861	1.2518	0.2643
Error	249	127.87794	0.513566		
C. Total	250	128.52081			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	86	4.34690	0.07728	4.1947	4.4991
Yes	165	4.45354	0.05579	4.3437	4.5634

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	86	10145.5	10836.0	117.971	-1.315
Yes	165	21480.5	20790.0	130.185	1.315

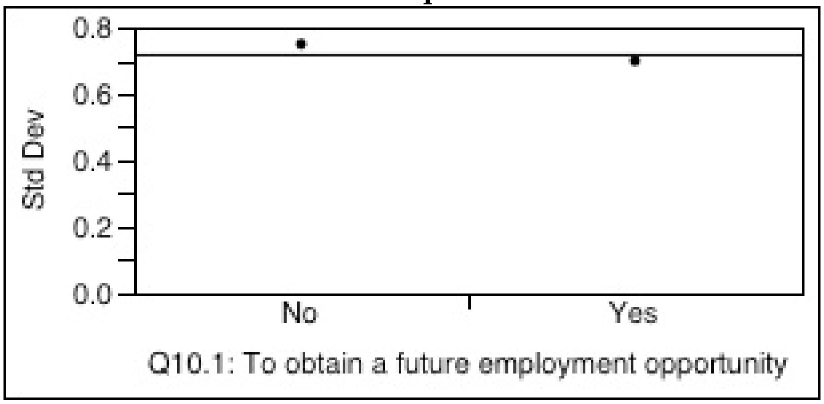
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
10145.5	-1.31457	0.1887

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
1.7306	1	0.1883

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	86	0.7498214	0.5448891	0.5445736
Yes	165	0.6988153	0.5426263	0.5000000

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.2292	1	249	0.6326
Brown-Forsythe	0.4075	1	249	0.5238
Levene	0.0013	1	249	0.9708
Bartlett	0.5611	1	.	0.4538
F Test 2-sided	1.1513	85	164	0.4418

Welch's Test

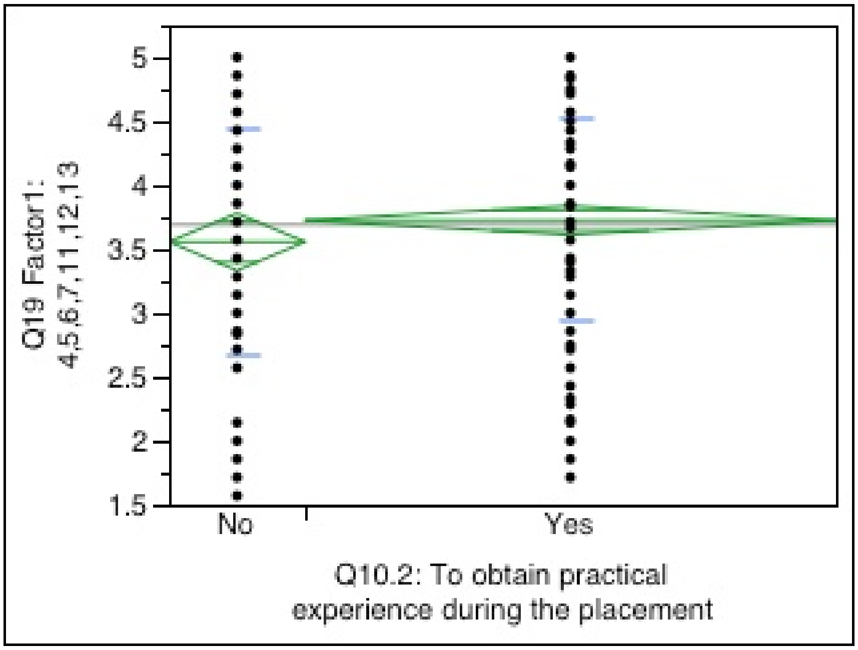
Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
1.1973	1	162.16	0.2755

t Test
1.0942

H2: ANOVA TEST FOR FACTOR 1 & 2 OF QUESTION 19 BY QUESTION 10.2

H2.1 Oneway Analysis of Q19 Factor1: 4,5,6,7,11,12,13 By Q10.2: To obtain practical experience during the placement



Missing Rows
15

Oneway ANOVA
Summary of Fit

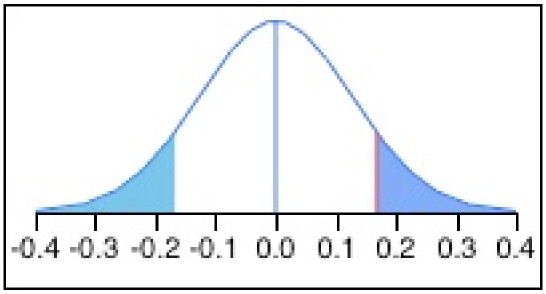
Rsquare	0.007015
Adj Rsquare	0.003011
Root Mean Square Error	0.810499
Mean of Response	3.690981
Observations (or Sum Wgts)	250

t Test
Yes-No

Assuming equal variances

Difference	0.16837	t Ratio	1.323614
Std Err Dif	0.12721	DF	248

Upper CL Dif	0.41892	Prob > |t|	0.1869
Lower CL Dif	-0.08217	Prob > t	0.0934
Confidence	0.95	Prob < t	0.9066



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q10.2: To obtain practical experience during the placement	1	1.15087	1.15087	1.7520	0.1869
Error	248	162.91346	0.65691		
C. Total	249	164.06433			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	51	3.55696	0.11349	3.3334	3.7805
Yes	199	3.72533	0.05745	3.6122	3.8385

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	51	5871.50	6400.50	115.127	-1.149
Yes	199	25503.5	24974.5	128.158	1.149

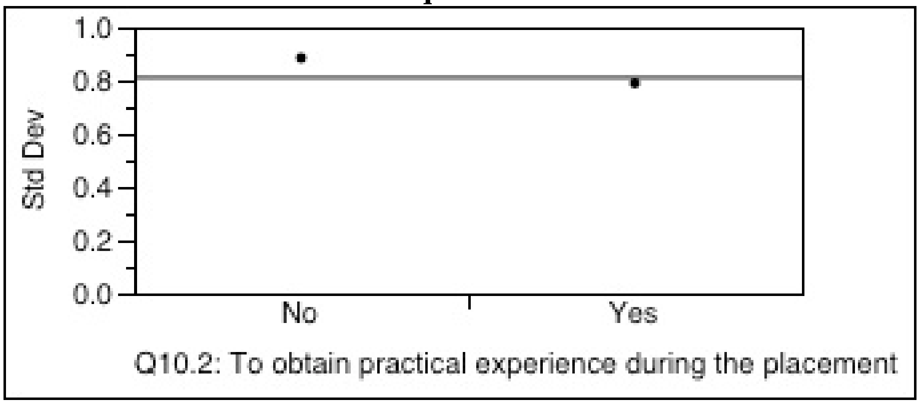
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
5871.5	-1.14865	0.2507

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
1.3219	1	0.2503

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	51	0.8852928	0.7161714	0.7119514
Yes	199	0.7904937	0.6372967	0.6315745

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	1.4705	1	248	0.2264
Brown-Forsythe	1.0423	1	248	0.3083
Levene	1.1198	1	248	0.2910
Bartlett	1.0629	1	.	0.3026
F Test 2-sided	1.2542	50	198	0.2817

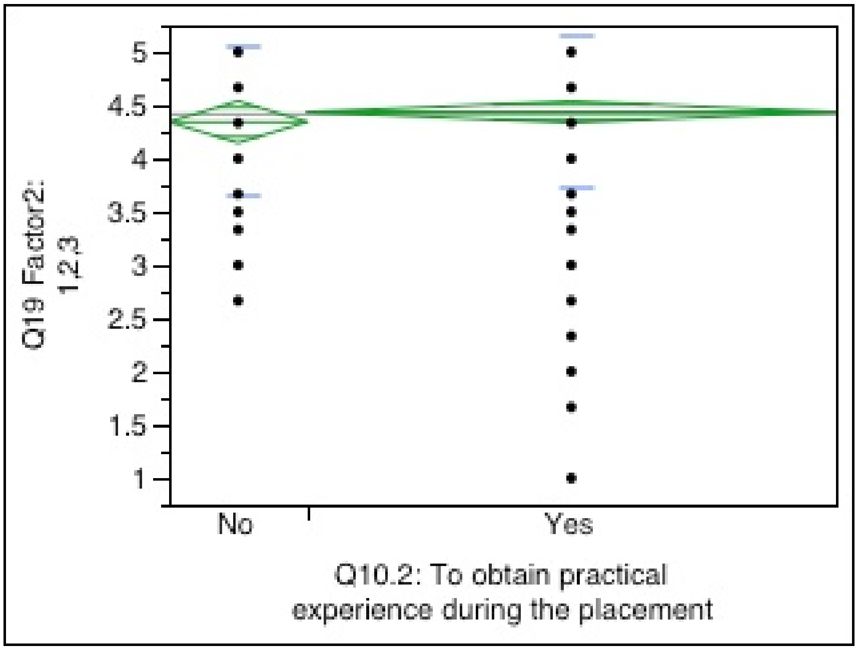
Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
1.5318	1	71.764	0.2199

t Test
1.2376

H2.2 Analysis of Q19 Factor2: 1,2,3 By Q10.2: To obtain practical experience during the placement



Missing Rows
14

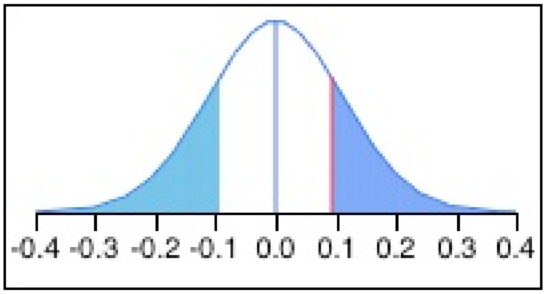
Oneway ANOVA
Summary of Fit

Rsquare	0.002798
Adj Rsquare	-0.00121
Root Mean Square Error	0.717428
Mean of Response	4.416999
Observations (or Sum Wgts)	251

t Test
Yes-No

Assuming equal variances

Difference	0.09340	t Ratio	0.835908
Std Err Dif	0.11173	DF	249
Upper CL Dif	0.31346	Prob > |t|	0.4040
Lower CL Dif	-0.12667	Prob > t	0.2020
Confidence	0.95	Prob < t	0.7980



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q10.2: To obtain practical experience during the placement	1	0.35964	0.359645	0.6987	0.4040
Error	249	128.16116	0.514703		
C. Total	250	128.52081			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	52	4.34295	0.09949	4.1470	4.5389
Yes	199	4.43635	0.05086	4.3362	4.5365

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	52	6066.00	6552.00	116.654	-1.083
Yes	199	25560.0	25074.0	128.442	1.083

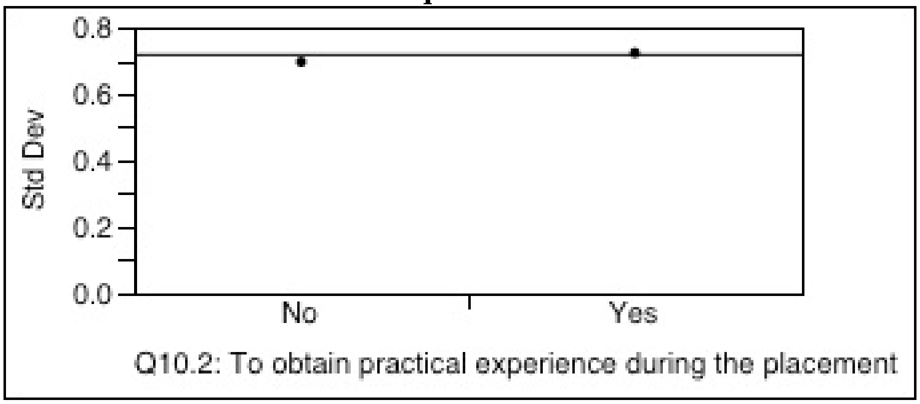
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
6066	-1.08315	0.2787

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
1.1756	1	0.2782

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	52	0.6957805	0.5420365	0.5416667
Yes	199	0.7228993	0.5465687	0.5083752

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.0442	1	249	0.8336
Brown-Forsythe	0.1579	1	249	0.6914
Levene	0.0039	1	249	0.9500
Bartlett	0.1160	1	.	0.7334
F Test 2-sided	1.0795	198	51	0.7664

Welch's Test

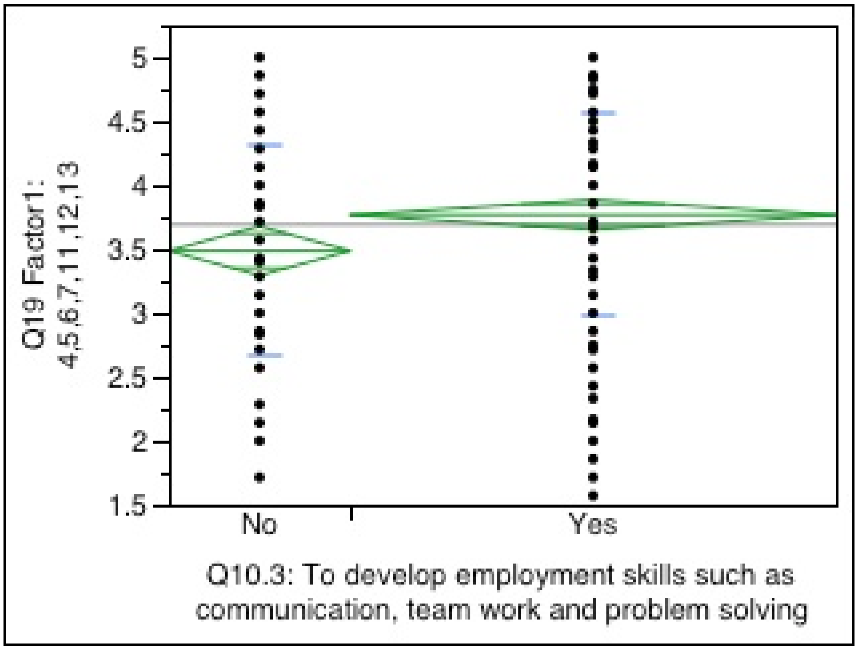
Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
0.7309	1	82.146	0.3951

t Test
0.8549

H3: ANOVA TEST FOR FACTOR 1 & 2 OF QUESTION 19 BY QUESTION 10.3

<u>H3.1 Oneway Analysis of Q19 Factor1: 4,5,6,7,11,12,13 By Q10.3: To develop employment skills such as communication, team work and problem solving</u>



Missing Rows
15

Oneway ANOVA
Summary of Fit

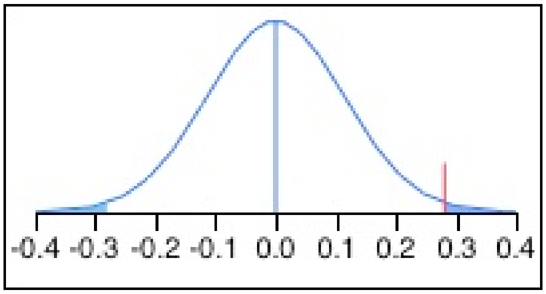
Rsquare	0.023858
Adj Rsquare	0.019922
Root Mean Square Error	0.803596
Mean of Response	3.690981
Observations (or Sum Wgts)	250

t Test
Yes-No

Assuming equal variances

Difference	0.281190	t Ratio	2.461968
Std Err Dif	0.114214	DF	248
Upper CL Dif	0.506142	Prob > |t|	0.0145*

Lower CL Dif	0.056238	Prob > t	0.0072*
Confidence	0.95	Prob < t	0.9928



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q10.3: To develop employment skills such as communication, team work and problem solving	1	3.91418	3.91418	6.0613	0.0145*
Error	248	160.15015	0.64577		
C. Total	249	164.06433			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	68	3.48627	0.09745	3.2943	3.6782
Yes	182	3.76746	0.05957	3.6501	3.8848

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	68	7266.00	8534.00	106.853	-2.495
Yes	182	24109.0	22841.0	132.467	2.495

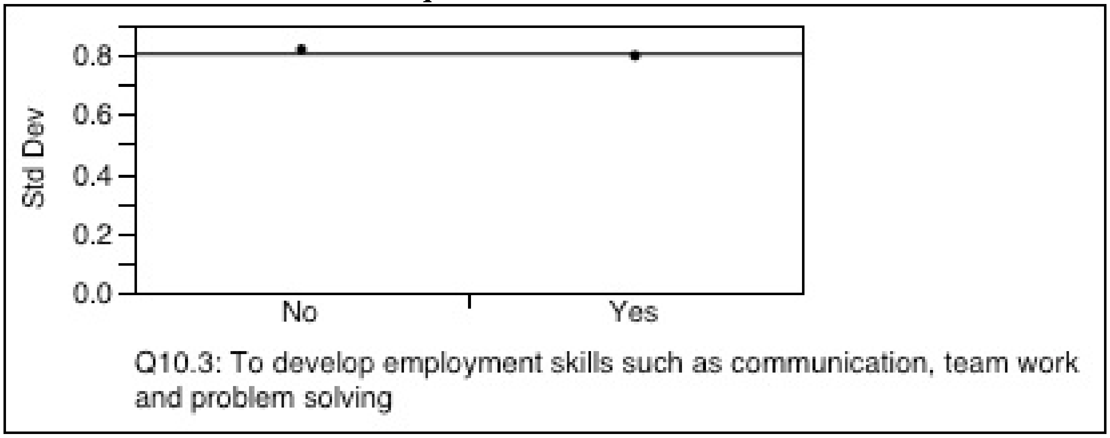
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
7266	-2.49466	0.0126*

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
6.2282	1	0.0126*

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	68	0.8188561	0.6751936	0.6726891
Yes	182	0.7978734	0.6355700	0.6267007

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	0.0796	1	248	0.7781
Brown-Forsythe	0.4338	1	248	0.5107
Levene	0.3465	1	248	0.5566
Bartlett	0.0661	1	.	0.7972
F Test 2-sided	1.0533	67	181	0.7732

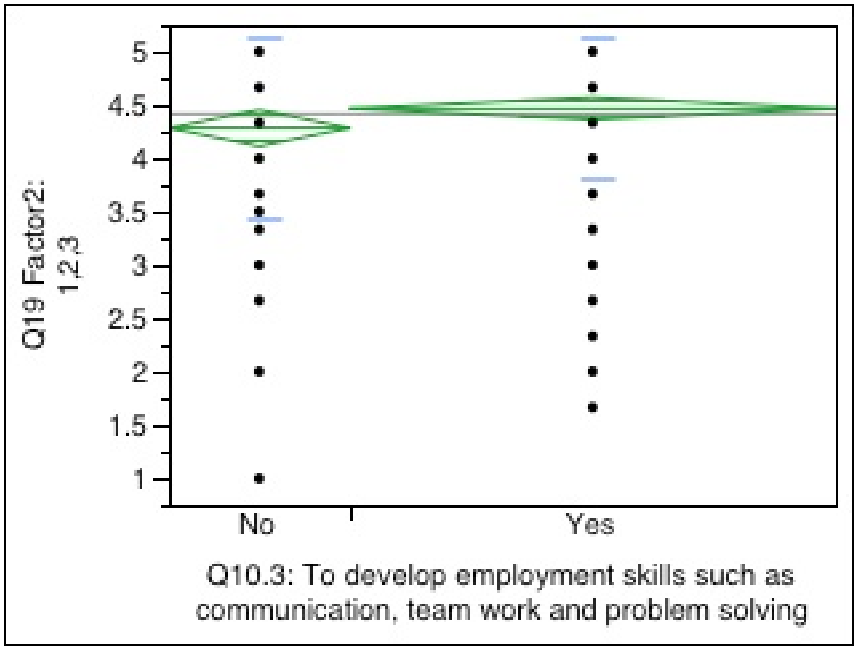
Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
5.9189	1	117.49	0.0165*

t Test
2.4329

H3.2 Oneway Analysis of Q19 Factor2: 1,2,3 By Q10.3: To develop employment skills such as communication, team work and problem solving



Missing Rows
14

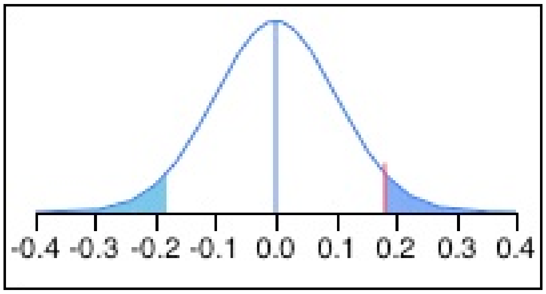
Oneway ANOVA
Summary of Fit

Rsquare	0.012776
Adj Rsquare	0.008811
Root Mean Square Error	0.71383
Mean of Response	4.416999
Observations (or Sum Wgts)	251

t Test
Yes-No

Assuming equal variances

Difference	0.18199	t Ratio	1.795116
Std Err Dif	0.10138	DF	249
Upper CL Dif	0.38166	Prob > |t|	0.0738
Lower CL Dif	-0.01768	Prob > t	0.0369*
Confidence	0.95	Prob < t	0.9631



Analysis of Variance

Q10.3: To develop employment skills such as communication, team work and problem solving	**DF**	**Sum of Squares**	**Mean Square**	**F Ratio**	**Prob > F**
Q10.3	0	0.000000	.	.	.
Error	182	73.564208	0.404199		
C. Total	182	73.564208			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	68	4.28431	0.08656	4.1138	4.4548
Yes	183	4.46630	0.05277	4.3624	4.5702

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	68	7940.50	8568.00	116.772	-1.276
Yes	183	23685.5	23058.0	129.429	1.276

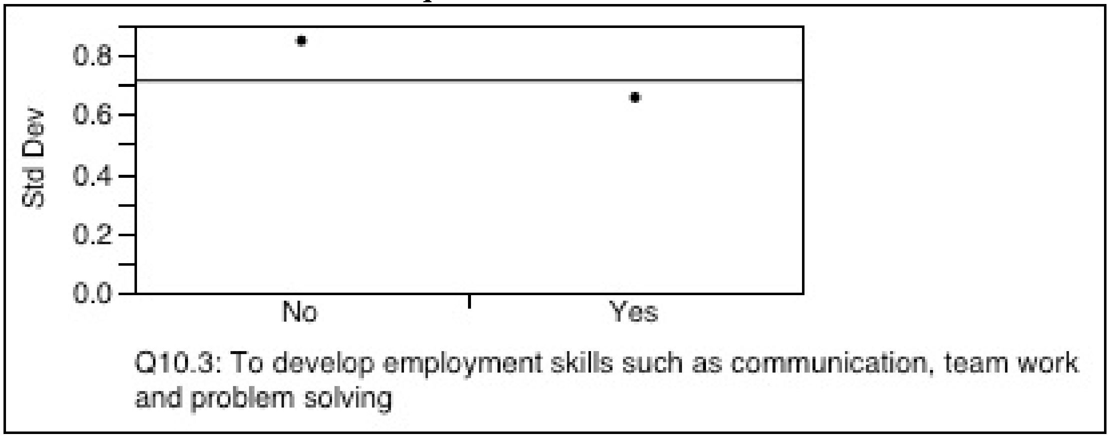
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
7940.5	-1.27560	0.2021

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
1.6297	1	0.2017

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	68	0.8484005	0.6335063	0.6176471
Yes	183	0.6573896	0.5119094	0.4735883

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	3.2233	1	249	0.0738
Brown-Forsythe	3.8009	1	249	0.0523
Levene	3.5351	1	249	0.0612
Bartlett	6.8020	1	.	0.0091*
F Test 2-sided	1.6655	67	182	0.0083*

Welch's Test

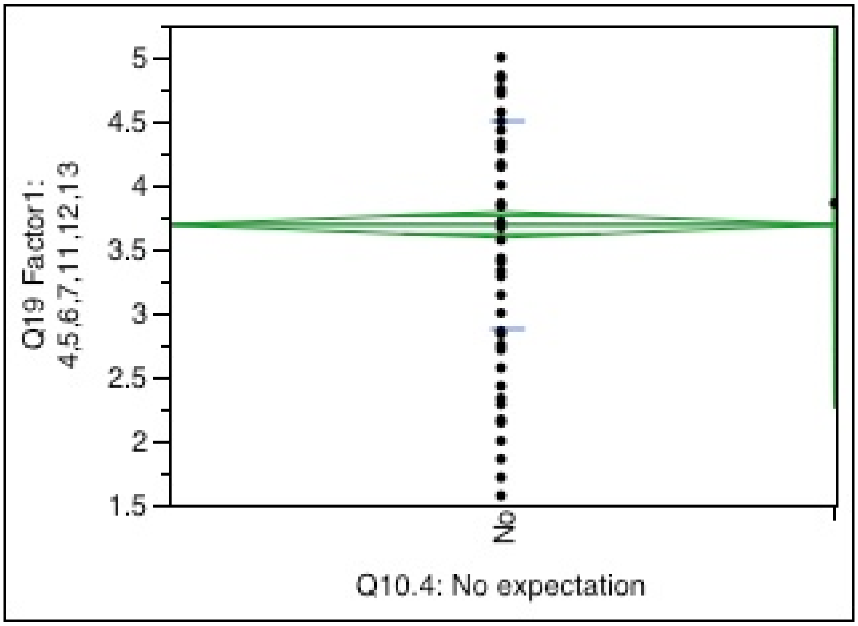
Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
2.5582	1	98.427	0.1129

t Test
1.5994

H4: ANOVA TEST FOR FACTOR 1 & 2 OF QUESTION 19 BY QUESTION 10.4

<u>H4.1 Oneway Analysis of Q19 Factor1: 4,5,6,7,11,12,13 By Q10.4: No expectation</u>



Missing Rows
15

Oneway ANOVA
Summary of Fit

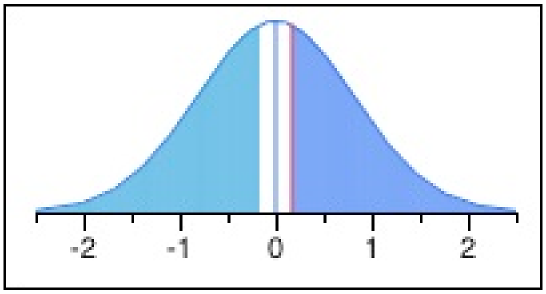
Rsquare	0.000169
Adj Rsquare	-0.00386
Root Mean Square Error	0.813288
Mean of Response	3.690981
Observations (or Sum Wgts)	250

t Test
Yes-No

Assuming equal variances

Difference	0.1668	t Ratio	0.204719
Std Err Dif	0.8149	DF	248
Upper CL Dif	1.7719	Prob > |t|	0.8380

Lower CL Dif	-1.4382	Prob > t	0.4190
Confidence	0.95	Prob < t	0.5810



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q10.4: No expectation	1	0.02772	0.027721	0.0419	0.8380
Error	248	164.03661	0.661438		
C. Total	249	164.06433			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	249	3.69031	0.05154	3.5888	3.7918
Yes	1	3.85714	0.81329	2.2553	5.4590

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	249	31240.5	31249.5	125.464	-0.118
Yes	1	134.500	125.500	134.500	0.118

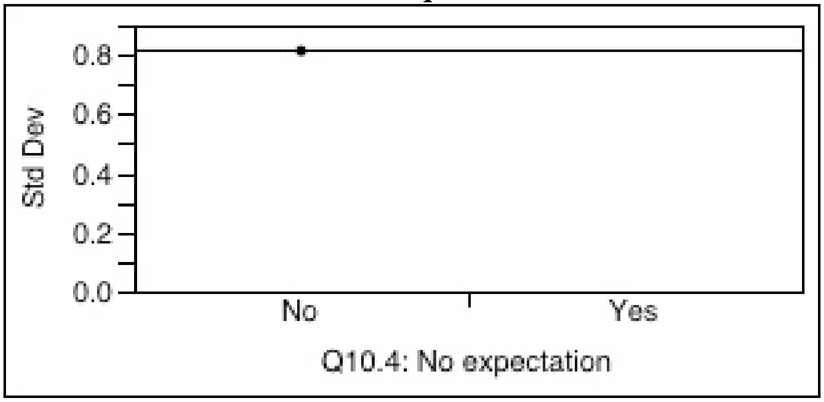
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
134.5	0.11794	0.9061

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
0.0156	1	0.9006

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	249	0.8132883	0.6579567	0.6534423
Yes	1	.	0.0000000	0.0000000

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	.	0	248	.
Brown-Forsythe	.	0	248	.
Levene	.	0	248	.
Bartlett	.	0	248	.
F Test 2-sided	.	0	248	1.0000

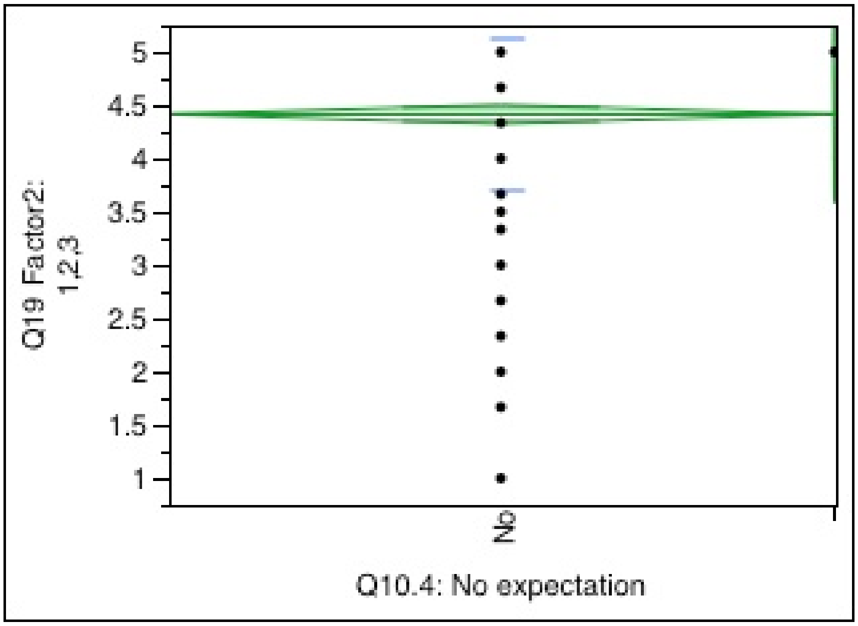
Warning: Small sample sizes. Use Caution.

Welch's Test
Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
.	.	.	.

t Test
.

H4.2 Oneway Analysis of Q19 Factor2: 1,2,3 By Q10.4: No expectation



Missing Rows
14

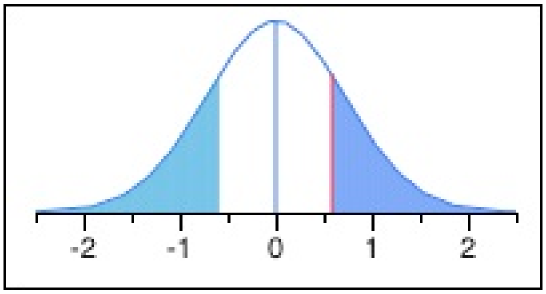
Oneway ANOVA
Summary of Fit

Rsquare	0.002655
Adj Rsquare	-0.00135
Root Mean Square Error	0.71748
Mean of Response	4.416999
Observations (or Sum Wgts)	251

t Test
Yes-No

Assuming equal variances

Difference	0.5853	t Ratio	0.814192
Std Err Dif	0.7189	DF	249
Upper CL Dif	2.0013	Prob > |t|	0.4163
Lower CL Dif	-0.8306	Prob > t	0.2082
Confidence	0.95	Prob < t	0.7918



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q10.4: No expectation	1	0.34125	0.341250	0.6629	0.4163
Error	249	128.17956	0.514777		
C. Total	250	128.52081			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	250	4.41467	0.04538	4.3253	4.5040
Yes	1	5.00000	0.71748	3.5869	6.4131

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	250	31425.0	31500.0	125.700	-1.069
Yes	1	201.000	126.000	201.000	1.069

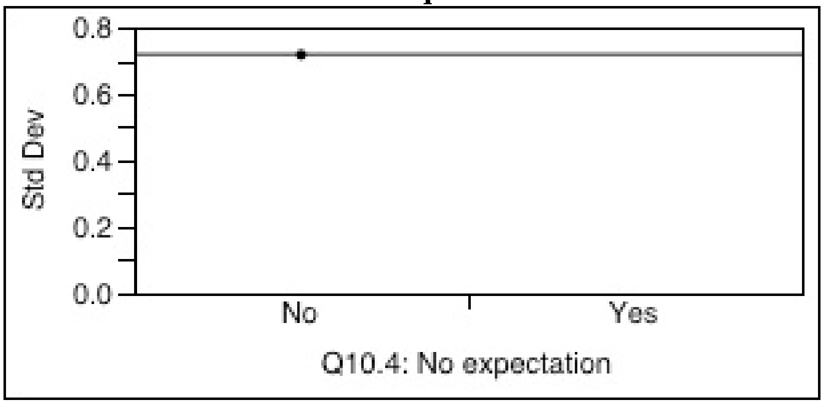
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
201	1.06933	0.2849

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
1.1589	1	0.2817

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	250	0.7174798	0.5489067	0.5186667
Yes	1	.	0.0000000	0.0000000

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	.	0	249	.
Brown-Forsythe	.	0	249	.
Levene	.	0	249	.
Bartlett	.	0	249	.
F Test 2-sided	.	0	249	1.0000

Warning: Small sample sizes. Use Caution.

Welch's Test

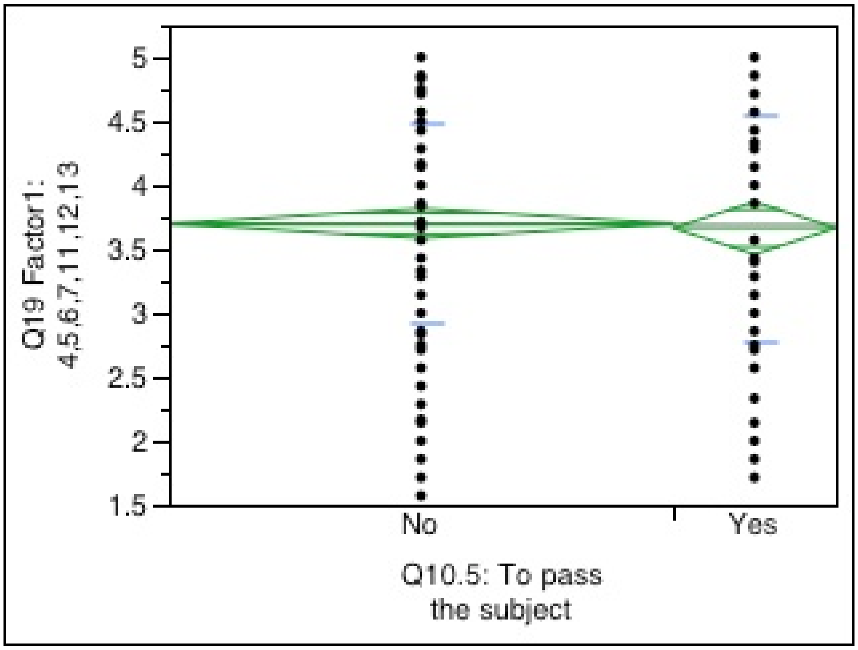
Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
.	.	.	.

t Test
.

H5: ANOVA TEST FOR FACTOR 1 & 2 FOR QUESTION 19 BY QUESTION 10.5

<u>H5.1 One-way Analysis of Q19 Factor1: 4,5,6,7,11,12,13 By Q10.5: To pass the subject</u>



Missing Rows
15

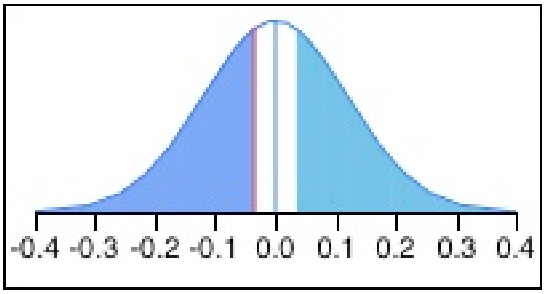
Oneway ANOVA
Summary of Fit

Rsquare	0.000346
Adj Rsquare	-0.00368
Root Mean Square Error	0.813216
Mean of Response	3.690981
Observations (or Sum Wgts)	250

t Test
Yes-No

Assuming equal variances

Difference	-0.03510	t Ratio	-0.29315
Std Err Dif	0.11975	DF	248
Upper CL Dif	0.20075	Prob > |t|	0.7697
Lower CL Dif	-0.27096	Prob > t	0.6152
Confidence	0.95	Prob < t	0.3848



Analysis of Variance

Source	**DF**	**Sum of Squares**	**Mean Square**	**F Ratio**	**Prob > F**
Q10.5: To pass the subject	1	0.05683	0.056830	0.0859	0.7697
Error	248	164.00750	0.661321		
C. Total	249	164.06433			

Means for Oneway ANOVA

Level	**Number**	**Mean**	**Std Error**	**Lower 95%**	**Upper 95%**
No	189	3.69955	0.05915	3.5830	3.8161
Yes	61	3.66444	0.10412	3.4594	3.8695

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	**Count**	**Score Sum**	**Expected Score**	**Score Mean**	**(Mean-Mean0)/Std0**
No	189	23752.0	23719.5	125.672	0.065
Yes	61	7623.00	7655.50	124.967	-0.065

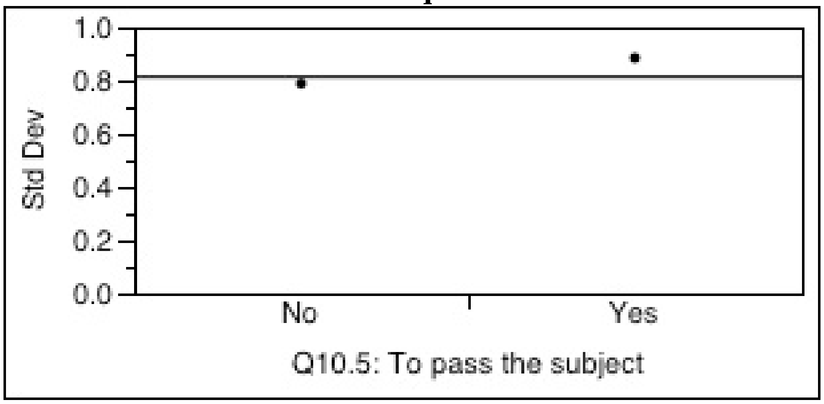
2-Sample Test, Normal Approximation

S	**Z**	**Prob>|Z|**
7623	-0.06525	0.9480

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	**DF**	**Prob>ChiSq**
0.0044	1	0.9472

Tests that the Variances are Equal



Level	**Count**	**Std Dev**	**MeanAbsDif to Mean**	**MeanAbsDif to Median**
No	189	0.7888284	0.6284598	0.6263542
Yes	61	0.8852915	0.7393315	0.7235363

Test	**F Ratio**	**DFNum**	**DFDen**	**p-Value**
O'Brien[.5]	1.6793	1	248	0.1962
Brown-Forsythe	1.7933	1	248	0.1818
Levene	2.5097	1	248	0.1144
Bartlett	1.2506	1	.	0.2634
F Test 2-sided	1.2595	60	188	0.2480

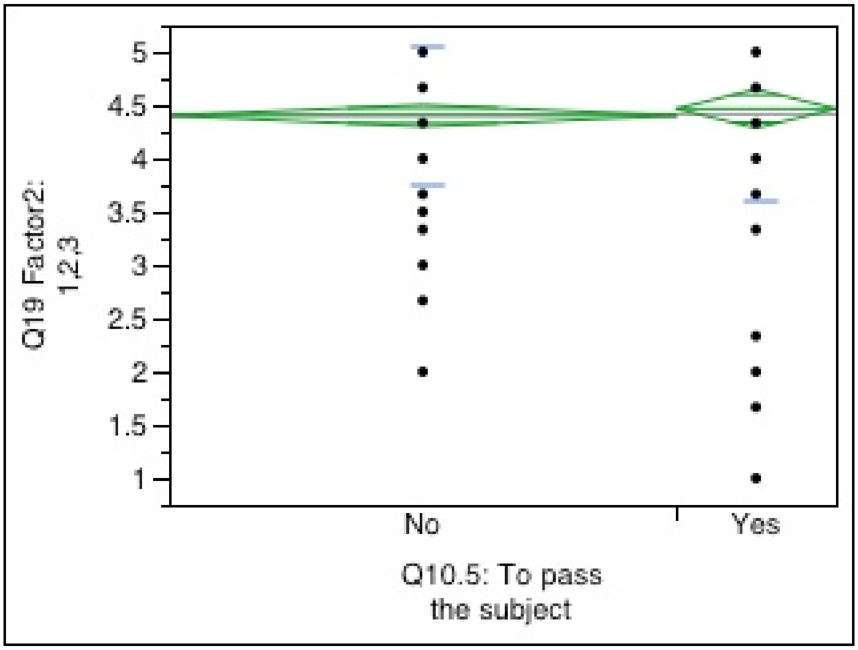
Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	**DFNum**	**DFDen**	**Prob > F**
0.0764	1	92.746	0.7829

t Test
0.2763

I5.2 One-way Analysis of Q19 Factor2: 1,2,3 By Q10.5: To pass the subject



Missing Rows
14

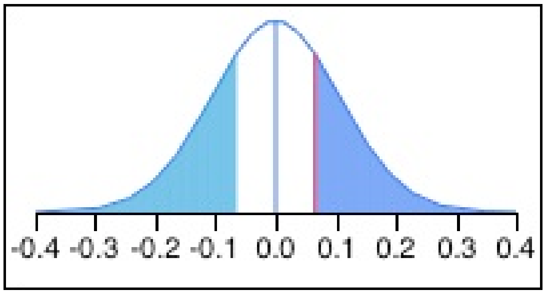
Oneway ANOVA
Summary of Fit

Rsquare	0.001513
Adj Rsquare	-0.0025
Root Mean Square Error	0.71789
Mean of Response	4.416999
Observations (or Sum Wgts)	251

t Test
Yes-No

Assuming equal variances

Difference	0.06527	t Ratio	0.614348
Std Err Dif	0.10624	DF	249
Upper CL Dif	0.27452	Prob > |t|	0.5395
Lower CL Dif	-0.14398	Prob > t	0.2698
Confidence	0.95	Prob < t	0.7302



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q10.5: To pass the subject	1	0.19451	0.194511	0.3774	0.5395
Error	249	128.32629	0.515367		
C. Total	250	128.52081			

Means for Oneway ANOVA

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
No	191	4.40140	0.05194	4.2991	4.5037
Yes	60	4.46667	0.09268	4.2841	4.6492

Std Error uses a pooled estimate of error variance

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Expected Score	Score Mean	(Mean-Mean0)/Std0
No	191	23169.0	24066.0	121.304	-1.901
Yes	60	8457.00	7560.00	140.950	1.901

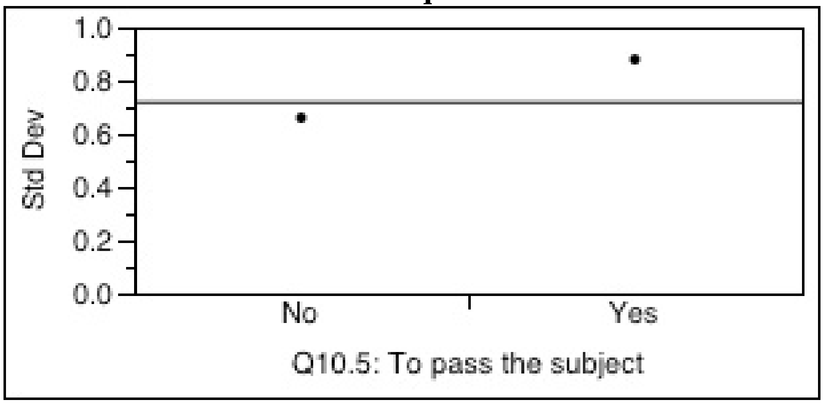
2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
8457	1.90057	0.0574

1-way Test, Chi Square (χ^2) Approximation

Chi Square (χ^2)	DF	Prob>ChiSq
3.6162	1	0.0572

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
No	191	0.6598496	0.5241633	0.5061082
Yes	60	0.8791367	0.6155556	0.5333333

Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	3.6498	1	249	0.0572
Brown-Forsythe	0.0908	1	249	0.7635
Levene	1.7878	1	249	0.1824
Bartlett	8.0773	1	.	0.0045*
F Test 2-sided	1.7751	59	190	0.0040*

Welch's Test

Welch ANOVA testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
0.2810	1	80.943	0.5975

t Test
0.5301

APPENDIX I

SHARED RESPONSES TO DIFFERENT QUESTIONS

I1: SHARED RESPONSES TO QUESTION 10 AND QUESTION 1

Q10.

Frequency

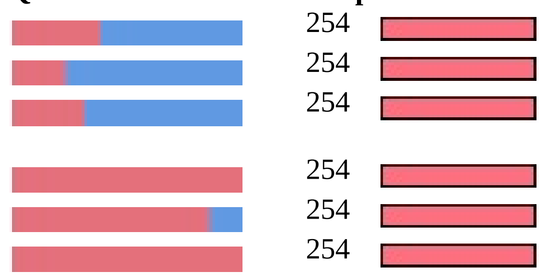
Response	**No**	**Yes**	**Responses**
Q10.1: To obtain a future employment opportunity	88	166	254
Q10.2: To obtain practical experience during the placement	53	201	254
Q10.3: To develop employment skills such as communication, team work and problem solving	71	183	254
Q10.4: No expectation	253	1	254
Q10.5: To pass the subject	193	61	254
Q10.6: Other	252	2	254

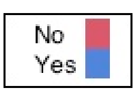
Share of Responses

Response	**No**	**Yes**	**Responses**
Q10.1: To obtain a future employment opportunity	0.3465	0.6535	254
Q10.2: To obtain practical experience during the placement	0.2087	0.7913	254
Q10.3: To develop employment skills such as communication, team work and problem solving	0.2795	0.7205	254
Q10.4: No expectation	0.9961	0.0039	254
Q10.5: To pass the subject	0.7598	0.2402	254
Q10.6: Other	0.9921	0.0079	254

Share Chart

Response	**Q10.**	**Responses**
Q10.1: To obtain a future employment opportunity		254
Q10.2: To obtain practical experience during the placement		254
Q10.3: To develop employment skills such as communication, team work and problem solving		254
Q10.4: No expectation		254
Q10.5: To pass the subject		254
Q10.6: Other		254





Q10. By Q1

Frequency

Response	**Q1**	**No**	**Yes**	**Responses**
Q10.1: To obtain a future employment opportunity	Male	68	119	187
Q10.1: To obtain a future employment opportunity	Female	20	47	67
Q10.2: To obtain practical experience during the placement	Male	38	149	187
Q10.2: To obtain practical experience during the placement	Female	15	52	67
Q10.3: To develop employment skills such as communication, team work and problem solving	Male	54	133	187
Q10.3: To develop employment skills such as communication, team work and problem solving	Female	17	50	67
Q10.4: No expectation	Male	187	0	187

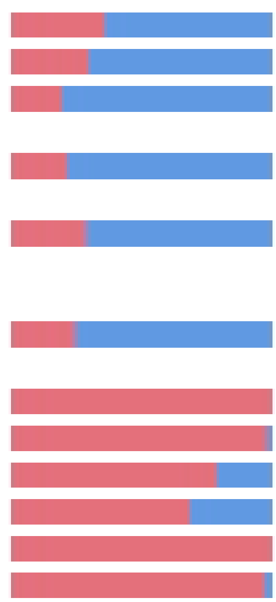
Response	Q1	No	Yes	Responses
Q10.4: No expectation	Female	66	1	67
Q10.5: To pass the subject	Male	147	40	187
Q10.5: To pass the subject	Female	46	21	67
Q10.6: Other	Male	187	0	187
Q10.6: Other	Female	65	2	67

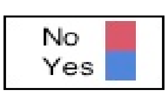
Share of Responses

Response	Q1	No	Yes	Responses
Q10.1: To obtain a future employment opportunity	Male	0.3636	0.6364	187
Q10.1: To obtain a future employment opportunity	Female	0.2985	0.7015	67
Q10.2: To obtain practical experience during the placement	Male	0.2032	0.7968	187
Q10.2: To obtain practical experience during the placement	Female	0.2239	0.7761	67
Q10.3: To develop employment skills such as communication, team work and problem solving	Male	0.2888	0.7112	187
Q10.3: To develop employment skills such as communication, team work and problem solving	Female	0.2537	0.7463	67
Q10.4: No expectation	Male	1.0000	0.0000	187
Q10.4: No expectation	Female	0.9851	0.0149	67
Q10.5: To pass the subject	Male	0.7861	0.2139	187
Q10.5: To pass the subject	Female	0.6866	0.3134	67
Q10.6: Other	Male	1.0000	0.0000	187
Q10.6: Other	Female	0.9701	0.0299	67

Share Chart

Response	Q1	Q10.	Responses
Q10.1: To obtain a future employment opportunity	Male		187
Q10.1: To obtain a future employment opportunity	Female		67
Q10.2: To obtain practical experience during the placement	Male		187
Q10.2: To obtain practical experience during the placement	Female		67
Q10.3: To develop employment skills such as communication, team work and problem solving	Male		187
Q10.3: To develop employment skills such as communication, team work and problem solving	Female		67
Q10.4: No expectation	Male		187
Q10.4: No expectation	Female		67
Q10.5: To pass the subject	Male		187
Q10.5: To pass the subject	Female		67
Q10.6: Other	Male		187
Q10.6: Other	Female		67





I2: SHARED RESPONSES TO QUESTION 14 AND QUESTION 1

Q14.

Frequency

Response	No	Yes	Responses
Q14.1: More appropriate work placement	183	71	254
Q14.2: More support from university	161	93	254
Q14.3: More support from industry	151	103	254
Q14.4:Better guidance from university	185	69	254
Q14.5: Better preparation such as induction course	206	48	254
Q14.6: Better theory course work at the university	211	43	254
Q14.7: Better liaison between university and industry	119	135	254
Q14.8: Other	248	6	254

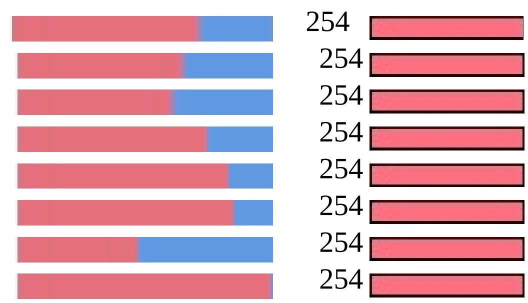
Share of Responses

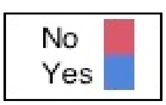
Response	No	Yes	Responses
Q14.1: More appropriate work placement	0.7205	0.2795	254
Q14.2: More support from university	0.6339	0.3661	254
Q14.3: More support from industry	0.5945	0.4055	254
Q14.4:Better guidance from university	0.7283	0.2717	254
Q14.5: Better preparation such as induction course	0.8110	0.1890	254
Q14.6: Better theory course work at the university	0.8307	0.1693	254
Q14.7: Better liaison between university and industry	0.4685	0.5315	254
Q14.8: Other	0.9764	0.0236	254

Share Chart

Response | **Q14.** | **Responses**

Q14.1: More appropriate work placement
Q14.2: More support from university
Q14.3: More support from industry
Q14.4:Better guidance from university
Q14.5: Better preparation such as induction course
Q14.6: Better theory course work at the university
Q14.7: Better liaison between university and industry
Q14.8: Other





Q14. By Q1

Frequency

Response	Q1	No	Yes	Responses
Q14.1: More appropriate work placement	Male	137	50	187
Q14.1: More appropriate work placement	Female	46	21	67
Q14.2: More support from university	Male	122	65	187
Q14.2: More support from university	Female	39	28	67
Q14.3: More support from industry	Male	116	71	187

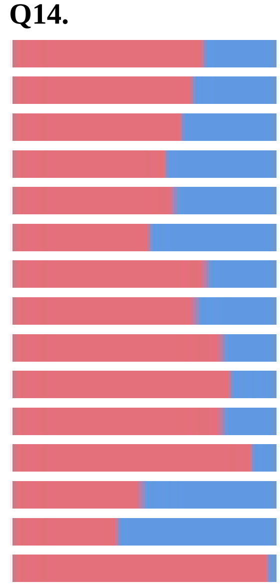
Response	Q1	No	Yes	Responses
Q14.3: More support from industry	Female	35	32	67
Q14.4: Better guidance from university	Male	138	49	187
Q14.4: Better guidance from university	Female	47	20	67
Q14.5: Better preparation such as induction course	Male	150	37	187
Q14.5: Better preparation such as induction course	Female	56	11	67
Q14.6: Better theory course work at the university	Male	150	37	187
Q14.6: Better theory course work at the university	Female	61	6	67
Q14.7: Better liaison between university and industry	Male	92	95	187
Q14.7: Better liaison between university and industry	Female	27	40	67
Q14.8: Other	Male	183	4	187
Q14.8: Other	Female	65	2	67

Share of Responses

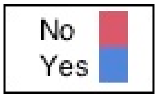
Response	Q1	No	Yes	Responses
Q14.1: More appropriate work placement	Male	0.7326	0.2674	187
Q14.1: More appropriate work placement	Female	0.6866	0.3134	67
Q14.2: More support from university	Male	0.6524	0.3476	187
Q14.2: More support from university	Female	0.5821	0.4179	67
Q14.3: More support from industry	Male	0.6203	0.3797	187
Q14.3: More support from industry	Female	0.5224	0.4776	67
Q14.4:Better guidance from university	Male	0.7380	0.2620	187
Q14.4:Better guidance from university	Female	0.7015	0.2985	67
Q14.5: Better preparation such as induction course	Male	0.8021	0.1979	187
Q14.5: Better preparation such as induction course	Female	0.8358	0.1642	67
Q14.6: Better theory course work at the university	Male	0.8021	0.1979	187
Q14.6: Better theory course work at the university	Female	0.9104	0.0896	67
Q14.7: Better liaison between university and industry	Male	0.4920	0.5080	187
Q14.7: Better liaison between university and industry	Female	0.4030	0.5970	67
Q14.8: Other	Male	0.9786	0.0214	187
Q14.8: Other	Female	0.9701	0.0299	67

Share Chart

Response	Q1	Q14.	Responses
Q14.1: More appropriate work placement	Male		187
Q14.1: More appropriate work placement	Female		67
Q14.2: More support from university	Male		187
Q14.2: More support from university	Female		67
Q14.3: More support from industry	Male		187
Q14.3: More support from industry	Female		67
Q14.4: Better guidance from university	Male		187
Q14.4: Better guidance from university	Female		67
Q14.5: Better preparation such as induction course	Male		187
Q14.5: Better preparation such as induction course	Female		67
Q14.6: Better theory course work at the university	Male		187
Q14.6: Better theory course work at the university	Female		67
Q14.7: Better liaison between university and industry	Male		187
Q14.7: Better liaison between university and industry	Female		67
Q14.8: Other	Male		187



Response	Q1	Q14.	Responses
Q14.8: Other	Female		67



Q14. By Q1

Frequency

Response	Q1	No	Yes	Responses
Q14.1: More appropriate work placement	Male	137	50	187
Q14.1: More appropriate work placement	Female	46	21	67
Q14.2: More support from university	Male	122	65	187
Q14.2: More support from university	Female	39	28	67
Q14.3: More support from industry	Male	116	71	187
Q14.3: More support from industry	Female	35	32	67
Q14.4: Better guidance from university	Male	138	49	187
Q14.4: Better guidance from university	Female	47	20	67
Q14.5: Better preparation such as induction course	Male	150	37	187
Q14.5: Better preparation such as induction course	Female	56	11	67
Q14.6: Better theory course work at the university	Male	150	37	187
Q14.6: Better theory course work at the university	Female	61	6	67
Q14.7: Better liaison between university and industry	Male	92	95	187
Q14.7: Better liaison between university and industry	Female	27	40	67
Q14.8: Other	Male	183	4	187
Q14.8: Other	Female	65	2	67

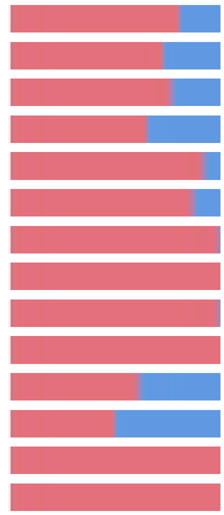
Share of Responses

Response	Q1	No	Yes	Responses
Q14.1: More appropriate work placement	Male	0.7326	0.2674	187
Q14.1: More appropriate work placement	Female	0.6866	0.3134	67
Q14.2: More support from university	Male	0.6524	0.3476	187
Q14.2: More support from university	Female	0.5821	0.4179	67
Q14.3: More support from industry	Male	0.6203	0.3797	187
Q14.3: More support from industry	Female	0.5224	0.4776	67
Q14.4: Better guidance from university	Male	0.7380	0.2620	187
Q14.4: Better guidance from university	Female	0.7015	0.2985	67
Q14.5: Better preparation such as induction course	Male	0.8021	0.1979	187
Q14.5: Better preparation such as induction course	Female	0.8358	0.1642	67
Q14.6: Better theory course work at the university	Male	0.8021	0.1979	187
Q14.6: Better theory course work at the university	Female	0.9104	0.0896	67
Q14.7: Better liaison between university and industry	Male	0.4920	0.5080	187
Q14.7: Better liaison between university and industry	Female	0.4030	0.5970	67
Q14.8: Other	Male	0.9786	0.0214	187
Q14.8: Other	Female	0.9701	0.0299	67

Share Chart

Response	Q1	Q14.	Responses
Q14.1: More appropriate work placement	Male		187
Q14.1: More appropriate work placement	Female		67

Response	Q1	Q14.	Responses
Q14.2: More support from university	Male		187
Q14.2: More support from university	Female		67
Q14.3: More support from industry	Male		187
Q14.3: More support from industry	Female		67
Q14.4: Better guidance from university	Male		187
Q14.4: Better guidance from university	Female		67
Q14.5: Better preparation such as induction course	Male		187
Q14.5: Better preparation such as induction course	Female		67
Q14.6: Better theory course work at the university	Male		187
Q14.6: Better theory course work at the university	Female		67
Q14.7: Better liaison between university and industry	Male		187
Q14.7: Better liaison between university and industry	Female		67
Q14.8: Other	Male		187
Q14.8: Other	Female		67



I3: SHARED RESPONSES TO QUESTION 14 AND QUESTION 4

Q14. By Q4_combined

Frequency

Response	Q4_combined	No	Yes
Q14.1: More appropriate work placement	Civil engineering	129	49
Q14.1: More appropriate work placement	Chemical/Metallurgical	53	22
Q14.2: More support from university	Civil engineering	117	61
Q14.2: More support from university	Chemical/Metallurgical	43	32
Q14.3: More support from industry	Civil engineering	116	62
Q14.3: More support from industry	Chemical/Metallurgical	34	41
Q14.4: Better guidance from university	Civil engineering	129	49
Q14.4: Better guidance from university	Chemical/Metallurgical	55	20
Q14.5: Better preparation such as induction course	Civil engineering	147	31
Q14.5: Better preparation such as induction course	Chemical/Metallurgical	58	17
Q14.6: Better theory course work at the university	Civil engineering	150	28
Q14.6: Better theory course work at the university	Chemical/Metallurgical	60	15
Q14.7: Better liaison between university and industry	Civil engineering	94	84
Q14.7: Better liaison between university and industry	Chemical/Metallurgical	25	50
Q14.8: Other	Civil engineering	173	5
Q14.8: Other	Chemical/Metallurgical	74	1

Share of Responses

Response	Q4_combined	No	Yes
Q14.1: More appropriate work placement	Civil engineering	0.7247	0.2753
Q14.1: More appropriate work placement	Chemical/Metallurgical	0.7067	0.2933
Q14.2: More support from university	Civil engineering	0.6573	0.3427
Q14.2: More support from university	Chemical/Metallurgical	0.5733	0.4267
Q14.3: More support from industry	Civil engineering	0.6517	0.3483
Q14.3: More support from industry	Chemical/Metallurgical	0.4533	0.5467
Q14.4: Better guidance from university	Civil engineering	0.7247	0.2753
Q14.4: Better guidance from university	Chemical/Metallurgical	0.7333	0.2667
Q14.5: Better preparation such as induction course	Civil engineering	0.8258	0.1742
Q14.5: Better preparation such as induction course	Chemical/Metallurgical	0.7733	0.2267
Q14.6: Better theory course work at the university	Civil engineering	0.8427	0.1573
Q14.6: Better theory course work at the university	Chemical/Metallurgical	0.8000	0.2000
Q14.7: Better liaison between university and industry	Civil engineering	0.5281	0.4719
Q14.7: Better liaison between university and industry	Chemical/Metallurgical	0.3333	0.6667
Q14.8: Other	Civil engineering	0.9719	0.0281
Q14.8: Other	Chemical/Metallurgical	0.9867	0.0133

Share Chart

Response	Q4_combined	Q14.
Q14.1: More appropriate work placement	Civil engineering	
Q14.1: More appropriate work placement	Chemical/Metallurgical	
Q14.2: More support from university	Civil engineering	
Q14.2: More support from university	Chemical/Metallurgical	

Response	Q4_combined	Q14.
Q14.3: More support from industry	Civil engineering	
Q14.3: More support from industry	Chemical/Metallurgical	
Q14.4: Better guidance from university	Civil engineering	
Q14.4: Better guidance from university	Chemical/Metallurgical	
Q14.5: Better preparation such as induction course	Civil engineering	
Q14.5: Better preparation such as induction course	Chemical/Metallurgical	
Q14.6: Better theory course work at the university	Civil engineering	
Q14.6: Better theory course work at the university	Chemical/Metallurgical	
Q14.7: Better liaison between university and industry	Civil engineering	
Q14.7: Better liaison between university and industry	Chemical/Metallurgical	
Q14.8: Other	Civil engineering	
Q14.8: Other	Chemical/Metallurgical	

I4: SHARED RESPONSES TO QUESTION 24 TO QUESTION 29

Q24.

Frequency

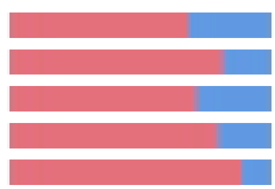
Response	No	Yes	Responses
Q24.1: Student	176	78	254
Q24.2: WIL Convener	209	45	254
Q24.3: Academic Supervisor	182	72	254
Q24.4: Industry Mentor	204	50	254
Q24.5: Placement coordinator	227	27	254

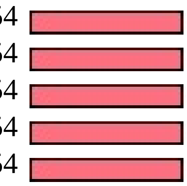
Share of Responses

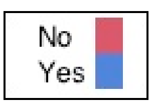
Response	No	Yes	Responses
Q24.1: Student	0.6929	0.3071	254
Q24.2: WIL Convener	0.8228	0.1772	254
Q24.3: Academic Supervisor	0.7165	0.2835	254
Q24.4: Industry Mentor	0.8031	0.1969	254
Q24.5: Placement coordinator	0.8937	0.1063	254

Share Chart

Response	Q24.	Responses	Sample
Q24.1: Student		254	
Q24.2: WIL Convener		254	
Q24.3: Academic Supervisor		254	
Q24.4: Industry Mentor		254	
Q24.5: Placement coordinator		254	







Categorical

Q25.

Frequency

Response	No	Yes	Responses
Q25.1: Student	234	20	254
Q25.2: WIL Convener	210	44	254
Q25.3: Academic Supervisor	189	65	254
Q25.4: Industry Mentor	158	96	254
Q25.5: Placement coordinator	229	25	254

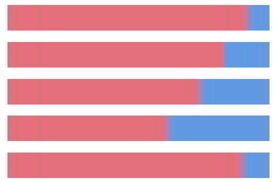
Share of Responses

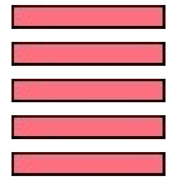
Response	No	Yes	Responses
Q25.1: Student	0.9213	0.0787	254
Q25.2: WIL Convener	0.8268	0.1732	254
Q25.3: Academic Supervisor	0.7441	0.2559	254
Q25.4: Industry Mentor	0.6220	0.3780	254

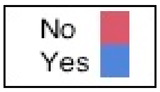
Response	No	Yes	Responses
Q25.5: Placement coordinator	0.9016	0.0984	254

Share Chart

Response	Q25.	Responses	Sample
Q25.1: Student		254	
Q25.2: WIL Convener		254	
Q25.3: Academic Supervisor		254	
Q25.4: Industry Mentor		254	
Q25.5: Placement coordinator		254	







Categorical

Q26.

Frequency

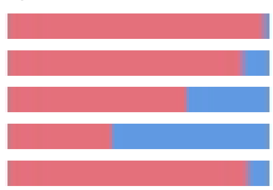
Response	No	Yes	Responses
Q26.1: Student	249	5	254
Q26.2: WIL Convener	229	25	254
Q26.3: Academic Supervisor	176	78	254
Q26.4: Industry Mentor	103	151	254
Q26.5: Placement coordinator	235	19	254

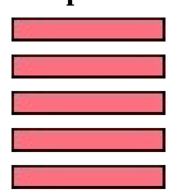
Share of Responses

Response	No	Yes	Responses
Q26.1: Student	0.9803	0.0197	254
Q26.2: WIL Convener	0.9016	0.0984	254
Q26.3: Academic Supervisor	0.6929	0.3071	254
Q26.4: Industry Mentor	0.4055	0.5945	254
Q26.5: Placement coordinator	0.9252	0.0748	254

Share Chart

Response	Q26.	Responses	Sample
Q26.1: Student		254	
Q26.2: WIL Convener		254	
Q26.3: Academic Supervisor		254	
Q26.4: Industry Mentor		254	
Q26.5: Placement coordinator		254	





Categorical

Q27.

Frequency

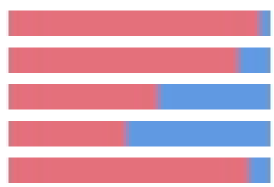
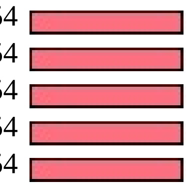
Response	No	Yes	Responses

Response	No	Yes	Responses
Q27.1: Student	246	8	254
Q27.2: WIL Convener	225	29	254
Q27.3: Academic Supervisor	146	108	254
Q27.4: Industry Mentor	115	139	254
Q27.5: Placement coordinator	235	19	254

Share of Responses

Response	No	Yes	Responses
Q27.1: Student	0.9685	0.0315	254
Q27.2: WIL Convener	0.8858	0.1142	254
Q27.3: Academic Supervisor	0.5748	0.4252	254
Q27.4: Industry Mentor	0.4528	0.5472	254
Q27.5: Placement coordinator	0.9252	0.0748	254

Share Chart

Response	Q27.	Responses	Sample
Q27.1: Student		254	
Q27.2: WIL Convener		254	
Q27.3: Academic Supervisor		254	
Q27.4: Industry Mentor		254	
Q27.5: Placement coordinator		254	

Categorical

Q28.

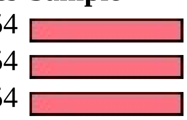
Frequency

Response	No	Yes	Responses
Q28.1: Student	210	44	254
Q28.2: WIL Convener	219	35	254
Q28.3: Academic Supervisor	196	58	254
Q28.4: Industry Mentor	134	120	254
Q28.5: Placement coordinator	211	43	254

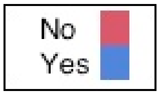
Share of Responses

Response	No	Yes	Responses
Q28.1: Student	0.8268	0.1732	254
Q28.2: WIL Convener	0.8622	0.1378	254
Q28.3: Academic Supervisor	0.7717	0.2283	254
Q28.4: Industry Mentor	0.5276	0.4724	254
Q28.5: Placement coordinator	0.8307	0.1693	254

Share Chart

Response	Q28.	Responses	Sample
Q28.1: Student		254	
Q28.2: WIL Convener		254	
Q28.3: Academic Supervisor		254	

Response	Q28.	Responses	Sample
Q28.4: Industry Mentor		254	
Q28.5: Placement coordinator		254	



Categorical

Q29.

Frequency

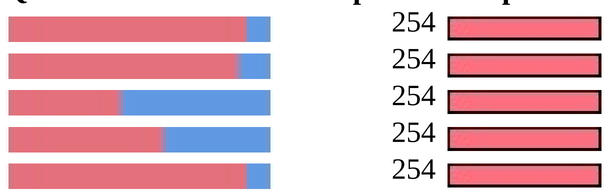
Response	No	Yes	Responses
Q29.1: Student	233	21	254
Q29.2: WIL Convener	223	31	254
Q29.3: Academic Supervisor	109	145	254
Q29.4: Industry Mentor	151	103	254
Q29.5: Placement coordinator	232	22	254

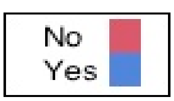
Share of Responses

Response	No	Yes	Responses
Q29.1: Student	0.9173	0.0827	254
Q29.2: WIL Convener	0.8780	0.1220	254
Q29.3: Academic Supervisor	0.4291	0.5709	254
Q29.4: Industry Mentor	0.5945	0.4055	254
Q29.5: Placement coordinator	0.9134	0.0866	254

Share Chart

Response	Q29.	Responses	Sample
Q29.1: Student		254	
Q29.2: WIL Convener		254	
Q29.3: Academic Supervisor		254	
Q29.4: Industry Mentor		254	
Q29.5: Placement coordinator		254	





APPENDIX J

RESPONSES TO OPEN-ENDED QUESTIONS 15, 20 AND 22

J1: RESPONSES TO OPEN-ENDED QUESTION 15

The following responses were given to question 15 of the questionnaire. It asked that "Do you have any suggestion for the improvement of the work integrated learning?" The responses were kept as the students expressed it.

1. Supervisor and mentor to communicate effectively on a weekly basis so that weaknesses can be dealt with in time.
2. More subjects should be computer-based learning.
3. To be visited at least four times during the period of experiential learning by the supervisor from the university.
4. Increase the student visits from the lecturers or mentors from the university.
5. Some of the criteria for the WIL are irrelevant.
6. The mentor at the industry should understand that the learner should acquire more insight of the work.
7. Good communication between the university mentor and industry mentor.
8. To work hand in hand with the industry.
9. Better lesion between mentor and supervisor.
10. Don't stop it.
11. Give candidates more responsibility in the workplace.
12. Supervisors must really do their work for inspecting the students' progress and guide them.
13. Being made aware of new and better technology.
14. Supervisors appointed should make it a priority to visit student during the training period.
15. Better liaison with industry (government) about requirement of the WIL.
16. More support from industry.
17. File the reports that were sent n, so that duplicates would not be necessary.
18. Industry must provide more mentors.
19. To notify of what is expected from me as a student and the employers role.
20. Placing learners with an experienced mentor for transferring skills.
21. Better description of experience required and report method.

22. Industry is full of bureaucracy, those who have been long in industry and are in power limiting accesses through loop-holed political policy to gain more by experimenting, not being told every time how you should do it or unless….
23. University should approve training facility before training commences.
24. A problem I experienced was the lack of guidance on the way forward from completing studies and experiential learning.
25. Dedicated mentor at workplace.
26. Regular lecturers visiting the industry and communication between university and industry.
27. The student should be visited soon enough by his/her TUT or any other university monitor.
28. Adequate exposure on different disciplines of Civil Eng.
29. Avoid working for government.
30. Specify minimum wage and employment conditions.
31. Training mentioned in 14.
32. A fulltime supervisor.
33. More supervision
34. They should monitor their task and give them task to do.
35. Follow up by the university/or technikon.
36. University should get feed-back from industry to cover any gap.
37. University to follow up on what the student is doing at the place of work like liaising with them and may be visiting them.
38. It’s fine, just more support from university is lacking.
39. Place trainees with relevant companies for short and long terms.
40. There needs to be an independent body monitoring the employers of the university, otherwise many requirements remain ignored but portrayed as being met.
41. The university/institutions should visit the student at workplace regularly.
42. Moral support from university lots of guidance through the industry and university for practical skills.
43. Look at discussions with different firms to swap students e.g., from consultants to contractors within the period.

44. Companies/industry should be encouraged to have better/well structured in-service training programs.
45. Follow ups must be done by the institutions and industry.
46. The university to do monthly visits, checking on the student's progress. Employers to give females site to supervise or assist as student trainees.
47. The university must visit the students regularly.
48. To pay attention to each person and understand background.
49. Supervisor should interact with students more during learner-ship period
50. University, be more involved and send feedback on reports, not just marks.
51. More practical work from S1-S4 before a student could go to industry.
52. The university should be more involved in order to see how we are progressing and the industry should have more structured training.
53. More work and projects.
54. Students should be given more responsibility in terms of projects and overall production processes.
55. People who are responsible for training students in companies often do not know what to do. Suggestion: thus train them to train students.
56. Study guideline & training program.
57. Yes, the university should help students to find training and make sure people are qualified to be our mentors.
58. Curriculum from the university must include courses on safety, health & environment to help students.
59. To improve communication between a student, employer and university.
60. A more hands-on mentor/guide from the university will be great.
61. Companies should have well structured training programme and refrain from using students as full-time employees.
62. There should be a programme that every mine or metallurgical industry has for experiential training.
63. Curriculum/syllabus for WIL should be drafted in conjunction with industry management and revived annually for different organization.

64. For industry a training schedule may be implemented to ensure experience in all relevant areas.
65. A fixed written programme with guidelines and outcomes for the mentor so that he/she always knows what the criterion for acceptable WIL will be.
66. Better relationship between me and senior management in my department.
67. Proper guidelines and criteria for the WIL.
68. All was well with my situation. Continue with it. It is the right thing to do.
69. The expectations of what is expected from the student by the University should be better communicated.
70. Better recognition of students.
71. All in question 14 above (more support from university, more support from industry).
72. Supervisors from universities should visit the work place to check if their students are getting proper training.
73. Students must be taught each and everything that is the responsibility of a metallurgist, so that they can become the… metallurgist in the future.
74. Clarify the duties of the trainee and be specific on the tasks to be performed by students.
75. Follow up from university to ensure student is doing the relevant and appropriate work (not a messenger or tea person).
76. The university should check on their students at industry to find out how they are treated.
77. Mentors or supervisors must always ensure that students have work to do at all time. Students should be given more responsibilities.
78. Universities should make it their sole business in ensuring experiential training for students in industries.
79. There must be job opportunities after we are done.
80. Provide extended contract for better experience.
81. There should be a programme by the company not only from school that will serve as a training program/guideline for exp training students.

82. The lecturers should make sure that they visit the industry to check how well the students are treated most times.
83. For the university to be more involved.
84. I think the institution must have their own facilities to help students with training.
85. Students should be thoroughly prepared before doing experiential training.
86. The university should visit the student work location to see the situation and to support the students in their participation on co. production.
87. The University of Technology must ensure that the students are placed at the appropriate work area, for example a student must submit a brief summary of the scope of work he/she will be doing.
88. There should be two contact sessions (one at the beginning of the year and the other mid-year) in our major cities.
89. Universities need to be hands on in the development of a student, they should keep track of the student development during WIL and should also try to assist students in finding suitable WIL.
90. More visit from lecturer, it is important. Log book need to be easy to understand to avoid confusion.
91. There should be a programme where students should rotate from government, consulting firm and construction.
92. I believe that 12 months is not enough and 12 (or 17?) should be 24 months.
93. Stricter monitoring of ‘WIL”, more comprehensive syllabus, testing after ‘WIL”.
94. It should be scrapped, since the universities do not do much to ensure that every student get such a placement and delay the student to get her/his diploma.
95. Tertiary institutions and the respective academic departments must liase with industry and tell them exactly what is required from the student during the WIL process, in order to achieve desired outcomes.
96. Set special tasks to complete.
97. That UNISA may register Work Integrated Learning any time during the year.
98. I think, the way it is done it is ok.

99. Industries are not obliged to cover WIL curriculum, negotiations with the industry is emphasized. The company focuses on what they think (routine) is good for them to benefit from you as future employee.

100. That the government built a WIL for Unisa that the good theory be practiced by students.

101. Companies seem not to know what to do with students doing WIL. We end up doing irrelevant things.

102. Improve the information about the (WIL) to all registered students because at the beginning you don't have any idea!

103. Clear communication between the institutions and industry is required. Student show the schedule, based on his/her working industry.

104. Induction into working environment.

105. University must try to understand training system of the workplace & liase with the company.

106. Industry to develop proper procedures for this training to cover all fields of engineering.

107. Can UNISA please find us (WIL), and stop making us re-register for P1 & P2 subjects, because we didn't fin (WIL).

108. If your mentor in that particular industry of your attachment is not qualified in your field, but to other discipline e.g. BSC, with the help of the university you should be allowed to source the support of other one from outside.

109. A brief discussion about the content of the logbook. Contact time with lecturer (should visit at placement of work). (WIL) should be started after all first level subjects are passed.

110. A proper liaison between university and industry need to be strengthened.

111. It is difficult to get training, so it is better if the university organize training with companies for students.

112. Students to be taken throughout the WIL syllabus on a monitored basis and serve mostly for training purposes rather industry needs such as production.

113. The universities must expose the students to the industries during their theory period so that when they are finished they can easily adopt to the industries and know what is expected from them.

J2: RESPONSES TO OPEN-ENDED QUESTION 20

The following responses were given to question 20 of the questionnaire. It asked "If you were not provided with experiences provided in your curriculum during Work Integrated Learning, then explain briefly why."

1. Because I was placed in 1 project for a long time with limited experiences.
2. I was placed as a bursary student in a building maintenance environment.
3. The work was entirely the same as what was taught at school but we were taught the basics. So it was hard to perform tasks especially …??
4. Different fields.
5. It was a small company and most duties were given to senior and only non-design work was given to us.
6. It did provide basic knowledge on some as it was dealing with only part of engineering not in a broad spectrum.
7. There was not enough work to be given and a lack of trust.
8. I learned more on school that what I learned on site.
9. I was in the company that they were focusing on one thing and I have to go around and get the experience for my curriculum.
10. They were no prescribed mentors.
11. Not enough support from employer
12. The biggest problem was not being familiar with commercial design programmes in the university.
13. Not given responsibilities to experiment and express ones potential. This turns formal/academic education to be stereotypical, colour being the main concern followed by rigid culture.
14. First 6 months of WIL, mentor was not a qualified engineering technician/technologist, could not always provide applicable tasks.
15. DWAF uses specialized people, the work I did was only in one field of civil engineering.
16. Depends on the company & who you work with.

17. Miscommunication.
18. National Diploma obtained in 1987. Experiences obtained through practical experience. Furthering studies now.
19. It depends on division within the industry, I inspected slip forming, which is nowhere covered in our curriculum.
20. I have to gain experience in civil work (design) not administration only.
21. Because I was black and intelligent, they didn't give me much work to do.
22. I wanted to be in-charge of a project but I had no experience, I was just helping there & there.
23. Often
24. The trust wasn't enough from management because of inexperience.
25. Sometime you spent the whole year on a contract where you just repeat the same kind of work.
26. Industry is quite specific on one training that they provide. Most of the items required on WIL curriculum are left-out of one's training as they do not form part of the employment core business.
27. Everyone was focusing on production.
28. Industry can't afford to put too much trust on students with relevant responsibilities, so they just let them do their test works for them.
29. Was hoping for a job placement thereafter.
30. Not enough training was offered.
31. The mentor always busy to assist the student, even forget if there is a student to be held responsible of. Can't supply or support a project to be done by student.
32. The curriculum was based on a ……….Eng. Point of view.
33. Mentors not technical but just experience. They should be a good academic background.
34. I did not have a good experience, because I was not provided a mentor and managers don't have time for the student.
35. At times in the industry they push more production than project exposure.
36. The objectives for metallurgy students were not specified clearly.
37. The work was not really for metallurgist.

38. There were not enough educated people to help me with my report and project.
39. The company I worked for had different divisions of Metallurgical Engineering and I wasn't allowed to work on the other divisions to get experience.
40. The people at the mines (i.e. Mentors) were very supportive but the training structure from the company's training centre was not up to the standard. They only gave proper development to Electrical engineering and Mechanical and not Metallurgy.
41. I was only based in one site which means I was learning only that aspect of process.
42. Sometimes, other industries are very small to put to practice everything you have done in the class.
43. No single industry encompasses the programme outlined in the curriculum content. If more than 70% is covered then training should be approved.
44. Different experiences were in different departments, but to have gained the experience I have, I had to take it to myself and asked to be rotated for a certain period in each of those departments.
45. I had to work as if I already know the job. One day training was given; I had to trouble shoot the plant/process I knew nothing about.
46. It depended on exactly the nature of the project the employer was busy with at the time (resources).
47. The problem with doing WIL at a government is that most of the projects are given to the consultants and there is little work to be done.
48. Supervisors focus on the routine work of the division/department and train you on that. The student's goals/objectives at the end of WIL period is overlooked.
49. I would not apply the theory that I learned and ultimately forget it, I can differentiate between class and WIL.
50. Employees at work give students hard time and unpleasant attitude thus making it hard to gain experience.
51. Even though I have learnt a lot during my WIL; I didn't have a curriculum/study guide and therefore I can't be sure.
52. Industry experience was very ….not specific. Industry not having proper guidelines for this training.

53. Some of the experiences were lacking because my mentor was not purely qualified to Engineering, but to BSC (pure science).

54. Company or industry, they don’t have proper/structure of WIL, they are more in production than training.

55. The experience is quite limited for that specific industry, especially if the whole syllabus is not covered and more attention was given to industry needs than training.

J3: RESPONSES TO OPEN ENDED QUESTION 22

The following responses were given to question 22 of the questionnaire. It asked that "Do you have any other challenges?"

1. Supervision of experienced people while ….from school??
2. Students having to feed themselves as they are not paid well.
3. At times students are treated as employees and what they did best is what the company keeps saying he/she should do and end up not doing some aspects of the learning.
4. Lack of confidence in students.
5. Racism
6. After you have been placed not one will make follow up on your progress.
7. Hope
8. Support to WIL is vitally important.
9. Being used as a driver or a tea lady.
10. Racism & victimization to black students by white guys.
11. Not placed in the right work place.
12. The challenge of being employed with a National-diploma. Universities must phase out a National diploma in Metallurgy.
13. Accountability in Industry: All work has to be supervised to prevent students from being targeted as "scapegoats".
14. No
15. Yes, most of the things that are done in industry is the same.
16. Trainees are not seen as part of the company especially by trade unions who think that trainees will be taking jobs of permanent employees who were employed because of experience and no qualifications.
17. Supervisors from company take time to mark my report.
18. Relevant lecturers not visiting students at their work place.
19. The challenge of always being considered as a student by industry and not an employee who is part of the team to produce for the co.

20. The university should periodically get feedback from the student's mentor to make sure that he/she is in a right track.
21. Universities tend to forget about students once students go for their WIL period in industry or company. Universities need to offer support to their students and practice such code and not for it to be good on paper as their policy.
22. Being taken as a student. Not being given the opportunity to prove yourself as one of the employee.
23. Set out criteria.
24. Improvement of industrial relation with universities & students, employees as well.
25. Teach students how to start projects and how to compile detailed reports and research!
26. After few month company used students to do all jobs and using them to reduce costs for employing staff.
27. Industry working together with varsity to develop the necessary training to be provided to equip students for employment and also ensure that they get to graduate.
28. Please contact and liaise with students more.
29. The need of having a fully qualified mentor in your field of study.
30. No.
31. Not using you/recognize your qualification.
32. No.