# The employability skills of analytical chemistry graduates from an institution of higher learning:  An investigation of their relevance to potential employers in the Western Cape

**by**

**FUNDISWA REGINA NOFEMELA**

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**Supervisor:  Dr Carly Steyn**

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# DECLARATION

I, Fundiswa Regina Nofemela, declare that the contents of this dissertation represent my own unaided work, and that the dissertation has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

**27 March 2014**

**Signed**                                                                                        **Date**

## ABSTRACT

The shift in the employability skills required by employers has meant that, over and above their qualifications, graduates now need to have a set of specific skills that will enable them to be productive in the workplace. The basis for this study stems from the hypothesis that the intense competition for employment among graduates has meant that prospective employers now have a say in the attributes that are needed for potential employment. It is now no longer adequate for graduates to have a qualification, but to have, over and above the degree, specific employability skills that will enable them to be productive in the workplace.

This study investigates the employability skills of analytical chemistry graduates at a university of technology for potential employers in the Western Cape. This was determined through a mixed-method approach, using both qualitative and quantitative research, and conducted amongst employers of analytical chemistry graduates in the chemical, cosmetic, petrochemical and pharmaceutical industries.

In order to investigate the relevance of the employability skills, the following questions were asked:

a. What skills are employers of new analytical chemistry graduates looking for in potential employees?

b. What are the skills that past and current employers of analytical chemistry students, and graduates from the university of technology under investigation, have identified as important in these students and graduates?

c. Is there congruence between the skills required by potential employers and those demonstrated by analytical chemistry graduates from the university of technology under investigation?

This study was the basis for a potential further investigation into the development of a curriculum that will enable students to acquire the skills required by industry.

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# DEDICATION

This dissertation is dedicated to the memory of my father, the late Sipho Goodluck Nofemela, who would have derived a great sense of pride from this academic achievement.

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**Chapter 1**

## 1.1    INTRODUCTION

The working environment has, in recent years, undergone a number of changes. There has been the move towards outsourcing, as a result of companies scaling down their operational requirements, as well as the influence of the information technology era, resulting in the automation of considerable operations. For a number of companies, these changes have resulted in the reduction of employee numbers as companies seek to keep their employee count as low as possible. This has been accompanied by a rise in graduate unemployment, irrespective of the areas in which these graduates have qualified (Moleke, 2005:19). This, in the researcher's opinion, suggests that today's employers, in trying to streamline operations, are looking for employees with more than just the technical knowledge, but those that also have other skills that would contribute to their effectiveness across a spectrum of jobs in the work place.

The rise in graduate unemployment has resulted in a debate on employability and employability skills. It has also prompted a number of countries, for example, Australia, Portugal and the United Kingdom, to conduct studies on what skills employers in those specific countries require from new graduates.

This study sought to establish the skills that the analytical chemistry sector requires from new chemistry graduates and whether the graduates from a university of technology in the Western Cape possess these skills.

## 1.2    PROBLEM AND PURPOSE STATEMENT

A student that enrols at an institution of higher learning does so with a specific purpose:  to acquire a qualification, find employment, be independent and advance in the chosen career (Moleke, 2005:21). As a result, the role and ultimate measure of an institution's success should not so much be the throughput of its students, but whether or not its graduates are able to find employment. For this reason, it is imperative for an institution of higher learning to keep abreast of the evolution that characterises the world of work.

In its 2005 report on employment experiences of South African graduates, the Human Sciences Research Council (HSRC) noted that only 60 percent of graduates find employment immediately after graduation (Moleke, 2005:19). This is probably attributable to a "skills mismatch problem" that exists between the types of skills and qualifications held by graduates and the demand for certain of these skills by potential employers (Stewart & Knowles, 1999:375; Cilliers, 2000:7; Moleke, 2005:19). This mismatch is because it is no longer adequate for graduates to have a qualification, but to have, over and above their degree, specific employability skills that will enable them to be productive in the workplace. As a result of the shift in employer requirements, there is an intense competition for employment among graduates as employers now value general employability skills more than they do degree status (Stewart & Knowles, 1999:375).

The purpose of this study was to investigate the relevance of the employability skills of analytical chemistry graduates from a university of technology for potential employers in the Western Cape. This investigation was conducted amongst employers of analytical chemistry students/graduates in the Western Cape, using a mixed methods approach of both quantitative and qualitative. Such organisations can be grouped into chemical, cosmetic, petrochemical, food, pulp and paper, nuclear, research and pharmaceutical industries and research.

## 1.3  OBJECTIVES OF THE RESEARCH

In undertaking this study, it was hoped that the findings would provide a basis for further research into how the Academic Planning Department at the institution under investigation could ensure the development of an employable chemistry graduate. This could be achieved through developing a curriculum as well as teaching and learning methods that enhance the desired employability skills in the graduates.

To this end, the following were the objectives of this study:
1. To determine the skills that employers require in analytical chemistry graduates.
2. To establish whether the graduates from the institution under investigation possess the skills that potential employers require.
3. To establish whether there is congruence between the skills that employers require and those that the new graduates from the institution under investigation possess.

## 1.4  THE RESEARCH QUESTIONS

The objective of this study was to investigate the relevance of the employability skills of analytical chemistry graduates at a university of technology for potential employers in the Western Cape.  In order to reach this objective, the following questions were asked:

1) What skills do employers look for in new analytical chemistry graduates?
2) What are the skills that Western Cape employers have identified in analytical chemistry students and graduates from the institution under investigation?
3) Is there congruence between the skills required by potential employers and those demonstrated by analytical chemistry graduates from the institution under investigation?

## 1.5  DELINEATION OF THE STUDY

As this study sought to investigate the relevance of the employability skills of analytical chemistry graduates for potential employers in the Western Cape, it was limited only to employers in this sector and region. Within this sector, the study was conducted amongst

employers in the chemical, cosmetic, petrochemical, food, pulp and paper, nuclear, research and pharmaceutical industries. The study was not limited to employers that have employed students from the institution under investigation, but included those that had not participated in the experiential learning and graduate recruitment programmes of the institution. This ensured that the quantitative research of this study was able to establish an elaborate list of employability skills required by employers across the various industries that this study was targeting. This list of required employability skills provided a benchmark against which the respondents based their opinions as to whether the graduates under investigation possessed the required skills or not.

## 1.6    RESEARCH METHODOLOGY

In order to develop a framework for the employability skills list, a mixed method of both qualitative and quantitative research was conducted among 50 supervisors at 25 organisations that employ analytical chemistry students and graduates. The study was conducted in three phases:

### 1.6.1    Desktop phase

A desktop study was conducted to establish a list of general employability skills. This phase was conducted with a view to formulating a framework for all skills across disciplines. As a result, it was not limited to literature referring only to employers in the sector under investigation. This enabled the researcher to compile a skills list that represented the requirements of various sectors.

### 1.6.2    Quantitative phase

In this phase, the comprehensive skills list established from the desktop phase was compiled into a questionnaire. This questionnaire was distributed among 50 supervisors at organisations in the chemical, cosmetic, petrochemical, pharmaceutical, food and nuclear industries.

The questionnaire was divided into two (2) sections. The first section listed the employability skills compiled from the desktop study. The participants were requested to rate these attributes according to levels of importance in their specific environment. This section was directed at supervisors across the industries that were targeted, irrespective of whether they

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had supervised analytical chemistry students and/or graduates from the institution under investigation, or not.

The second section was specifically directed at supervisors that had supervised experiential learning students and new graduates from the institution under investigation in the period under review. In this section, the respondents were provided with a list that combined both the skills list that had been identified from the desktop study as well as Section 1 of the questionnaire. The respondents were requested to identify those skills which they had found that the students and/or graduates under investigation, demonstrated.

### 1.6.3  Qualitative phase

In preparing for this phase, a data sheet which showed the skills that had emerged to be extremely important, yet lacking in the graduates under investigation, as well as the respondents that had given this indication, was compiled. These respondents were interviewed in order to establish the use and value of the selected skills at the various organisations as represented by the respondents.  In addition to this, the respondents were asked to suggest ways in which the institution under investigation could enhance these skills in their graduates.

### 1.6.4    Sampling

The study population comprised organisations that had hosted students and/or graduates from the institution under investigation during the period 2006 – 2010.  Specifically the population comprised organisations that operate in the chemical, cosmetic, petrochemical, food, pulp and paper, nuclear, research and pharmaceutical industries in the Western Cape Province. As there was no available data on graduate placements at the institution at the time of the study, the population comprised only those organisations that had employed experiential learning students in the period under review.  The activity of some of these organisations in graduate employment was established in the interview phase.

To be able to establish whether or not there is congruence between the skills list portfolio of students and graduates from the institution under investigation and the skills that are required

by potential employers from these students, it was necessary to conduct the study across all industries where the institution's analytical chemistry students were employed in the period under review. Despite the lack of delineation in this regard, the study was able to give an indication of common general skills that are crucial for the sector.

## 1.7 SIGNIFICANCE OF STUDY

One of the challenges facing South Africa is a "mismatch between the output of higher education and the needs of a modernising economy" (South Africa, Dept of Education, 1997). As such, one of the goals of the *White Paper* on the transformation of higher education is to develop graduates who subscribe to the notion of life-long learning, think analytically, and can deal with change and diversity (South Africa, Dept of Education, 1997).

The results of this study have the potential to inform the development of a curriculum that enables the students to acquire the skills that are required by industry. To this end, the chemistry department at the institution under investigation will be provided with the list of skills that have been identified through the results of this study, as those that are required by industry. It is hoped that the department will then include these in the curriculum design. The envisaged outcome is that the inclusion of this study's results in the curriculum will help the institution to make progress in its vision to include relevant graduate attributes in the programmes that it offers and that, through this effort, a positive contribution towards the transformation of higher education in South Africa will have been made.

## 1.8 CLARIFICATION OF TERMS AND ACRONYMS

### 1.8.1 Abbreviations

CPUT:     Cape Peninsula University of Technology

ITS:     Integrated Tertiary System

Co-op:      Co-operative Education

SLA:     Service Level Agreements

HEQC**:**     Higher Education Quality Committee

### 1.8.2 Terms

**Co-operative Education:** Co-operative Education is a philosophy of learning that promotes the concept of enhanced learning based on cooperation between education institutions on the one hand and industry, commerce and the public sector on the other (HEQC, June 2004, p. 40).

**Experiential Learning:** Experiential Learning is a term that refers to any form of learning that has meaningful learner involvement. It is learning through reflection on doing. It is related to co-operative education and service-learning.

**Sector**: The part of the economy made up by companies. It is a subset of the domestic economy, excluding the economic activities of general government, private households, and non-profit organisations serving individuals.

**Industry**: The production of economic goods or services within an economy

### 1.9    OUTLINE OF CHAPTERS

Chapter 1 gives an overview of the project, including the introduction of the topics in the different chapters. The second chapter presents a literature review which was conducted in order to develop a conceptual framework of the different aspects of graduate employability, its importance in the competition amongst institutions of higher learning, as well as employability skills. Further, this chapter draws distinctions between employment and employability and also demonstrates how various authors classify skills.

Chapter 3 details how the research was designed and executed. It also gives a theoretical background to research methodologies, detailing the reasons for the use of specific research methods in this study. In the fourth and fifth chapters, respectively, the findings of the quantitative and qualitative studies are analysed. These findings are interpreted in Chapter 6.

Conclusions drawn from the research project, as well as recommendations for taking the study forward are presented in Chapter 7.

# Chapter 2
# LITERATURE REVIEW

## 2.1 INTRODUCTION

This study seeks to establish whether there is congruence between the skills that prospective employers from the Western Cape require, and those that analytical chemistry graduates from a university of technology in this region, possess.

The focus of this literature review, therefore was, firstly, to gain a deeper understanding of the terms "employability" and "employability skills", as well as their relevance to higher education. Secondly, it was to interrogate what previous studies have found to be desirable employability skills in new graduates, across disciplines and industries.

## 2.2 THE RELEVANCE OF EMPLOYABILITY SKILLS TO HIGHER EDUCATION

The relevance of an employability skills study in respect of higher education is that the environment in which these institutions are operating has become more competitive, thus forcing each institution to adopt a more market-driven approach and to redefine its product (the student) and its attributes.

The background to the marketization of higher education, as documented by various authors, provides an insight into this market approach within the higher education environment. The major contributors to this phenomenon have been financial pressures that emanate from a variety of areas:

1. Cuts in state funding that have resulted in institutions of higher learning having to find alternative ways of raising funds (Bolsman & Uys, 2001:176).

2. Pressures on institutions of higher learning in South Africa to transform, means that they have to accommodate a student population that is representative of the country's demographics (Bolsman & Uys, 2001:176). Often, the majority of these students are unable to meet the financial requirements of higher education. Despite this, institutions are often placed under pressure not to embark on financial

exclusions; thus students continue to study, while accumulating debt against the institution. The result of this is that institutions are under immense financial pressure.

3. Mergers in higher education have resulted in the formation of universities of technology and comprehensive universities. This has meant that, unlike in the past, where technikons (now called universities of technology) and universities had different target markets, most institutions now compete in the same market. This means that prospective students now have a wider choice of where they would like to enrol. As a result of this, students now act as clients to various markets or segments of the market (Bolsman & Uys, 2001:176).

The above factors have resulted in increasing competition amongst institutions (De Jager & Du Plooy, 2006:11), as each institution aims at attracting the best and ideal type of student from across the artificial barriers of society.

The students, in turn, now have a wider scope when it comes to choosing an institution at which to enrol. As in any competitive environment, students, in this case, the clients, will base their choice of institution on the potential of that institution to meet their expectations. In view of the assertion by Moleke (2005:21) that students study in order to eventually enter the labour market, it follows that institutions of higher learning now face pressure to ensure that the students that they have accepted will eventually be absorbed into the working world. It therefore becomes imperative for institutions of higher learning to redefine the product that it offers its client, the student, and to place emphasis on developing the attributes that are required by prospective employers to give these students an opportunity to compete favourably.

There are a number of ways that institutions have endeavoured to do this. Of particular interest to the author is the fact that, in getting closer to the market place, institutions have become "knowledge factories", in that they now no longer produce knowledge for its own sake, but seek to produce what is called "useful knowledge" (Bolsman & Uys, 2000:177). The researcher's understanding of this term is that this is "knowledge that can be applied in the workplace".

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Knowledge is now seen as a *commodity* (Bolsman & Uys, 2000:176), which implies that institutions of higher learning are moving away from the classical liberal arts education that was essential to prepare moral, civic and intellectual leaders, and closer to vocationalism, which places emphasis on equipping graduates with knowledge necessary for the labour market (Bolsman & Uys, 2000:176).

## 2.3 EMPLOYABILITY, EMPLOYMENT AND THE WORLD OF WORK

The definition of employability seems to have gone full circle (Clarke, 2008:258). Initially, in the 1800s, the concept meant being in a job where one took responsibility for one's own employment (Bagshaw, 1997:187). Contracts were shorter and employees moved around in pursuit of job opportunities. This changed in the period immediately after the industrial revolution. This period saw employability changing to longer contracts and employee expectations of long-term employment as long as they had company-specific knowledge and loyalty to the employer (Rousseau, 1995:5). The twentieth century saw the emergence of an environment where employment patterns changed as a result of structural changes within organisations. As organisations underwent downsizing, restructuring, de-layering and outsourcing, they moved away from the long-term hierarchical careers characterised by long-term employment and transactional agreements which promised job security, career opportunities and promotion, to one where organisations could only keep an employee for as long as they needed his or her particular skill (Rousseau, 1995:5). Now, in the 21st century, the employment world has reverted to an environment that is characterised by short-term contracts and one where employment is dictated by skills that a particular employee has acquired.

Employment is defined as having a job, while employability is having the qualities that enable one to obtain employment, maintain that employment as well as progress in it (Lees, 2002:2). According to Lees, the individual's employability depends on the following factors:

1) Their assets in terms of the knowledge (what they know), skills (what they do with the knowledge) and attitudes (how they do it).
2) The way they deploy these assets.
3) The way they present them to prospective employers.

4) The context within which they see work.

While this may be true, these may not be the only factors that determine an individual's employment. There may be factors that are outside the individual's sphere of control that impact his or her employment. These could be *prevailing labour market contexts* (Moleke, 2005:50; Clarke, 2008:262). These play a role in employability of individuals and can thus foster or hinder an individual's employment.

Having the correct skills mix may well increase one's likelihood of securing employment, but does not necessarily guarantee it (Clarke, 2008:262). The nature of the labour markets in individual regions plays a role as well. For instance, Moleke's (2005:5) study found that, in the case of South Africa, graduates who studied at historically white institutions were absorbed into the labour market fairly quickly after graduation, when compared with their counterparts from historically black universities. These findings were consistent with the racial breakdown of graduates in employment. This is attributed to the fact that South African employers seem to perceive white graduates and/or graduates from historically white universities to be more employable (Moleke, 2005:15). Furthermore, the impact of an individual's personal characteristics is highlighted by Moleke (2005:2), Tomé (2007:339) and Clarke (2008:265), although with differing levels of emphasis. In Moleke (2005:2), the impact of personal characteristics is encapsulated in the field of study that an individual has chosen. Graduates from engineering, economic management sciences and natural sciences are absorbed much more easily into the labour market, as employers perceive them to have the character traits that they need (Moleke, 2005:2). It is, however, not clear from Moleke (2005:2), whether this refers to specific traits that are associated with specific fields, or if it refers to general traits that are applicable across fields. Clarke (2008:266) is specific in this regard and asserts that self-esteem, self-efficacy, risk-taking and adaptability play a role in an individual's employability. This author takes this argument further by elaborating on variables that determine an individual's personal characteristics, maintaining that age, gender, marital status, ethnicity, family responsibilities and physical characteristics, while being factors outside an individual's control, are often critical in determining a person's ability to secure and keep employment.

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For example, employers view age in varying ways. While some may be prejudiced against employing older individuals as they may view them as being less flexible and adaptable, others see them as having experience, knowledge and a stronger work ethic. For other workers, the ability to secure employment may be hindered by family responsibilities, for example, children, partners, ageing parents, etc.

Tomé (2007:340), concurs that labour factors do impact on employability, but expands on Clarke's (2008) argument by adding that the following economic factors also have an impact on employability:

1) Economic changes affect employability as innovation renders individuals unsure of what skills will be required in the future. This makes it difficult to embark on lifelong studies and educational institutions are often not sure if what they teach corresponds to social needs.

2) Diversification: As organisations undergo globalisation, competence profiles of individuals become more diverse.

3) Equality of jobs: According to Tomé (2007), jobs are not all equal, and individuals with employability skills will be capable of securing jobs that are well paid and secure, with good working conditions.

4) Public policies: In some instances public intervention may be instituted in cases where skills equilibrium is either low, with low numbers of highly qualified people, or high, with jobs requiring very high qualifications. In both these instances, government may enforce a specific educational system for the majority of the population or an incentive to companies that create vacancies for qualified individuals.

In order to keep within the context of this study, and while accepting the impact of both the employability skills as well as other extrinsic factors, the focus of this study will be on the impact that the skills of an individual have on his/her employability. In keeping with this, the discussion will now turn to defining the skills that determine a person's employability.

## 2.4    EMPLOYABILITY SKILLS AND EMPLOYMENT

Cilliers (2000:7) cites a lack of employability skills as one of the challenges encountered by new graduates in securing employment. According to this author's study, one of the primary complaints of organisations in the nineties was that graduates were generally not well prepared for current and future workplace needs.

The studies by Clarke (1997:2), Stewart and Knowles (1999:374) and Moleke (2005:19), all concur with that of Cilliers (2000:264) and indicate that there is a disjuncture between what the employer needs and what the new graduates can offer. This is caused by the fact that there is now a shift from "knowing what" to "knowing how" and institutions of higher learning need to keep this in mind in their development of the student.

While the definition for employability, discussed earlier, is useful, one also accepts that it is broad, thus making it difficult to have consensus on the definition of employability skills. One of the reasons for this difficulty is that various authors define these skills according to how they choose to classify them.

There are also, according to Lees (2002:2), several synonyms used for employability skills, viz. core, key, generic, personal transferable skills, common, work or employment-related skills.

Lees (2002) chooses to classify skills according to four areas, namely:

1) Traditional intellectual skills.  In essence, these refer to the ability to construct a logical argument and to give a critical evaluation.
2) Key skills. These are skills that one uses in the daily life, for example, communication, information technology, teamwork, etc.
3) Personal attributes. These are skills that are inherent in an individual and cannot be learned, for example, motivation, self-reliance, self-management and willingness to learn.
4) Organisational knowledge. This is knowledge about the organisation, its culture, norms, its vision, etc.

Stewart and Knowles (1999:381), in examining the changing nature of graduate careers, refers to the three-way classification as put forward by the London Department for Education and Employment report. According to this report, employability skills are classified according to:

1) Vocational skills – These are skills needed in particular occupations or groups of occupations but may not be as useful outside of these occupations.  An example of these is the ability to use a computer.
2) Job-specific skills – These are specific forms of knowledge and their usefulness is limited to a much narrower field of employment.
3) Key or core skills – Very general skills needed in almost any job.  These include literacy and numeracy and a range of personal transferable skills such as the ability to organise one's own work and, often, a basic capability to use information technology.

Clearly the skills referred to in the latter group are applicable across employment fields, and in the researcher's opinion, may well be some of the skills that higher education should consider incorporating into most of its curricula.

Stewart and Knowles (1999:371) report on the classification of the actual skills, prefer the term "transferable skills" as opposed to "key" or "core" skills. Transferable skills require reflection and self-awareness on the part of a worker, as these are refined and developed in the course of every activity that the student undertakes, whether it is related to academic study, a job or social life.  These skills are required in any job.

Although De Lange's (1998:57) classification is similar to the one by Stewart and Knowles (1999:371), it differs slightly.  This author refers to employability skills as workplace skills and classifies these according to two categories, viz. job content skills and non-technical skills. The author further classifies non-technical skills into functional skills and adaptive skills. According to De Lange, the non-technical skills are not job specific but are *complementary to job content skills* (De Lange, 1998:57). In unpacking the non-technical skills, De Lange refers to various terms used to define functional skills and clusters transferable skills, together with basic skills, general skills, work behaviours and key

generic skills, under these skills. On the other hand, De Lange (1998:57) clusters personal skills, self-management skills, and attitude towards work under adaptive skills (see Fig 2.1). This clearly shows the distinction that he draws between these two classifications, with functional skills referring to skills that can be learned and adaptive skills referring to skills that come from within.

It is interesting to note that both De Lange (1998:40) and Stewart and Knowles (1999:382) use employability skills as a generic term that encompasses all skills, including vocational and job specific skills, while Lees (2002:4), in her classification, and even in the examples that are cited, does not make reference to any other skills but the general ones.

To illustrate De Lange's classification, an adaptation of this author's framework is represented below.

```
                    ┌──────────────────────────┐
                    │   Non-technical skills   │
                    │      Also known as:      │
                    │   Employability skills   │
                    │      Generic Skills      │
                    │       Life Skills        │
                    └──────────────────────────┘
                    ┌────────────┴────────────┐
┌──────────────────────────┐      ┌──────────────────────────────────┐
│      Functional Skills   │      │        Adaptability Skills       │
│    Communication skills  │      │   Personal self-management skills│
│      Creative thinking   │      │  Work-related desposition and    │
│       Problem-solving    │      │            attitude              │
│   Information management │      │           leadership             │
└──────────────────────────┘      └──────────────────────────────────┘
```
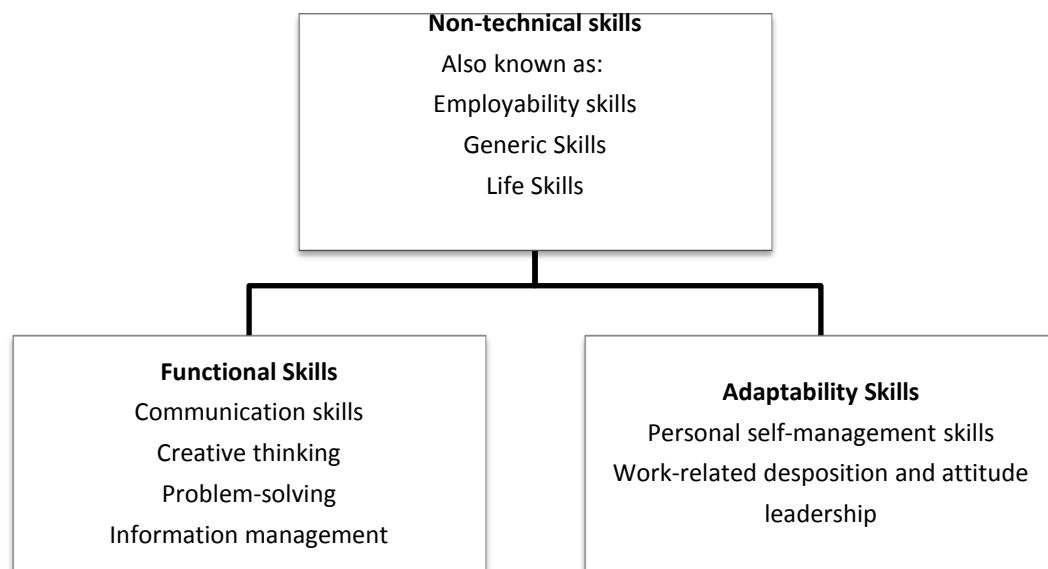
**Fig. 2.1: A schematic representation of De Lange's (1998) classification framework**

The emphasis of the work by Cilliers (2000:258) is on employability skills under general terms, and classifies these into intrapersonal and interpersonal skills (Fig. 2.2). A closer look at the classification by Cilliers (2000:258), shows that, though different terminology is used, the skills clustered under interpersonal and intrapersonal skills, are similar to the ones proposed by De Lange (1998:57). Of note, however, is that

Cilliers (2000:258) does not mention technical skills. Also, in reading this author's chapter on the changing demands on employee attributes, one gets the impression that when Cilliers (2000:258) refers to employability skills, technical skills are excluded, which suggests that the author sees technical skills as a separate class of skills.

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                        ┌─────────────────────────┐
                        │   Employability skills  │
                        │                         │
                        └─────────────────────────┘
                                    │
                      ┌─────────────┴─────────────┐
          ┌───────────────────────┐   ┌───────────────────────────┐
          │                       │   │    Intrapersonal Skills   │
          │  Interpersonal Skills │   │   •Life-long learning     │
          │  •Communication skills│   │  •Self-management skills  │
          │   •Creative thinking  │   │      •Motivation          │
          │    •Problem-solving   │   │      •Leadership          │
          │ •Information management│   │ •Flexibility and adaptability│
          │                       │   │                           │
          └───────────────────────┘   └───────────────────────────┘
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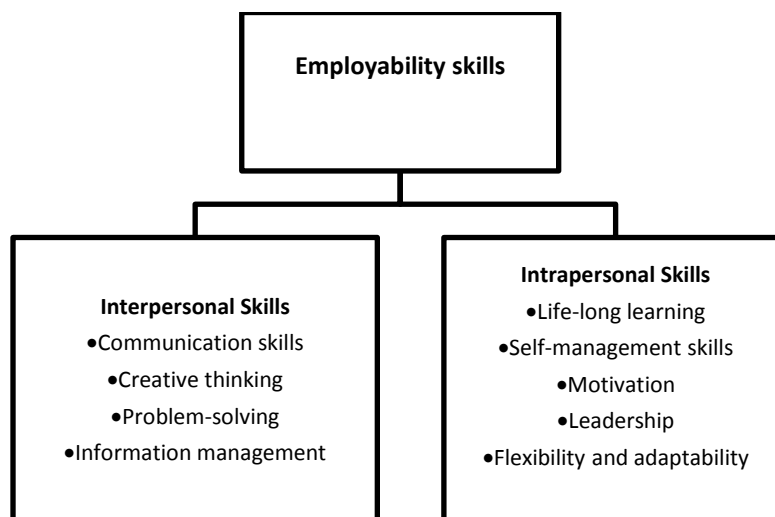
**Fig. 2.2:  A schematic representation of Cilliers' classification framework**

A comparison of the works by De Lange (1998:57), Stewart and Knowles (1999:382), Cilliers (2000:258) and Lees (2002:3) has yielded a broad understanding of the various skills that are important for the work place, despite the varying classifications.

It is also important to note that the works of the four authors referred to in the paragraphs above is a result of research conducted across varying industries and is, therefore, not limited to a specific industry.

Interestingly, in a pilot study conducted prior to commencing this study, the researcher held individual discussions with six human resource practitioners from employers of third-year analytical chemistry students. These discussions revealed that organisations seek more than just job-specific skills when selecting employees, but that teamwork, life-long learning, adaptability and technology skills form a major part of the skills required for the workplace (Nofemela, 2007). Clearly, some of these correspond with those listed above. What is notable is that while the classifications differ, there seems to be a common thread running through these classifications in that the majority of the actual skills noted by

authors in the various classifications, are common. This has made it easier for the researcher to draw a comparative tabulation of the various skills identified by the various authors as those that are required across industries (Table 2.1).

These skills lists are a combination of independent studies by higher education practitioners from South Africa and abroad, as well as studies commissioned by governments in Australia and Canada. The lists compiled by the latter studies were conducted by means of surveys amongst employers in these countries. The purpose of these studies was to assist the departments of education in these countries in developing curricula.

The other group of literature comprises individual studies conducted by higher education practitioners concerned with the development of curricula that are responsive to employer needs. Most of the literature from this group is written by authors from abroad, and was compiled through a survey of existing literature.

As there is a paucity of literature dealing with this topic in South Africa, the South African authors have surveyed international literature and have also conducted surveys amongst employers in specific local industries.

From the literature studies, the researcher has compiled a list of twenty three skills in order to develop a framework of skills for this project (see Table 2.1).

From the literature studies, the researcher has created a tabulation of skills as indicated by various authors to be the most commonly required skills. When this tabulation was analysed, only the skills that were mentioned by more than one study were considered. The following three skills were therefore eliminated, trustworthiness, decision making and the ability to take initiative. In certain instances two skills were combined due to their relatedness. These were flexibility and the ability to adapt to new situations, as well as planning and organising. This resulted in the shortening of the list from 23 to 18 skills (Table 2.2).

**Table 2.1: A tabulation of the lists of employability skills as presented in some of the reviewed literature**

| | Cilliers | Raybould | SAQA | Stewart & Knowles | McQuade & McGuire | Clarke (1997) | Lees | Curtis & McKenzie | Employability Skills 2000+ | Overmeyer & Morris | Griesel & Parker |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ability to solve problems | X | | X | X | X | X | X | | X | X | X |
| Ability to think critically | X | | X | | | | | | X | | X |
| Willingness to learn and continue learning | X | X | | | | X | X | | X | | X |
| Flexibility | X | | | | | X | X | | | X | X |
| Ability to adapt to new situations | X | | | | X | X | X | | X | | |
| Leadership | X | | | X | | | | | | | X |
| Communication | X | X | X | X | X | X | X | | X | X | |
| Ability to plan | | X | | | | | | | | X | |
| Ability to use technology | | X | X | | | | | | X | X | |
| Self-confidence | | X | | | | X | X | | | | X |
| Self-management | | x | | | | | | | | X | |
| Ability to work in a team | X | X | X | X | X | X | X | | X | X | X |
| Entrepreneurship | | | X | | | | | | | | |
| Motivation | | | | X | | X | X | | | | X |
| Organisation | | | X | X | | | | | | X | |
| Client focus | | | | | X | X | | | | | |
| Trustworthiness | | | | | X | | | | | | |
| Decision making | | | | | | X | | | | | |
| Numeracy | | | | | | | X | | X | | X |
| Ability to take initiative | | | | | | | X | | | | |
| Research skills | | | | | | | X | | | | X |
| Time management | | | | | | | X | | | | |
| Analytical skills | | | X | | | X | X | | X | | X |

Table 2.2 below shows all the skills that, according to Table 2.1, are indicated as being commonly required across disciplines.

**Table 2.2: A list of the most commonly required employability skills across disciplines (in no particular order)**

Team work

Different forms of communication (oral, written and presented)

Problem identification, analysing and solving

Life-long learning

Adaptability

Flexibility

Use of technology

Self-confidence

Motivation

Planning and Organising

Critical thinking

Numeracy and quantitative literacy

Appreciation of different cultural contexts

Client focus

Negotiation and mediation

Ability to generate new ideas

An understanding of economic and business realities

Research skills

Interestingly, the above list of skills seems to fit into the groupings as illustrated in the schematic representations of the classifications by De Lange (1998:57) as well as Cilliers (2000:258) (see Figures 2.1 and 2.2). Also notable from the list above is that a number of the skills listed, viz. the ability to work in teams, inclination to learn and continue learning, adaptability, flexibility, self-confidence, motivation and self-management are those that come from within the person. This clearly points to the fact

that employability has shifted to the *type of person* as opposed to *what the person knows.*

Below is a discussion of some of the skills taken from the ones listed above. This discussion was meant to give the researcher an understanding of the definitions of the various skills. With this done, the researcher was able to probe respondents better, where necessary, in order to gain a clear picture of the capabilities of the group of students under investigation.

## 2.5    DISCUSSION OF THE MOST COMMONLY REQUIRED SKILLS

### 2.5.1  Teamwork

Teams in organisations are groups of people that have been formed to work together in a common cooperative action. The main purpose of this is to achieve outcomes that are to the benefit of the organisation rather than to the benefit of an individual (Potgieter, 2007:132-136). An organisation's purpose is to be profitable. The workers and teams within the organisation are important vehicles to achieve this goal.

According to Potgieter (2007:134), teams are important because they:

- improve performance through reduction of defects and higher customer service and sales,
- lead to improved job satisfaction due to intrinsic rewards for the workers,
- free management from buffering the work process,
- lead to increased commitment to team performance,
- help in the generation of creative solutions to problems, and
- help to decentralise decision making.

All the above benefits of teams lead to higher productivity. By implication, this means that the individuals that an organisation employs have to be able to work effectively within these teams.  According to Curtis and McKenzie (2002:44), studies conducted by Field and Mawer in 1996, show that high performance in an individual is attributable to the ability to work in a team. These authors are of the opinion that an

individual who is a team player can tolerate uncertainty and respects different view points and communication styles.  Stewart and Knowles (1999:382) agree and define teamwork as the willingness to work as an effective member of a team, involving others to forward one's ideas and solve problems, utilising the skills of team members and being open to the opinions and ideas of others. This attribute is part of the intellectual and attitudinal core required by employers (Curtis & McKenzie, 2002:33). On close examination, the benefits listed by Potgieter (2007:132-136) encompass the utilisation of various other skills. For example, an increased commitment to team performance results from a sense of accountability to the team.  Likewise, taking advantage of a decentralised decision-making process requires individuals who actually have the decision-making skill. As such, one would affirm Curtis and McKenzie's (2002:44) assertion that teamwork forms part of an employee's intellect and attitude as it encompasses some of the skills as listed above, viz., problem solving, effective communication, adaptability and flexibility, and teamwork, and therefore, has a broader impact than just the ability to work with others.

All the readings revealed that employers view teamwork as one of the top skills required in a worker, in the current changing work environment. The fact that team-work encompasses other skills also, means that the ability to work in a team is perhaps one of the most important traits for employees in this era of change and re-engineering.

### 2.5.2  Communication

Communication is a process by which information is exchanged between two or more people, usually with the intention of motivating and influencing behaviour (Cunningham, 2007:162-166). Communication skills include oral and written forms as well as the use of technology.

During communication, many activities take place from the source of the message to the receiver.  In the model for interpersonal communication cited by

Cunningham (2007:162), the communicator's skill, at the source of the message, informs how the message is encoded so that the receiver understands it in order to be able to give feedback. Likewise, the receiver's skill informs how the message is decoded in order to give appropriate feedback. Both the communicator and the receiver's skills are informed by the individual's attitudes, knowledge and cultural systems. See Fig 2.3, below.
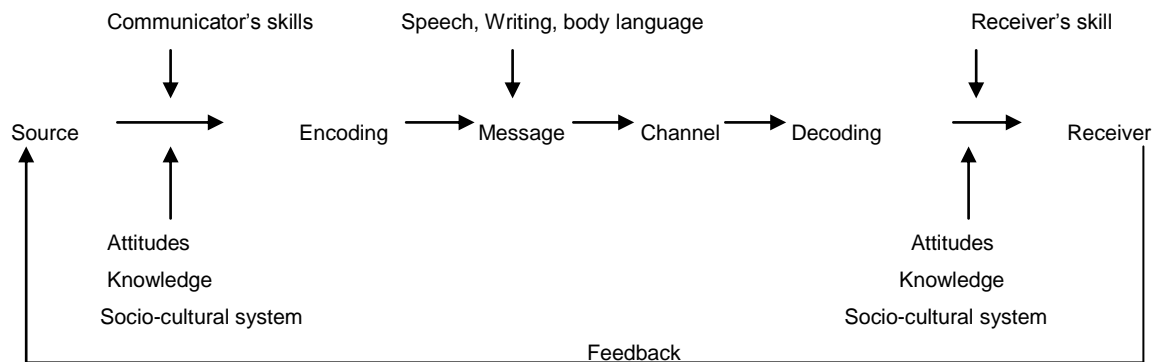


**Fig 2.3: A basic interpersonal communication model**

If this is true, it then follows that the communication skill of both the communicator and the receiver is crucial for the transmitted message to have the desired impact.

Communication in an organisation serves three purposes, viz. it allows members to coordinate actions, share information and satisfy social needs (Cunningham, 2007:162-164). Without communication, groups or organisations cannot effectively transmit orders, build team spirit and cooperation, nor identify problems and their solutions. This, therefore, can result in a host of organisational problems.

Communication skills emerge in all desktop material consulted as one of the most important skills required from new graduates. An enormous range of attributes are conferred by communication skills; it has therefore become clear

that these skills no longer comprise only the ability to read, write and be conversant, but to do this clearly and persuasively (Stewart & Knowles, 1999:374).

As mentioned earlier, communication is more than the personal interaction between two people, but one of the ways in which organisations maintain their cutting edge. The changing work environment has begun to require its workers to have technological savvy, as this is one of the ways that organisations in the twentieth century communicate with internal and external stakeholders. With the emergence of new patterns of communication, and with flatter organisational structures, firms are increasingly involving lower-level employees in decision making and forming loose alliances with external stakeholders. The impact of this is that the demand for this type of communication skill is high amongst employers. Similarly, with the tendency for large organisations to embark on succession planning and development of new graduates, it is not unusual for employees to be called upon to do presentations to top management, thus emphasising the need for the ability to give logical and effective presentations.

Report writing and producing press releases and memoranda have also become of vital importance, especially with the duties of secretaries and administrative support staff increasingly being scaled down (Cilliers, 2000:272).

Cilliers (2000:272) concludes this argument by defining communication as the link that connects. She also asserts that teamwork will collapse in the absence of communication skills. This author also links communication skills to a marketing function within an organisation, saying that leading an organisation to a competitive edge, dealing successfully with conflict, as well as marketing creative ideas to clients, all require excellent communication skills.

With the arguments cited above, it is evident why communication skills are rated among the top skills required by most employers in new graduates.

### 2.5.3 Problem solving

Problem solving is an individual's ability to select and use efficient and useful tools and actions to reach a desired outcome. It has different stages which Snyder and Snyder (2008:90) identify as follows:

- Identification of the problem – *the real question the person is facing*
- Definition of the context – *establishing the facts that frame the problem*
- Enumeration of the choices – *exploring the different opinions available*
- Listing reasons explicitly – *thinking about why this is the best choice*
- Self-correcting – *re-looking to establish what could have been missed*

The stages above prove Snyder and Snyder's contention (2008:90) that *students who are able to think critically are able to solve problems effectively.* These authors also suggest that this trait makes a person effective in the workplace.

### 2.5.4 Life-long learning:

An employee's attitude to learning has been cited as another factor in maintaining employability (Clarke 2008:266). This author asserts that there has been movement from the traditional concept of getting an education for a particular job or profession to the type of learning that recognises the potential of all aspects of life and work to contribute to on-going skill and the acquisition of knowledge. This is possible provided that the individual has a learning attitude towards life.

Learning is an on-going process and, in a work environment, is closely linked to Continuing Professional Development (CPD) (Guest, 2006:274). In order to define CPD, Graham Guest of Graham Guest Consulting, explores a number of definitions, but there is one that seems to encompass the various aspects linked to learning. According to Guest, CPD is:

> … a systematic maintenance, improvement and broadening of knowledge and the development of personal qualities necessary for the execution of professional and technical duties throughout the practitioner's working life.

This implies, therefore, that learning is not only the formal acquisition of knowledge, which in many cases, is evidenced by a certificate, but that it can also take the form of informal education. This is so because particularly in a networked world, the *focus is more on the individual* (Guest, 2006:274) rather than on the individual's qualification.

Cilliers (2000:260) confirms this by asserting that the changing needs of the workplace require workers who not only have the basic subject-specific knowledge, but those who have the capacity to transfer and apply knowledge to different settings. Such workers are able to use *higher-order cognitive skills* like analytical and creativity skills (Cilliers, 2000:260) and can apply their competences to various fields as opposed to following established patterns of work. They tend to apply a skill automatically without thinking about it, but with the mind taking control, thus leaving the conscious mind to take care of other things. In this case, workers may not be able to articulate what they have learned during an involvement in a project until they are prompted to think through it. Guest (2006:274) refers to this as unconscious competence.  Workers who fit into this category are those that often embark on lifelong learning.

There also seems to be consensus among the authors that the changing work environment requires workers with a self-directed need to learn (motivation) as well as those that take responsibility for their own lifelong learning.

It is crucial for new graduates to view their own learning as an on-going process, particularly in this era of technological advancement where production can be handled with ease and employment exists primarily for self-development (Guest 2006:278).

Continuous learning will ensure staying on the cutting edge. Life-long learning is made up of a range of skills, namely, self-regulatory, self-motivation and self-assurance (Cilliers 2000:261). These, in turn, encompass various attributes that collectively point to a worker's ability to take charge of his or her level of motivation and a deep sense of individual accountability and responsibility.

### 2.5.5  Motivation

Motivation is the force that drives an individual to act and meet a need (Maund, 1999:86). This author, in illustrating the components of a motivational process, assets that motivation begins with an individual's identification of a need or a deficiency, for an example, in his/her career. The next action is for the individual to seek ways to satisfy that need. This is followed by the individual making a choice on the behaviour to take, then acting on that choice and subsequently experiencing reward or failure. It is notable that all the steps in this process centre around the individual concerned. Evidently, this is an intrinsic process and links with various other skills, like decision making, problem solving and inclination towards life-long learning.

### 2.5.6  Flexibility and adaptability

Flexibility and adaptability comprise the ability to adapt to changing situations. Employable persons, according to Clarke (2008:265), have flexible attitudes towards work and career and this attitude, in turn, leads to adaptive behaviours in the workplace. Flexibility and adaptability in a worker usually manifests itself in a positive attitude towards learning. Such workers are eager to learn new technologies and are proactive in dealing with ever-increasing changes and possibilities. These workers can pursue a number of careers in a lifetime because they can apply knowledge to changing situations. Flexibility, while it does not guarantee employment, greatly increases the possibility of being employed (Clarke, 2008:265).

**2.5.7  Appreciation of different cultural contexts**

With the move towards cross-functional teams, collaborations now mean that teams are diverse and multi-cultural across all ages and gender. (Cilliers, 2000:275).  It goes without saying that workers are required to have an understanding of different cultural contexts. This will enable them to work effectively in these cross-functional and diverse teams. For example, in the South African context, black South African people are raised to show respect to an older person by not addressing them by their first name, while this is not necessarily so in other cultures. It therefore becomes important for all members in a team to keep this in mind when working in a team with differing cultural and age groups.

**2.6    CONCLUDING REMARKS**

The changes in the work environment have been evident in the researcher's personal experiences. Having trained as a scientific worker in the 1980s, the researcher's training was geared solely towards imparting basic scientific techniques. The nineties saw a change in this as competition among medical scientific laboratories increased with new competitors coming into the picture. The scientific environment suddenly began to incorporate technology and continuous professional development in a bid to maintain a competitive edge. Selection processes of medical laboratory staff began to lean towards a balance between scientific skills and general skills as a requirement for employment. Lately, the scientific environment has begun to be client-oriented because of the interdependency of the customer – company relationship and the need to maintain a competitive edge.

The author therefore concurs with Cilliers (2000) in the assertion that the change in the work environment, as well as the pressure on organisations to place greater emphasis on productivity and effectiveness, quality management, a work

ethic and purposefulness, requires organisations to change and re-engineer so that they now require a worker that can demonstrate certain requisite skills.

In the desktop study, while not all the literature uses the same classification, an overlap of required skills as documented by various authors has been noted. Also of note, is that there seems to be coherence between the findings of the pilot study conducted by Nofemela (2007) and the desktop findings.

Furthermore, the discussion of some of the skills has illustrated an inter-relationship between the various skills, such that one skill requires the presence of another in order to be manifested. For example, various forms of communication require teamwork, problem solving, technology, etc.

In order to conclude this chapter and provide a framework for further work on this study, the researcher has elected to use De Lange's classification and expand it by clustering the various skills that fall under each composite skill under the classifications of functional and adaptability skills (see Figure 2.4 below).
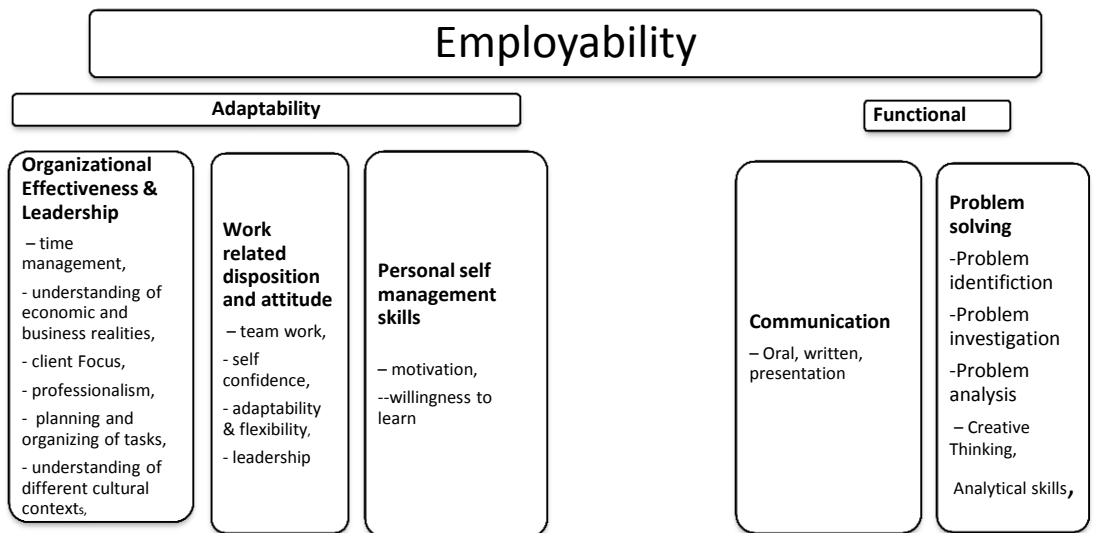


**Fig 2.4: Adaptation of De Lange's Classification Framework**

## Chapter 3:
## Research Methodology

### 3.1 INTRODUCTION

Research is a process whereby one gains a better understanding of the complexities of human experiences and, based on that understanding, takes action (Marshall & Rossman, 1999:21). This involves systematic and collaborative strategies of information gathering, allowing the researcher to reflect on the meanings of the interactions, arrive at conclusions, evaluate them and, eventually put forward an interpretation. In order to give meaning to this definition, a researcher will decide on a method to be used in the process of data collection. Three methods of data collection are suggested by various authors such as Borrego et al. (2009:57), Foss and Ellefson (2002:243), Onwuegbuzie and Leech (2005:375), as well as by Struwig and Stead (1994:338), viz. quantitative, qualitative and mixed methods. The quantitative method is a procedure for the collection and analysis of data in order to test a hypothesis. This data is presented in numbers (Struwig & Stead, 1994:338) and it has the advantage of enabling the researcher to reach a large representative sample and to collect a fairly structured data. However, its nature limits the respondents from voicing their opinions.

The qualitative methodologies, on the other hand, consist of open-ended information that the researcher gathers (Creswell & Plano Clark, 2007). It allows the researcher to obtain the respondents' perspectives while allowing for the description of the respondents' social context (Struwig & Stead, 1994:338).

The mixed methods approach is a combination of the two methods and entails the qualitative and quantitative collection and analysis of data in a single study. It is based on the pragmatists' perspective that both the quantitative and qualitative methods have strengths that can be utilised to better understand a social phenomenon (Onwuegbuzie & Leech, 2005:382). The different sets of data, collected concurrently or sequentially, are given priority, and are integrated at one or more stages in the process of research (Borrego et al., 2009:64).

In order to answer the research questions, the researcher used a mixed methods research approach. The researcher understood, however, that, despite its value, the mixed methods approach is expensive, time consuming and has potential to yield contradictory outcomes (Foss & Ellefson, 2002:244).

In conducting the mixed methods approach, it was necessary to collect the data in three phases. In the first phase, a primary list of the employability skills required by analytical chemistry graduates, needed to be compiled. A literature study was therefore a logical source for such a list. The literature study was conducted not only for this purpose, but also to try to understand how the various authors define and classify employability skills. This, on its own, posed another question, viz. what exactly does employability mean? Because of this, considerable emphasis of the desktop study was directed at establishing theory around the meaning of employability and employability skills, as well as obtaining a general list of skills deemed to make a person employable. This phase of the study was not limited to literature referring only to employers in the chemistry sector, but was conducted across sectors in order to formulate a comprehensive skills list. From the skills list that emerged in this phase, questionnaires were compiled and used in the second phase of the study.

The objective of the quantitative phase was to measure the opinions of employers of analytical chemists in the Western Cape in respect of the desired skills for their environment, as well as to ascertain whether graduates and students from the institution under investigation possessed the required skills. This was done via a survey method. In order to arrive at the final analysis, the data from the quantitative phase was analysed to compile a list of those skills that the respondents rated *important* or *extremely important*, yet lacking in the graduates from the institution under investigation.  This was followed by a qualitative method in the form of face-to-face interviews in which participants were given the opportunity to elaborate on their answers in the quantitative phase. Lastly the results of the two phases were analysed and compared to reach a final result.

## 3.2  QUANTITATIVE PHASE

### 3.2.1  Introduction

As indicated in the sections above, the desktop study provided a base for the researcher to conduct the quantitative phase of the study through the provision of a general skills list.  This list of 18 skills (see Table 2.2 on page 20), was incorporated into a questionnaire that required respondents to indicate their opinions with respect to the importance of the various skills as well as the extent to which students and graduates from the institution under investigation possessed these skills (Appendix B). It should be noted that in order to enable respondents to interpret the questionnaire with relative ease, certain skills were broken down into various composite skills, for an example, communication was broken down into verbal, written as well as English language proficiency. As a result, the final list on the questionnaire comprises 32 skills. The survey was self-administered and the questionnaires were sent to potential respondents via electronic mail.   Despite the potential for a low response rate as suggested by Struwig and Stead (1994:338), the electronic platform was viewed by the researcher as one that would allow for a larger sample to be reached with minimum cost and time.

### 3.2.2  Sample

The research population for the study was drawn from the institution's Co-operative Education (Co-Op) sub-system of the Integrated Tertiary System (ITS).   This is a database of employer partners of the institution under investigation and consists of approximately 1 250 employers across all disciplines and industries, nationally.  From this database, all employers operating in the chemical, petrochemical, pharmaceutical, food, nuclear as well as pulp and paper industries were isolated.  This group accounted for approximately 50 organisations in the database. Further, only organisations based in the Western Cape were selected, as dictated by the delineation of the project.  This resulted in a list of 20 employer organisations.   A placement list was drawn to identify the number of supervisors at each organisation. This list showed that, on average, each

organisation had three supervisors registered on the ITS Co-op sub-system.  As the ITS Co-op sub-system is a platform that is used to manage the experiential learning placement programme, it comprises a database of only those employers that participate in this programme.  For this reason, as well as that no database of graduate placement existed in the institution, the initial employer list compiled from this source could not include graduate employers.  However, an opportunity to distribute questionnaires to employers of graduates presented itself when it was noted that of the 35 graduate employers participating in the institution's graduate recruitment programme in 2010, five were in the industries under investigation.

In total, therefore, 25 employer organisations were targeted and, although the number of supervisors in the different organisations varied according to the organisation's size, each employer organisation had, on average, three supervisors. This brought the total study population to 70 potential respondents. The respondents were requested to return the questionnaires electronically for ease of reply, as well as for the tracking of the responses.  As responses arrived, they were recorded against the list of names on the researcher's target list.

Only 10 percent of the responses were received by the due date.  Although the due date was extended, and two follow-up Emails were sent, ultimately a total of 50 responses (71%) were received. The respondents represented all the industries that had been targeted, that is, chemical (34%), petrochemical (12%), pharmaceutical (6%), food (20%), and nuclear (8%). Additionally, a number of responses were received from government departments (6%) as well as retail (2%), pulp and paper (8%) and retail (2%) industries.

**Table 3.1: Data on industry representation**

| Industry | | Frequency | Percent | Valid percent | Cumulative % |
|---|---|---|---|---|---|
| Valid | Chemical | 17 | 34.0 | 37.8 | 37.8 |
| | Petrochemical | 6 | 12.0 | 13.3 | 51.1 |
| | Pharmaceutical | 3 | 6.0 | 6.7 | 57.8 |
| | Food | 10 | 20.0 | 22.2 | 80.0 |
| | Nuclear | 4 | 8.0 | 8.9 | 88.9 |
| | Other | 5 | 10.0 | 11.1 | 100.0 |
| | Total | 45 | 90.0 | 100.0 | |
| Missing System | | 5 | 10.0 | | |
| Total | | 50 | 100.0 | | |

### 3.3.3  Questionnaire design

In designing the questionnaire instruments, the structured type questionnaire format was chosen.  To this end, questions that were asked in the questionnaire were derived from the literature study which had provided the researcher with a preliminary skills list. To limit the costs, the questionnaire was designed so that it would be self-administered. As a pilot, the questionnaires were administered to a group of five human resource practitioners as well as to a small group of practitioners at the researcher's place of work.  This was done with two purposes, viz. to test the clarity of the questions as well as the effectiveness of the scale of measurement used; also to check the potential validity of the researcher's hypothesis that gaps do exist between the skills of the students and those that industry requires.

While the pilot gave the researcher an idea of the skills that industry required (Nofemela, 2007), its results were limited because the questions asked were clustered and might even have been vague. In the design of the final questionnaire instrument, attention was paid to the design principles as discussed by Greenfield (2002).  Care was taken to ensure that the questionnaire embraced the following principles:

- Reliability – to ensure that the questions were devoid of ambiguity or vagueness so that a question would yield the same answer on different occasions.
- Validity – to ensure that the instrument measured the intended objective.
- Response rate – care was taken to encourage a response by simplifying the questionnaire, thereby ensuring that the questions asked were not difficult and provided sufficient response categories.

Of the different types of questions proposed by Struwig and Stead (2007:345), viz. open-ended, multiple choice, dichotomous and scaled-response questions, the latter type was chosen. Using the 5-point Likert scale, the respondents were required, in Section 2 of the questionnaire, to rate the importance of the listed skills from *extremely important*, on the one hand, to *unimportant* at the other extreme. Section 3 required respondents to use the same scale to rate their level of agreement from *strongly agree*, on the one hand, to *strongly disagree* at the other extreme. This section was meant to give the researcher an indication of the respondents' opinions in respect of the abilities of the students and graduates from the institution under investigation).

### 3.3.4 Questionnaire format

The questionnaire used in this study comprised three sections. Sections 1 and 2 were directed at all supervisors irrespective of whether or not they had supervised analytical chemistry students and/or graduates from the institution under investigation in the period under review.

In the first section, respondents identified the organisation they worked for, their designation, as well as the industry their organisation operated in. The intention of this was to understand if trends prevailed or differed from industry to industry. It was important to identify organisations that respondents were employed at to make it easy for the researcher to set up interviews and conduct them.

The designation of each respondent was important for the researcher to validate that the respondent was indeed in a supervisory position.

Section 2 required the respondents to comment on the level of importance of each skill, as compiled from the literature study. It further allocated a space for respondents to add the skills that they thought were important in their environment, but that were not included in the skills list.

The third section was directed at those supervisors who had supervised analytical chemistry students and/or graduates from the institution under investigation in the period under review. This section required the respondents to identify those skills that the students and/or graduates from the institution demonstrated. Once again the questionnaire provided the list as derived from the literature study and required the respondents to state their level of agreement to each statement that hypothesised that students and/or graduates from the institution under investigation possessed a particular skill. The questionnaire used in this study is shown in Appendix B.

### 3.3.5 Questionnaire administration

Greenfield (2002) identifies four main ways of questionnaire administration, viz.

- face-to face, where fieldworkers administer the questionnaire;
- telephone, where trained interviewers use the Computer Assisted Interviews (CATI) technique;
- postal, where Paper-and-Pencil Interviewing (PAPI) self-administered questionnaires are used; and
- Internet-based interviews administered either through email or web pages.

As it was anticipated that electronic contact would be easier and more cost effective, the researcher opted to use email questionnaire administration. An email address list of contact persons in the organisations was compiled. The first challenge encountered was that some of the organisations on the list had hosted students as a "once-off" and as a result, it was difficult to re-establish contact, especially since some of them, had, in the meantime, restructured and for some of them, contact details were outdated. In the end, 35 organisations could be approached. Formatted questionnaires in the form of an

attachment, together with a letter of request (Appendix A) were sent via electronic mail to contact persons in the organisations with a specific request to first seek permission, via the letter of request, from decision makers in each organisation. Once permission was granted, contact people in the organisations were requested to identify appropriate supervisors within the organisations and request those people to complete the questionnaire. A list of these potential respondents was also sent to the researcher for record purposes as well as for follow-up interviews. As mentioned elsewhere in this research, a further five questionnaires were distributed amongst employers of graduates. These were distributed by hand to training personnel participating at the institution's annual career fair in 2010.

### 3.3.6 Ethical considerations

In conducting the study, the researcher kept in mind the ethics of research. To this end, the questionnaire was designed so that the purpose of the research was clear. In order to ensure that respondents gave informed consent, a letter of request clarified the objective of the research and assured potential respondents of confidentiality (Appendix A). Where responses were not forthcoming, follow-up reminders were sent to the potential respondents.

### 3.3.7 Data analysis

The data collected was analysed with the use of the SPSS19 program. As per the specifications of the program, each questionnaire was allocated a number. Each question in the questionnaire was also allocated a number. This would make it easy to log the information onto the SPSS program.

During the analysis, the researcher isolated the organisations represented by the respondents as well as the industries that they represented. The frequency of each category was calculated and presented as a percentage of the total figure (50). The respondents ranged from one to four respondents per company. As the unit of analysis was individual supervisors and not the employer, the responses were not aggregated.

Using the mean scores and standard deviation values, the skills were ranked from *most important* to *least important*. This gave the researcher the 26 most important skills. These were all the skills with mean scores below 2.00.

Paired sample T-tests were conducted in order to determine whether there were any significant differences in the mean scores, based on the skills and competencies that were regarded as important and those possessed by the graduates.

A manual administration of the data material was done to isolate the respondents that identified certain skills as *important* and *extremely important*, yet lacking in the graduates from the institution under investigation. These respondents were grouped according to the organisations for which they worked. This was done with the intention of preparing for the interview phase.

## 3.4    QUALITATIVE PHASE

### 3.4.1  Introduction

The qualitative study in this project was conducted via interviews (Appendix C). The aim of this phase was to engage those respondents that cited some skills as *important* and/or *extremely important*, yet had been found to be lacking in the students/graduates from the institution under investigation. This was done in order to get substantial depth and detail. Where it was possible, face-to-face interviews were conducted. In one instance where it was impossible to conduct a face-to-face interview, a telephonic interview was conducted. Despite the advantage that this provided, this type of interview method presented some challenges in that it was not possible to pick up nonverbal cues from the interviewees as would have been the case with face-to-face interviews (Sekaran, 2003:225-231). It was also difficult to build rapport with some of the interviewees to the extent that the face-to-face interviews would have permitted. With a face-to face interview, the researcher was also able to clarify questions and ensure that the questions were understood.

### 3.4.2  Sampling

For the qualitative phase, a purposeful sampling approach was used. This required the researcher to intentionally select participants that had experience with the key concepts being explored (Creswell & Plano Clark, 2007:112).  To this end, this phase was conducted only among the respondents that had supervised the graduates from the institution under investigation and had, as such, completed both Sections 1 and 2 of the survey. Further, the researcher selected all the respondents from the quantitative phase that had rated particular skills to be important or extremely important in their work environment, yet lacking in the graduates from the institution under investigation.  In one instance, respondents had demonstrated uncertainty with respect to whether the graduates they had supervised possessed certain skills or not, and as such, on a number of skills, these respondents had opted to use the "neither agree nor disagree" option on the Likert scale.  This group of respondents was included in the sample as the researcher needed to probe them in the hope of understanding the reason behind this uncertainty. The selected respondents were grouped according to the companies they were employed at so that small groups were interviewed in order to have a deeper discussion on their opinions at their own work environment. The interviews were conducted at the groups' workplaces which reduced the time that the respondents spent away from their workstations. As the group interviews were conducted amongst all respondents in an organisation and the researchers was not prescriptive in terms of the composition of the groups, the researcher was cognisant of the fact that group dynamics could have prevailed that could have inhibited quieter or more junior participants in the group from being too vocal. Where possible, the interviewer ensured that all participants in the group were asked for input as the interview progressed

### 3.4.3  Interview instrument design

In order to ensure that the researcher asked pre-determined questions while maintaining flexibility to steer the interview into areas that appeared promising to provide additional insight (Crowther & Lancaster, 2009:147), a semi-structured interview approach was used.

The interview instrument was structured in two sections. The first section required respondents to identify the organisation they were employed at, as well as the industry that the organisation operated in. They were then required to indicate whether or not they had supervised a student from the institution under investigation in the period under review and in what capacity the student had been employed.

The second section referred to the skills that emerged as *extremely important* and/or *important* in the questionnaires and asked the respondents how each of these skills is utilised in their respective environments and why they value these skills over the other skills. As all interviewees had indicated in the questionnaire, that the students and/or graduates from the institution under investigation lacked that particular skill, they were asked to suggest ways in which the institution under review could enhance such skills in their students.

### 3.4.4  Interview administration

The respondents that had indicated certain skills to be important and/or extremely important, yet lacking in the students from the institution under investigation, were isolated and noted on a spread sheet, along with the relevant skills. These respondents were then grouped according to the organisations for which they worked. This made it easier to form groups. Telephonic contact was made with these groups to make appointments. A 30-minute slot was allocated for each group. In order to save time, an electronic mail was sent to these groups to detail the process and format that the interview would follow. The interviews were recorded (with permission from the interviewees) to ensure that the full conversation was captured. A verbatim transcription of the interviews was done to enable the researcher to isolate emerging themes.

### 3.4.5  Analysis of qualitative data

Using grounded theory in the analysis of this phase, the researcher identified key themes from the interviews (Crowther & Lancaster, 2009:183). This is because, in this

study, the qualitative phase was conducted based on data that is grounded in the empirical study phase, and therefore sought to evaluate the fit between the initial research questions as put forward in Chapter 1 and the emerging data. To this end, all aspects of the conversation in the interviews were taken into account and were categorised to establish a common thread. This approach is more suitable than the content analysis approach, which assumes that the more a concept is mentioned, the more significant it is (Crowther & Lancaster, 2009:184).

In order to develop suitable descriptions and notions related to the experiences of the supervisors in their interactions with the students, the researcher used the summary-aided approach, as suggested by Miles and Huberman (1994:352). This involved gathering the data to obtain the total impression, writing it up, coding it, displaying it, drawing conclusions from it and reporting it.

## 3.5    MIXED METHODS ANALYSIS

Final data analysis was conducted by using the triangulation method of mixing data. The purpose of using this method was to obtain *different but complementary data* (Cresswell & Plano Clark, 2007:70) as well as a *multifaceted view of the problem* (Foss; Ellefson: 2002:244). This allowed the researcher to compare and contrast the results of both the quantitative and qualitative analyses. The two sets of results were mixed in order to provide well-substantiated conclusions in so far as the relevance of employability skills of the analytical chemistry graduates from the institution under investigation.

# Chapter 4

## Analysis of the Quantitative phase results

### 4.1 INTRODUCTION

The quantitative phase was conducted in order to give the researcher a view of which skills are valued most by the employers in the sectors under investigation as well as which of those skills were demonstrated by the students and /or graduates under their supervision in the period under review.

### 4.2 DESCRIPTIVE STATISTICS

#### 4.2.1 Industry representation

As indicated in Figure 4.1 below, 34% of the respondents came from the chemical industry, 12% from the petrochemical industry, 6% from the pharmaceutical industry, 20% from the food industry, 8% from the nuclear industry and 10% from other industries or sectors such as government, and the pulp and paper, research, and retail industries. Ten percent of the respondents had not specified the industry that they represented. This was represented as a Missing System on the analysis sheet.
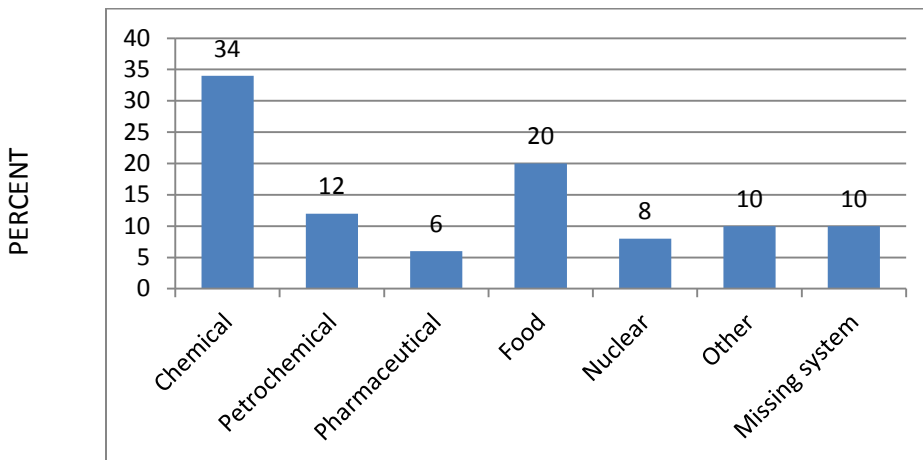


**Figure 4.1: Industry representation (N=50)**

#### 4.2.2 Respondents' involvement

Figure 4.2 below represents the activity of the respondents with respect to the supervision of students and graduates from the institution under investigation. Fifty-six

percent of the respondents reported that they had supervised only undergraduate students while 18% had supervised both undergraduate students and graduates.

Two percent had only supervised graduates, while 22% had not supervised any of the groups under investigation. Once again, 2% of the respondents did not provide an answer for this category and were represented as missing from the system.
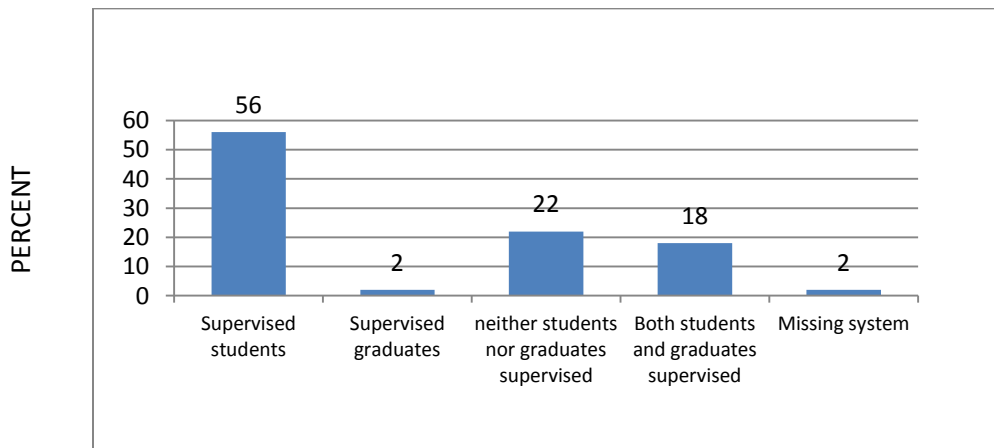


**Figure 4.2:  Groups under supervision of respondents(N=50)**

### 4.2.3  Importance of skills

The next set of analysis concentrated on the various skills as listed on the questionnaire (refer to table 4.1 which lists the skills from most to least important).

In the raw data analysis, the descriptive statistics show that the skills that emerged with the lowest means, and therefore the most important, were time management (mean =1.44; SD=0.58), the ability to identify problems (mean=1.46; SD=0.50), the ability to investigate a problem (mean=1.46; SD=0.50), and the ability to analyse problems (mean=1.48; SD=0.50). Worth noting is that the ability to solve problems had a higher mean score (mean=1.62;SD=0.73) and therefore was regarded as less important than the other skills associated with problem solving.

The following were also in the top ten skills in terms of importance: numeracy and literacy skills (mean=1.52;SD=0.61), ability to adapt successfully to changing situations(mean=1.52;SD=0.54),willingness to learn and continue learning(mean=1.56; SD=0.50), self-management(mean=1.60;SD=0.63) and ability to work confidently within a group (mean=1.64;SD=0.48).

The middle cohort of skills in terms of importance ranged from the ability to execute a plan (mean=1.64;SD=0.56) to the ability to present information(mean=1.94;SD=0.68). Interestingly, the skills associated with communication, that is, written and oral communication as well as the ability to present information, are also quite dispersed in terms of importance, within this middle group. Another interesting observation is the proximity of the ability to execute a plan in relation to the ability to plan activities (mean=1.74;SD=0.60) and organise tasks (mean=1.80;SD=0.83).

At the bottom of the ranking are skills like entrepreneurial skills (mean=3.06;SD=0.74), negotiation and mediation (mean=2.74; SD=0.94), understanding of economic and business realities (mean=2.58; SD=0.81), client focus (mean=1.94; SD=0.69) and the ability to generate new ideas (mean=1.94; SD=0.68).

**Table 4.1: Distribution of skills according to mean scores of importance**

| Skill | N | Mean | Std Deviation |
|---|---|---|---|
| Time management (most important) | 50 | 1.44 | 0.577 |
| The ability to identify problems | 50 | 1.46 | 0.503 |
| The ability to investigate problems | 50 | 1.46 | 0.503 |
| The ability  analyse problems | 50 | 1.48 | 0.505 |
| Numeracy and quantitative literacy | 50 | 1.52 | 0.614 |
| Adaptability and flexibility | 50 | 1.52 | 0.544 |
| Willingness to learn and continue learning | 50 | 1.56 | 0.501 |
| Self-management | 50 | 1.60 | 0.639 |
| The ability to solve problems | 50 | 1.62 | 0.725 |
| The ability to work confidently within a group | 50 | 1.64 | 0.485 |
| The ability to execute a plan successfully | 50 | 1.64 | 0.563 |
| Verbal communication | 50 | 1.68 | 0.513 |
| The ability to use information | 50 | 1.68 | 0.513 |
| Self-confidence | 50 | 1.70 | 0.580 |
| The ability to apply knowledge to new situations | 50 | 1.72 | 0.671 |
| Proficiency in English | 50 | 1.74 | 0.527 |
| The ability to access information | 50 | 1.74 | 0.527 |
| The ability to plan activities | 50 | 1.74 | 0.600 |
| The ability to think critically | 50 | 1.76 | 0.591 |
| The ability to organise tasks | 50 | 1.80 | 0.833 |
| The ability to act professionally | 50 | 1.80 | 0.670 |
| Written communication | 50 | 1.84 | 0.584 |
| Appreciation of different cultural contexts | 50 | 1.84 | 0.918 |
| The ability to present information | 50 | 1.86 | 0.729 |
| Client focus | 50 | 1.92 | 0.695 |
| The ability to generate new ideas | 50 | 1.94 | 0.682 |
| The ability to follow logical arguments | 50 | 2.18 | 1.024 |
| The ability to summarise key issues | 50 | 2.22 | 0.975 |
| Research skills | 50 | 2.34 | 0.872 |
| The ability to construct logical arguments | 50 | 2.36 | 0.802 |
| The ability to lead | 50 | 2.40 | 0.881 |
| Understanding of economic and business realities | 50 | 2.58 | 0.810 |
| Negotiation and mediation skills | 50 | 2.74 | 0.944 |
| Entrepreneurial skills (least important) | 50 | 3.06 | 0.740 |

### 4.2.4  Skills possessed by graduates

Of the total number of respondents, 36 (76%) had some experience of supervising students from the institution under investigation.  This meant that they were able to comment in both Sections 2 and 3 of the questionnaire (refer to table 4.2 which lists the skills most to least demonstrated by students and /or graduates).

In the analysis, the majority of the skills appeared to have mean scores above 2.5, which meant that the respondents did not think that the students and/or graduates from the institution under investigation had demonstrated the skills.  Only a small number of skills in this group had mean scores much lower than 2.0, which means that the respondents agreed that the students and/or graduates from the institution under investigation had demonstrated the skills. These were the ability to work confidently within a group (mean=1.91; SD=0.95), proficiency in English (mean=1.81; SD=0.57),as well as the ability to present information (mean=1.94; SD=0.95).

A significant number of skills had mean scores of between 2.0 and 2.6, including oral communication (mean=2.03; SD=0.73), numeracy and quantitative analysis (mean=2.06; SD=0.47), willingness to learn and continue learning (mean=2.08; SD=0.84), self-confidence (mean=2.28; SD=0.74), ability to plan activities (mean=2.28; SD=0.88), ability to think critically (mean=2.44; SD=0.73), time management (mean=2.44; SD=0.998) and ability to analyse (mean=2.53; SD=1.05) and investigate problems (mean=2.56; SD=1.05).

At the other extreme, negotiation and mediation (mean=3.34; SD=0.72) and client focus (mean=3.03; SD=0.89) had the highest mean scores, which were interpreted to mean that the respondents thought that the graduates did not demonstrate the skills.  The rest of the skills in this upper category fell between 2.94 and 2.61.  Among these were: self-management (mean=2.94; SD=0.79), understanding of business and economic realities (mean=2.92; SD=0.99), the ability to summarise key issues (mean=2.83; SD=0.84), the

ability to solve problems (mean=2.81; SD=0.95), the ability to execute a plan (mean=2.67; SD=1.01),as well as the ability to apply knowledge to new situations (mean=2.61;SD=0.73).

**Table 4.2: Mean scores of employability skills possessed by graduates**

|  | Mean |
|---|---|
| Proficiency in English | 1.81 |
| The ability to work confidently within a group | 1.91 |
| The ability to present information | 1.94 |
| Oral communication | 2.03 |
| Written communication | 2.06 |
| Numeracy and quantitative literacy | 2.06 |
| Willingness to learn and continue learning | 2.08 |
| Self-confidence | 2.28 |
| The ability to plan activities | 2.28 |
| The ability to organise tasks | 2.31 |
| The ability to use information | 2.39 |
| The ability to think critically | 2.44 |
| Time management | 2.44 |
| The abilityto analyse problems | 2.53 |
| The ability to adapt successfully to changing situations and environments (Flexibility) | 2.53 |
| Appreciation of different cultural contexts | 2.54 |
| The ability to identify problems | 2.56 |
| The ability investigate problems | 2.56 |
| The ability to follow logical arguments | 2.58 |
| The ability to generate new ideas | 2.58 |
| The ability to apply knowledge to new situations | 2.61 |
| The ability to access information | 2.61 |
| Research skills | 2.61 |
| The ability to act professionally | 2.61 |
| The ability to execute a plan successfully | 2.67 |
| The ability to solve problems | 2.81 |
| The ability to lead | 2.83 |
| The ability to summarise key issues | 2.83 |
| Entrepreneurial skills | 2.92 |
| The ability to construct logical arguments | 2.92 |
| Understanding of economic and business realities | 2.92 |
| Self-management | 2.94 |
| Client focus | 3.03 |
| Negotiation and mediation skills | 3.34 |

## 4.3. **PAIRED DIFFERENCES**

A paired differences analysis was conducted in order to establish whether there were any significant differences between the means indicating the importance of a skill and the means indicating whether or not the graduates possessed the skills. It is notable that none of the skills that were deemed unimportant were found to be demonstrated by the graduates. The difference was regarded as significant if $p \leq 0.05$.

Significant differences were observed between importance and possession across all the skills, with the exception of proficiency in English($p=0.06$), entrepreneurship skills ($p=0.06$), the ability to lead ($p=0.07$), research skills($p=0.08$), written communication ($p=0.058$), ability to present information ($p=0.182$),ability to work confidently in a group ($p=0.404$), as well as understanding of economic and business realities($p=0.09$).

Below is a brief discussion of the skills that showed the most significant differences:

Self-management: While this skill was indicated to be among the extremely important skills in the environment under investigation (mean=1.61: SD=0.639), the respondents did not think that the graduates demonstrated it (mean=2.94: SD=0.791). The mean for this skill in the paired differences analysis also shows that the skill showed the most significant differences (mean=-1.306; SD=0.951) between significance and possession.

Client focus: Both with importance (mean=1.92:SD=0.695) and possession(mean=3.03; SD=0.891), client focus is among the lower cohorts of skills. There is, however, significance in differences in that, while the respondents thought that the skill was important in their environment (mean below 2.00), they did not think that the graduates possessed it (mean above 3.00). This is confirmed by the mean of the paired differences for this skill (mean=-1.143;SD=1.114), which places this skill among the skills with the most significant differences.

Problem solving: With respect to importance, all the skills in the problem solving cluster, that is, the ability to identify problems (mean=1.46; SD=0.503), the ability to investigate a problem (mean=1.46; SD=0.503) and the ability to analyse problems (mean=1.48; SD=0.505), as well as the ability to solve problems (mean=1.62; SD=0.725), were regarded important in the environment under investigation. With respect to possession, however, the respondents did not think that the graduates possessed the skills. This was indicated by the mean scores which were as follows: the ability to identify problems (mean=mean=2.56;SD=0.171), the ability to investigate a problem (mean=2.56; SD=0.176) and the ability to analyse problems (mean=2.53; SD=0.176), as well as the ability to solve problems (mean=2.81; SD=0.158).

The differences between importance and possession in all of the skills in this cluster were indicated to be significant as indicated by the mean scores: the ability to investigate problems (mean=-1.111;SD=1.141); the ability to identify problems (mean=-1.083;SD=1.131); the ability to solve problems (mean=-1.083; SD=1.025), as well as the ability to analyse problems (mean=-1.028;SD=1.158).

Time management: This skill was identified among the skills that were regarded as extremely important (mean =1.44; SD=0.577) in the environment under investigation.  It was also considered possessed by the graduates under investigation (mean=2.44; SD=0.998); however, there were significant differences (p=0.00) when importance and possession were compared.

Planning and organising: With regard to importance, the three skills that constitute this cluster, the ability to plan activities (mean=1.74; SD=0.600), the ability to organise tasks (mean=1.80;SD=0.833), as well as the ability to execute a plan (mean=1.64; SD=0.563), were all considered extremely important.  With possession, the ability to plan activities (mean=2.28; SD=0.882) as well as organise tasks (mean=2.31;SD= 0.889) was clearly demonstrated by the graduates while the ability to execute a plan (mean=2.67; SD=1.014) was clearly not found to be present.

When importance and possession are compared, all the skills showed significant differences as follows: the ability to plan (mean=-0.556; SD=0.939), ability to organise tasks (mean=-0.472; SD=1.082) and the ability to execute a plan (mean= -0.972; SD=1.106).

Adaptability and flexibility:  The ability to adapt to changing environments was indicated to be among the skills that are extremely important in the environment under investigation (mean=1.52; SD=0.544).  Likewise, the ability to apply knowledge to new situations (mean=1.72; SD=0.671) was indicated to be extremely important.  However, both these skills were indicated not be possessed by the graduates under investigation. While both of these skills showed significant differences, the ability to adapt to changing situations was among the skills with the most significant differences (mean=-1.028; SD=0.941).

## 4.4    SUMMARY

Skills that showed the most significant differences were deemed to be the ones that showed significant differences between mean =-0.9 and -1.306. These were: self-management (mean=-1.306;  SD=0.951),  client focus(mean=-1.143;SD=1.114), the ability to investigate problems (mean=-1.111; SD=1.141), the ability to identify problems (mean=-1.083; SD=1.131), the ability to solve problems (mean=-1.083; SD=1.025); time management (mean=-1.056; SD 1.17), the ability to analyse problems (mean=-1.028; SD=1.158), adaptability and flexibility (mean=-1.028; SD=0.941) and the ability to execute a plan (mean=-0.972; SD=1.108).

The skills that showed the least significant differences were verbal communication (mean=-0.306; SD=0.822), willingness to learn and continue learning (mean=-0.444; SD=0.998), numeracy and literacy (mean=-0.611; SD=0.903), the ability to think critically (mean=-0.722; SD=0.944),as well as the ability to apply knowledge to new situations (mean=-0.778; SD=0.989). Below, in Table 4.3, is a list of all the skills that showed significant differences.

**Table 4.3: Skills that showed significant differences in the paired differences analysis**

| | | Importance | | Possession | | Paired Differences | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std Deviation | Mean | Std Deviation | Mean | Std Deviation | | | |
| Pair 23 | Self-management - Self management | 1.60 | 0.639 | 2.94 | 0.791 | -1.306 | 0.951 | -8.239 | 35 | 0 |
| Pair 33 | Client focus - Client focus | 1.92 | 0.695 | 3.03 | 0.891 | -1.143 | 1.115 | -6.063 | 34 | 0 |
| Pair 9 | The ability to investigate problems - The ability investigate problems | 1.46 | 0.503 | 2.56 | 1.054 | -1.111 | 1.141 | -5.843 | 35 | 0 |
| Pair 8 | The ability to identify problems - The ability to identify problems | 1.46 | 0.503 | 2.56 | 1.027 | -1.083 | 1.131 | -5.748 | 35 | 0 |
| Pair 11 | The ability to solve problems - The ability to solve problems | 1.62 | 0.725 | 2.61 | 0.951 | -1.083 | 1.025 | -6.343 | 35 | 0 |
| Pair 31 | Time management - Time management | 1.44 | 0.577 | 2.44 | 0.998 | -1.056 | 1.17 | -5.414 | 35 | 0 |
| Pair 10 | The ability to analyse problems - The ability to analyse problems | 1.48 | 0.505 | 2.53 | 1.055 | -1.028 | 1.158 | -5.323 | 35 | 0 |
| Pair 12 | Adaptability and flexibility - The ability to adapt successfully to changing situations and environments (flexibility) | 1.52 | 0.544 | 2.53 | 0.774 | -1.028 | 0.941 | -6.555 | 35 | 0 |
| Pair 19 | The ability to execute a plan successfully - The ability to execute a plan successfully | 1.64 | 0.563 | 2.67 | 1.014 | -0.972 | 1.108 | -5.264 | 35 | 0 |
| Pair 14 | The ability to access information - The ability to access information | 1.74 | 0.527 | 2.61 | 1.050 | -0.889 | 1.141 | -4.675 | 35 | 0 |
| Pair 29 | The ability to act professionally - The ability to act professionally | 1.80 | 0.670 | 2.61 | 0.903 | -0.806 | 1.091 | -4.431 | 35 | 0 |
| Pair 13 | The ability to apply knowledge to new situations - The ability to apply knowledge to new situations | 1.72 | 0.671 | 2.01 | 0.728 | -0.778 | 0.989 | -4.719 | 35 | 0 |
| Pair 27 | The ability to summarise key issues - The ability to summarise key issues | 2.22 | 0.975 | 2.83 | 0.845 | -0.75 | 0.967 | -4.652 | 35 | 0 |
| Pair 15 | The ability to use information - The ability to use information | 1.68 | 0.513 | 2.39 | 0.803 | -0.722 | 1.003 | -4.32 | 35 | 0 |
| Pair 22 | The ability to think critically - The ability to think critically | 1.76 | 0.591 | 2.44 | 0.735 | -0.722 | 0.944 | -4.588 | 35 | 0 |
| Pair 6 | Numeracy and quantitative literacy - Numeracy and quantitative literacy | 1.52 | 0.614 | 2.06 | 0.475 | -0.639 | 0.639 | -5.996 | 35 | 0 |
| Pair 30 | The ability to generate new ideas - The ability to generate new ideas | 1.94 | 0.682 | 2.56 | 0.937 | -0.611 | 0.903 | -4.059 | 35 | 0 |
| Pair 34 | Appreciation of different cultural contexts - Appreciation of different cultural contexts | 1.84 | 0.618 | 2.54 | 0.852 | -0.6 | 0.976 | -3.636 | 34 | 0.001 |
| Pair 17 | The ability to plan activities  -  The ability to plan activities | 1.74 | 0.600 | 2.28 | 0.882 | -0.556 | 0.939 | -3.548 | 35 | 0.001 |
| Pair 25 | The ability to construct logical arguments - The ability to construct logical arguments | 2.38 | 0.802 | 2.92 | 0.906 | -0.556 | 1.054 | -3.162 | 35 | 0.003 |
| Pair 26 | The ability to follow logical arguments - The ability to follow logical arguments | 2.18 | 1.024 | 2.58 | 0.841 | -0.528 | 1 | -3.168 | 35 | 0.003 |
| Pair 32 | Negotiation and mediation skills - Negotiation and mediation skills | 2.74 | 0.944 | 3.34 | 0.725 | -0.514 | 0.818 | -3.72 | 34 | 0.001 |
| Pair 16 | Self-confidence – Self-confidence | 1.70 | 0.580 | 2.28 | 0.741 | -0.5 | 1 | -3 | 35 | 0.005 |
| Pair 18 | The ability to organise tasks - The ability to organise tasks | 1.80 | 0.833 | 2.31 | 0.889 | -0.472 | 1.082 | -2.619 | 35 | 0.013 |
| Pair 7 | Willingness to learn and continue learning - Willingness to learn and continue learning | 1.56 | 0.501 | 2.08 | 0.841 | -0.444 | 0.998 | -2.671 | 35 | 0.011 |
| Pair 4 | Oralcommunication –Oral communication | 1.68 | 0.513 | 2.03 | 0.736 | -0.306 | 0.822 | -2.231 | 35 | 0.032 |

## 4.4 CONCLUSION

The quantitative phase results indicate that all the skills that had emerged from the desktop study, except Negotiation and Mediation, as well as Entrepreneurial Skills, had mean scores below 2.5, which indicates that they are regarded as important in the environment under investigation.

The results also show that less than 50 percent of the skills regarded as important in the environment under investigation, were demonstrated by the students and/or graduates under investigation.

Some of the skills that were among the top most important skills in the environment under investigation, for example, problem solving, adaptability and flexibility, self-management, etc., were not among those that were deemed to have been demonstrated by the group under investigation.

# Chapter 5
## Analysis of the qualitative phase results

## 5.1 INTRODUCTION

The qualitative phase of the research was conducted in order to provide additional insight into the results of the quantitative phase. In this phase, the researcher probed the respondents on some of the skills that they noted as important yet missing in the graduates of the institution under investigation.

## 5.2 INDUSTRY REPRESENTATION

The qualitative phase of the research took the form of interviews which were conducted among respondents in focus groups of three. This resulted in a total of 12 respondents that were interviewed. The focus groups were formed according to the organisations where the respondents were employed and represented the pulp and paper, and chemical industries and government sectors. All the respondents had participated in the quantitative phase of the research.

**Table 5.1: Industry representation of interviewees**

| Industry | No. of participants |
|---|---|
| Pulp and paper | 3 |
| Chemical industry | 6 |
| Government | 3 |
| Total | 12 |

## 5.3 RESPONDENTS' INVOLVEMENT

All participants in the focus groups had supervised students and/or graduates from the institution under investigation in the period 2008 to 2010. Six participants had supervised both students and graduates, while the other six participants had only supervised trainee analysts in the period under investigation.

## 5.4. ANALYSIS

The skills that emerged as important in the environment under investigation but were not possessed by the graduates were oral communication, the ability to present information, willingness to learn and continue learning, problem solving, adaptability and flexibility, ability to access information, planning and organising, critical thinking, logical argument, understanding of economic and business realities, and client focus, as well as appreciation of different cultural contexts. Interviewees were probed specifically on the skills that were indicated in the questionnaires to be important yet not demonstrated by the students and/or graduates in the different environments. Additionally, the respondents were probed on the skills that they identified as important for their environment(s) though not included in the questionnaires.

The emergent themes, as tabulated in Table 5.2 below were:

- An explanation of how the skill is used in the respondent's environment, represented as T1.

- An explanation of the significance of the skill in the respondents' environment, represented as T2.

- Scenarios that demonstrate that the graduates lacked the skill, represented as T3.

- Improvements that the respondents could suggest to the institution under investigation, represented by T4.

- Cases where respondents thought that the mentor had the responsibility to help the students develop skills, represented by T5.

**Table 5.2: Emerging themes from the qualitative interviews**

| SEGMENT (skills) | THEMES (T1=Use; T2=Significance;T3=Evidence of lack; T4= Improvement recommendation); T5= mentor responsibility (indicative of partnership responsibility) |
|---|---|
| The ability to think critically | T1= The skill is used in troubleshooting where a fault is observed during an analysis.<br><br>T2= This skill is significant as this is an automated environment and faults can range from as simple a fault as an unconnected instrument.<br><br>T2= As students work on their own on an instrument, the ability to think critically is crucial to be able to note deviations and to troubleshoot where there is a need.<br><br>T3= Often students and/or graduates call on the supervisor and need to be guided towards a (sometimes very simple) solution.<br><br>T3 = Students tend to panic when put on the spot.<br><br>T4= More exposure to instrument handling during practical activities.<br><br>T5= Mentors have the responsibility to nurture and develop the skill in the student under their care. |
| The ability to solve a problem | T2= The skill's significance is in the ability to identify a problem, troubleshoot and then seek help where necessary.<br>T2= It shows independent thinking ability.<br><br>.<br>T4= Incorporation  into work preparedness training. |
| The ability to manage one's time | T3= Significance is in being able to honour service level agreements with clients and adherence to due dates. |
| Communication | T4= Technical writing – important to use correct terminology in industry.<br><br>T4= Early introduction to technical report writing.<br><br>T4= Academic writing for their own development.<br><br>Note: impact of social media. |
| Self-management | T2= Time management.<br><br>T2= Manifests self-motivation.<br><br>T5= Mentor responsibility to identify internal drive level and nurture where it lacks. |
| The ability to work independently | T1 = Ability to completely run by oneself.<br><br>T2= Self-confidence indicator; person to know what he/she is doing.<br><br>T3= Inability to demonstrate at the interview stage.<br><br>T3= Lack of basic skills. |

| | T4= Practical activity structure. |
|---|---|
| The ability to work effectively in a group | T1= Inter-dependence of teams in the laboratory setting.<br><br>T2= Production chain.<br><br>T2= Consolidated reporting.<br><br>T2= Role identification.<br><br>T3= Inability to identify roles in teams; lack of inter-activeness.<br><br>Extra note: check diversity issues. |
| Willingness to learn and continue learning | T2= Application in industry context.<br><br>T2= Increase in the theory base.<br><br>T2= Need to accumulate knowledge.<br><br>T4= Incorporate in work preparedness training. |
| The ability to adapt successfully to changing situations, new situations and situations (Adaptability and flexibility) | T2= Environment changes constantly.<br><br>T4= Incorporate in work preparedness training. |
| The ability to access information | T2: Their own development.<br><br>T3= Tendency to "cut & paste".<br><br>T4= Ethics teaching. |
| Client focus | T1= Laboratory accreditation status<br>T2= Understanding importance of clients for viability of business.<br>T2= Accreditation requirement. |
| An understanding of business and economic realities | T2= Dependency of business viability to ISO accreditation.<br><br>T2= Economic motivation for suggestions they recommend in projects. |
| The ability to organise tasks and activities | T2= Significance is in the ability to break tasks into a lot more detail.<br><br>T3= Students tend to get lost with categorising activities.<br><br>T5= Responsibility of workplace mentor. |
| The ability to relate to others | T2= Manifests ability to get people to work with you (team work).<br><br>T2 = Conflict management.<br><br>T2= Diversity management (understanding of where people come from). |

## 5.5    DISCUSSION OF QUALITATIVE RESULTS

The discussion of the results of the qualitative phase will be carried out according to the skills and how the interviewees interpret their use in their respective fields.  It will also give insight into how the interviewees observe the lack or presence of such a skill in the trainee. Lastly, it will document the suggestions that the interviewees make to the institution under investigation in order to enhance the skills in the students.

### 5.5.1 Ability to think critically

<u>1)      How critical thinking skills are used in the environment</u>

The use of this skill implies that a worker is able to receive information, evaluate it and thereafter determine his or her own interpretation of the information. The implication is that as a new graduate, one is often required to follow the lead of older employees. It is important to be able to evaluate all information that one receives and formulate one's own interpretation instead of blindly following other people's direction.

According to the focus group interviewees, new graduates come into an environment where certain employees have been working for a long time and are used to doing things in a particular, but not necessarily correct way. These employees often "cut corners" when doing certain procedures. New graduates tend to think that this is acceptable, and, even though they know the correct way, often follow the lead of the older employees. This perpetuates incorrect procedures in the work environment.

In order to demonstrate critical thinking abilities, new graduates are expected to evaluate what they are doing and understand why they are doing it. This enables them not to simply follow other people's lead but to be able to interrogate the way things are done in the workplace.

It also transpired during the interviews that because the environment under investigation is an automated one, many of the problems in this environment are due to instrument failure. The origin of a problem of this nature can range from an unconnected plug to a faulty instrument. While it is the senior technicians that maintain instruments, the new

graduates (technicians) are expected to be able to trouble shoot basic things. One of the interviewees used the example of an instrument that is running in a carousel and suddenly stops. The technician should be able to ask himself/herself, "Why has the machine stopped and what could be the source of the problem?" The critical thinking ability helps the person handling the instrument in the troubleshooting in order to find the origin of the error instead of "running to the senior technician all the time".

Further, because workers are allocated to work on an instrument individually, the ability to think critically helps them to carry on working on their own without supervision instead of "being prodded all the time". When they have critical thinking abilities, students are "able to note deviations in the standard and are able to think about them" and "try to work out causative factors before calling a supervisor", some interviewees said.

2) Significance of the ability to think critically

The significance of critical thinking is that people with these abilities can evaluate facts and are less likely to be misinformed (Facione, 1998).

The significance of critical thinking abilities in the environment under investigation is that when working alone, it is crucial for the student to be able to note deviations in the standard when working on an instrument, and then be able to analyse the possible origin of the deviation before calling on the supervisor.

3)      Evidence that critical thinking skills are lacking

Lack of critical thinking is often evidenced by people taking action and important decisions without first giving it thought. Often, when questioned deeply about their actions, these people are unable to provide answers. According to Facione (1992:2), people who fail to think critically, often make bad decisions.

In the environment under investigation, the lack of this skill is evident where sometimes the student or new graduate, on noticing a fault with an instrument, or readings that are clearly erratic, "calls the supervisor without first investigating the problem". One often

finds that "the origin of the problem is a simple one". The respondents thought that the reason this happens is that the students or new graduates often think that the origin of a problem in the workplace ought to be sophisticated. One of the interviewees in one focus group made reference to students "having the tendency to panic when put on the spot and trying to find a sophisticated solution to a simple question".

4)      Recommended improvement

Most of the interviewees in the focus groups thought that the possible reason why students sometimes fail to think about possible causative factors for a faulty reading on an instrument could be that they are not used to handling the instruments. The respondents were of the opinion that it might help if, while at the institution, the students were given more exposure to instrumentation during practical activities.

5)      Mentor responsibility

Some of the interviewees commented that students sometimes show that they can reason and felt that mentors have the responsibility to "just nurture and develop this skill" in the student under their care during experiential learning.

**5.5.2 Ability to solve a problem**

The different phases of problem solving, that is, identifying, investigating, analysing and solving a problem, all emerged as important in the environment under investigation. All these skills were deemed not to have been possessed by the students and/or graduates under investigation.

1)      Use of problem-solving abilities

Problem-solving skills are used to identify, investigate and analyse a problem, then come up with a solution. The implication is that a worker who is able to use this skill is able to work independently.

The interviewees in the focus groups linked the use and significance of this skill to the discussion on critical thinking. Problem-solving abilities, according to them, are used to

trouble shoot when the instrument a student or graduate is working on fails to either calibrate properly or produces results that are constantly out of the normal ranges.

2)     Significance of problem-solving skills

According to the interviewees, because of the high cost associated with the work in this environment, the students or new graduates are expected "to see when something is not quite right with the instrument or the sample before running an analysis".

One of the interviewees made the point that supervisors are not always in the laboratory and that therefore, the student or new graduate ought to be able to investigate the source of a problem and attempt a solution on his or her own.

In the interviewees' opinion, "the ability to identify a problem, troubleshoot and then seek help where necessary shows independent thinking ability".

3)     Evidence that the skill is lacking

A lack of this skill is often observed when students call on the supervisor to report a problem and are not able to offer or suggest a solution. One interviewee said that "it is almost as though they think there is a right and a wrong answer and they fear that theirs will be wrong".

Interviewees in one focus group referred to a recent incident where a student called on a mentor because "the instrument was not switching on".  In the end it transpired that the instrument was not plugged into the electricity socket. This, according to the interviewees, showed that the student had not properly investigated the problem.

4     Recommended solutions

The respondents thought that this skill is not something that can be taught through the chemistry curriculum but that it could be developed through the work preparedness programme.  Short workshops that are geared specifically towards developing this skill were highly recommended.

### 5.5.3 Ability to manage one's time

The quantitative phase results indicate that the ability to manage one's time is the most important skill in the environment under investigation. The students and/or graduates under investigation were found to possess the ability to manage their time.

1)      Significance and use of the ability to manage one's time:

On being asked what the significance of time management is in their environment, they attributed this to the maintenance of Service Level Agreements (SLAs). According to them, this is important, particularly now that the laboratories have to be accredited. In order to maintain a laboratory's accreditation status, it is important to honour the SLAs with clients and adhere to deadlines. This responsibility trickles down to every employee in the laboratory as all employees need to ensure that their work is done correctly and at the specified time. For the students, specifically, the significance is that, while they are workers, they also have academic assignments to complete. This skill helps them to manage their time effectively between completing the assignments and contributing to productivity.

2)      Evidence of a lack of the ability to manage one's time

One interviewee pointed out that, as part of the training, he gives the students certain tasks as well as due dates. Often the students do not make the deadlines and are scared to declare this. Interestingly, one interviewee made the point that the students seem to prioritise their academic assignments, which is the reason why they sometimes miss the work deadlines. In the opinion of one interviewee, the students "see their academic work as more important" and tend to allocate more time to that. While the interviewees understand this tendency, they also consider it important that the student gives equal attention to the work as well.

3)      Recommendation for improvement

The interviewees thought that this skill formed part of the soft skills and could therefore be developed through short workshops rather than in the chemistry curriculum.

## 5.5.4 Client focus

Client focus emerged in the quantitative phase as one of the skills that are important for the environment under investigation. This skill, however, was identified as one of the skills that were lacking in the students and/or graduates under investigation.

1)      Use of client focus abilities

This skill is used in giving clients a service that is of a high standard.

According to the interviewees, in the environment under investigation, clients are kept satisfied through issuing accurate results in a reasonably short turn-around time.

2)      Significance of client focus

The respondents indicated that the students need to understand that clients are important for the viability of the business. It is, according to the respondents, crucial to keep the clients happy. One of the ways in which this environment ensures that it keeps its clientele, is through adherence to Service Level Agreements (SLAs). This ensures that a particular client's work is completed within a specifically negotiated time period. This, according to the interviewees, is linked to the ability to plan and manage one's time. The adherence to SLAs is also an accreditation requirement for all laboratories. It is therefore linked to the viability of the business as clients prefer to work only with accredited laboratories.

According to the respondents, it is also important for graduates to understand that businesses operate in a competitive environment and that a good client focus results in satisfied clients who ultimately chose the laboratory to do business with among competing businesses.

3)      Evidence that client focus is lacking

The interviewees could not be specific on evidence that showed the lack of client focus in the graduates, but linked this to the tendency not to prioritise laboratory work over academic work.

4)       <u>Recommendation for improvement</u>

While none of the focus groups could specifically cite incidences where students or new graduates were not demonstrating client focus, some of them thought that the institution under investigation could talk to the students about ISO accreditation and its requirements for laboratories. They said that students also needed to be sensitised about how the accreditation status of a laboratory affects the viability of the laboratory as a business and how this translates to the sustainability of jobs. In other words, "make them see the link", said one interviewee.

### 5.5.5 Understanding of business and economic realities

The mean score for this skill in the quantitative phase was between 2.5 and 3.00. This indicates that the respondents were not too certain as to whether or not this skill is important in their environment. The skill, however, is shown to have been lacking in the group under investigation.

1)       <u>Significance of the understanding of business and economic realities</u>

In all the focus groups, interviewees highlighted the fact that the continued existence of a business in this environment is, to a great extent, linked to its ISO accreditation status. According to the interviewees, clients prefer to work with laboratories that are accredited to provide the service that they require. For this reason, all laboratories strive to maintain an accredited status all the time. It is important for the students and new graduates in this environment to understand this. They also need to understand the variables that play a role in maintaining this accreditation status so that they can locate and play their role accordingly.

2)       <u>Evidence of a lack of the skill</u>

Students, particularly during their experiential learning year, take on real projects at their workplace. Often they are required to give economic motivations for the recommendations that they make. Interviewees in some of the focus groups thought that the students were not always able to come up with sound motivations that show that they understood the context of the chemistry environment.

The fact that the interviewees thought that the importance of this skill is linked only to the students' own academic assignments, clarifies to the researcher the reason why the respondents could not be certain as to the importance of the skill.

3)     Recommended improvement

As was the case with client focus abilities, the interviewees thought that the students needed to be alerted to the link between ISO accreditation, competitiveness in business and the role of a person as a new graduate in this regard.

## 5.5.6 Self-management

Self-management emerged in the quantitative phase to be among the top ten most important skills in the environment under investigation.  However, according to the inferential statistics, the skill was not demonstrated by the group under investigation.

1)     Significance of self-management

Self-management in workers helps them to regulate themselves and to constantly remind themselves to do what is right. In the environment under investigation, the experiential learning students or new graduates are introduced into an environment where lower level, often older employees, are used to doing things routinely to the extent that they have worked out "short-cuts" in certain instances.  As some of these employees do not understand the theory underpinning their activities in the laboratory, they do not understand the impact of their actions, and therefore continue with this practice and often get agitated with following standard operating procedures. According to the interviewees, the significance of self- management lies in the fact that it is extremely important for new graduates not to be influenced by these older staff members but "to do the right thing at all times".

The interviewees also asserted that the ability of the students to manage themselves is linked to their ability to manage their time in such a way that they are able to do what needs to be done, at the right time. This is especially so since experiential learners are

required to "juggle their time between being productive in the workplace and completing their assignments".

2)    Evidence of a lack of self-management

One group cited as an example an incident where, in their environment, one of the older staff members decided not to test the integrity of an instrument, as routinely required. The result was that the junior staff (experiential learners), though knowing that this is a requirement, followed this example. This showed clearly that the students failed to remind themselves of the negative impact of issuing results from an instrument of which the integrity has not been ascertained, thereby casting doubt on the reliability of the result.

3)    Recommended improvement

The interviewees understand that it may not be possible to incorporate this skill in the chemistry curriculum. They, however, believe that making students aware of the importance of understanding their role in the workplace and in the production chain, will go a long way towards solving this problem.

**5.5.7 Communication skills**

According to the results of the quantitative phase, both oral and written communication is valued in the environment under investigation but only oral communication is deemed to be possessed by students and/or graduates from the institution under investigation.

1)    Significance of written communication

As the environment under investigation does not require junior staff to complete written reports, the written communication skill is not a requirement for new graduates. However, as mentors, the respondents are required to guide the students in their projects and, ultimately the write-up of their technical report or preparation of their project presentation.

## 2) Evidence that written communication is lacking

All the respondents reported that they often find that the students do not use the correct industry terminology in their technical reports and/or presentations. The respondents acknowledged that the social media might have an impact on the students' poor written communication skills as they tend to get used to the "shorthand" writing that they use in social media.

## 3) Recommendation for improvement

The respondents thought that, for their own development, the students should be introduced to technical report writing earlier in their training, perhaps at second-year level.

### 5.5.8 Ability to access information

The quantitative phase results indicate that the environment under investigation values the ability to access information. The inferential statistics, however, show that the students and/or graduates under investigation do not demonstrate this ability.

## 1) How the ability to access information is used

The use of the ability to access information means that the worker is able to find information using various sources. Its implication for an organisation is that workers are constantly required to research information pertaining to products that they are working with. In the environment under investigation, information searches are required for benchmarking purposes.

The students that are on experiential learning use the skill to research information for the projects that they are required to do in their third year.

## 2) Significance of the ability to access information

Experiential learning students are not required to use the skill in their daily work in the environment under investigation. They use the skill only to get information used for their experiential learning projects. The significance of the skill, therefore, is for the students' own development in that they are required to support the results of their projects with

literature studies. For new graduates, however, the skill is important as it is used to benchmark results.

3)      Evidence of lack of the ability to access information

It emerged in the focus group interviews that the respondents did not think that students and/or graduates from the institution under investigation are unable to access information (as it appeared to be the case in the quantitative phase). On the contrary, they have noticed that the students can effectively use information sources to seek and compile information for their academic assignments. What they have observed, however, is that, in conducting the research, ethical research practices were, in some instances, compromised. This, according to the respondents, is evidenced by the students' tendency to "cut and paste" information. This is an indication that while the students know how to access information, they may not understand issues associated with ethical research practices.

4)      Recommended improvement

The respondents suggested that perhaps there should be a greater emphasis on ethics in research at undergraduate level.

### 5.5.9 The ability to work effectively in a group

The quantitative phase results suggest that the ability to work effectively in a group is among the top most important skills in the environment under investigation. It also seems as though the respondents thought that the students and/or graduates under investigation do possess this skill, to some extent.

1)      Significance of the ability to work effectively in a group

The work in laboratories follows the pattern of a production chain where workers and teams are inter-dependent, thus the final report that is issued to the client is a consolidated one. It is, for this reason, important for each individual to identify his or her role within the chain.

The interviewees attributed the significance of this skill to the ability to relate to others. Although some respondents had added the ability to relate to others as a required skill in the environment, it emerged in the focus group interviews that the respondents linked it to the ability to work effectively within a group. According to the interviewees, this skill enables workers to relate better with others in a team.

The respondents also attributed the significance of this skill to better conflict management abilities as well as diversity management.

2)      Evidence that students are not able to work effectively in a group

The lack of this skill is often evidenced by the students' inability to identify their roles as well as a lack of interaction with other team members. The interviewees said that they often noticed that the students and new graduates tended to be comfortable interacting with team members who spoke the same language as they did. They were, however, not too certain as to whether the cause for this is language proficiency, issues of diversity among teams or if it can be attributed to preferences. Interviewees based in the rural areas of the Western Cape, where Afrikaans is predominant, were, however, mindful of the fact that the Afrikaans language barrier might have an impact on this.

3)      Recommended improvement

The interviewees noted that students are able to work effectively in groups, but that they are able to do this among people who speak their own language.  Because of this, the interviewees could not suggest ways to help students improve this.

**5.5.10 Ability to work individually**

The ability to work individually was not among the skills that had emerged in the desktop study as a required skill in any industry. It was therefore not included in the questionnaire. However, it was added by some respondents who felt that it was required in their environment

1)      How the ability to work individually is used

The use of the skill implies that an individual is comfortable working individually and taking responsibility for an area to which he or she is assigned. In the environment

under investigation, although workers work as part of a production chain, they work individually on an instrument and therefore take responsibility for the results from a particular instrument.

2)    Significance of the ability to work individually

While the staff in laboratories work in production chains, it is just as important for individuals to have the ability to work individually as each person is required to complete a run by him or herself. According to the respondents, the significance of this skill in the environment under investigation is that it is an indicator of a person's self-confidence level.

Another significance of the ability to work individually is that, while supervision is built into the system of working in the laboratory, analysts are expected to, as far as possible, work without supervision, and not be "prodded all the time".

3)    Evidence that the students were unable to work individually

The respondents reported that a lack of this skill was often noted at the interview stage where, as interviewers, the respondents often discerned that the students were unable to give examples of how they utilised this skill.

4)    Recommended improvement

The suggestion of the respondents was that perhaps the practical activities during the academic training should be structured in such a manner that students are given individual practical activities in addition to group activities. In this way, the students could learn to work individually as well as in groups. This, according to the respondents, could help the students develop the confidence to work individually and take full responsibility for an individual task.

### 5.5.11  Ability to adapt successfully to changing situations (adaptability and flexibility)

Adaptability and flexibility were rated among the top ten most important skills in the environment under investigation, but appeared to be considered lacking in the students

and graduates from the institution under investigation. In the focus group interviews, the participants compared this skill to the ability to apply knowledge to new situations. This skill had also been rated among the important skills in the environment but, like adaptability and flexibility, was deemed lacking on the part of the students and graduates.

It also transpired in the focus group interviews that participants linked the ability to adapt and be flexible to a worker's willingness to learn and continue learning

## 1)      Significance of the ability to adapt successfully to changing situations

The respondents indicated that the scientific world, and life in general, changes constantly. For this reason they felt that "it is important for people not to be stuck with doing one thing for long" but to be flexible and adapt quickly to changes and changing environments. In the environment under investigation, the interviewees thought that students needed to understand that the industry is diverse and that some companies might be using instruments that the students had not been exposed to on campus. They therefore needed to be able to adapt and learn to use the new instrument. The interviewees linked this skill to the willingness to learn new things as well as apply knowledge to new situations.

## 2)      Evidence that the students lack the ability to adapt and be flexible

A lack of this skill was made clear by the interviewees from the tobacco industry where it was clear that the students struggle to settle into this environment because they find it very different from other industries. This is because the tests that are done in this environment are unique.

## 3)      Recommended improvement

The interviewees thought that this skill is within the "softer skills portfolio" and can therefore be dealt with in the work preparedness workshops.

### 5.5.12. Willingness to learn and continue learning

Although in the quantitative phase results did not show significant differences between means indicating the importance of the skill and means indicating the extent to which the graduates possessed the skill in so far as the willingness to learn and continue learning is concerned, the focus group interview discussions showed that the participants linked this skill to the ability to adapt and be flexible as well as apply knowledge to new situations. For this reason, the researcher decided to probe the interviewees on the significance of this skill in their environment.

1) <u>Significance of the willingness to learn and continue learning</u>

The willingness to learn is linked to adapting to the environment, learning the ways of the workplace and understanding the difference in the contexts between work and the university.

> *"It is important for students to understand that what they learn at university is not applied as is in industry. It is important for everybody working here to be willing to learn and to continue learning."*

2) <u>Evidence of a lack of the willingness to learn</u>

The respondents indicated that the students and graduates often fail to understand that every new situation is an opportunity to expand one's theory base and accumulate knowledge.

> "*What we found is that with some students, you may be explaining something to them and they would be whispering: Why do I need to do that?*"

> *"I understand their unwillingness, I was the same when I finished my degree because I thought I knew everything, and so I can understand where a person is coming from, but they need to also understand there is a role to perform and they need to do things and do it a certain way, and if he/she has a supervisor then he/she must follow what that person tells him to do."*

Interviewees felt that students tend to be unwilling to learn things *"outside of what they know".*

The discussions with the interviewees certainly indicate that the interviewees, despite the results of the quantitative phase, feel that the students do lack the willingness to learn and accumulate knowledge.

3)      Recommended improvement

The interviewees recommended that this be part of the work preparedness programme. Some of them thought that as this is linked to adapting to new environments, more site visits need to be incorporated as part of the Work Preparedness Skills Program (WPSP) so that students can understand that industries differ. The WPSP is a series of workshops that are run with students in the semester prior to their experiential learning year.  It seeks to prepare students for the workplace.

## 5.5.13 The ability to plan and organise tasks

The quantitative phase results showed that the respondents value the ability to execute a plan more than the ability to do the planning.

1)      Significance of the ability to organise tasks

Although the chemistry environment is characterised by routine work, it is important for workers to be able to organise their work in such a way that they do not compromise the chain production system. One interviewee indicated that it is important to break down tasks into details as failure to do this may result in skewed results. Some interviewees pointed out that junior analysts in their environment are not required to plan the work (this is the responsibility of the senior analysts), but that it is important for them to be able to follow the plan thoroughly. Interviewees in one focus group, however, had added the ability to prioritise tasks in their questionnaire alluding to the fact that it is an important activity in organising one's tasks.

2)	Evidence that the skill is lacking

Respondents indicated that their experience has been that the students tend to get "lost when it comes to implementing and organising things at work". One interviewee indicated that students often fail to "go into a lot more detailed breakdown of activities". Interviewees in another focus group pointed out that they find that the students do understand a plan. What is lacking is the understanding to do things according to the plan and the time lines specified.

3)	Mentor responsibility

The interviewees also showed an understanding of the fact that the students are "coming into the working world with little or no experience and are still learning". The mentor, therefore, has a responsibility to help the student or the new graduate in this regard.

## 5.5.14 Assertiveness and self-leadership

Assertiveness and leadership were added by some respondents who thought that it was important in their environment, even though it had not been included in the list of skills that they were asked to comment on in the quantitative phase.

1)	How assertiveness and self-leadership are used in the environment

Respondents from one organisation had added this skill to their questionnaire indicating that it was an important skill in their environment. In the focus group interview, the interviewees from this organisation indicated that the use of this skill is attributed to the fact that junior analysts are required to report "things that are not working properly" to the production team. It helps to be able to do this confidently. Having said this, the interviewees were also emphatic about the need for the junior analysts to "check themselves" and "verify results" so that they do not report on the same thing every day. This is what they cited to be self-leadership on the part of the junior analyst.

2)    Significance of assertiveness and self-leadership

As production personnel may often be intimidating in the questions that they pose, it is crucial that the person reporting the fault be assertive enough to be able to insist that an instrument be checked for optimal functioning if they suspect something. The interviewees thought that if the junior analysts were not assertive enough, or if they reported on the same things repeatedly, they might be ignored and that could result in the laboratory issuing results that were not quite reliable.

3)    Evidence that the skill is lacking

The interviewees cited that students tend to be influenced by older staff to "ignore" things that do not seem right. Because they are juniors in the laboratory, they tend to follow the lead of older employees blindly.

4)    Recommended improvement

Although the focus group had cited this, they were unable to offer suggestions for the improvement in this area except to allude to the fact that in could be included in the work preparedness programme of the students.

**5.5.15    Accuracy**

Accuracy was not included as a required skill in the desktop study; hence it was not included in the quantitative phase questionnaires. Some respondents, however, felt that it was a requirement in their environment

1)    Use of accuracy in the environment

Reports that analysts give, while they are for the client's benefit, are also used to make adjustments in the plant.

2)    Significance of accuracy

A lack of accuracy in reporting may result in wrong adjustments being made to the plant and this may be very costly for the organisation.

<u>3).    Evidence that the skill is lacking</u>

The interviewees pointed out that where they suspected a lack of skill was when it became clear that students had not double-checked their work. The interviewees were inclined to think that it was not so much a lack of the skill, but rather that students were sometimes careless.

<u>4).    Recommended improvement</u>

The interviewees thought that the practical sessions' supervision could be strengthened. This would ensure that students did not just do tasks in order to complete them, but that they applied their minds.

## 5.6 CONCLUSION

Through this chapter, the researcher has had an opportunity to probe the respondents more deeply on the results of the quantitative phase. The researcher found in this regard that the interviewees were able to elaborate, and to a great extent, give insight into the results that had emerged in the quantitative phase.

In some instances, however, the researcher picked up that the interviewees were not very specific in giving scenarios that showed a lack of the skill. This made it difficult to draw conclusions in this regard.

It also emerged in other instances that a perceived lack of a particular skill was a symptom of another inadequacy. For example, where accuracy had been cited as a skill that needed attention, it transpired in the interviews that it was actually carelessness in the student's failing to double-check the work that caused the problem.

The researcher also established through this phase that where interviewees referred to critical thinking, the scenarios that were sketched were more on analytical thinking abilities rather than critical thinking ones. This, however, was understandable because of the thin line that separates these two forms of thinking skills.

The researcher also established that the interviewees had the tendency to place certain groups of skills together under one common group. As an example, where the interviewees were discussing adaptability and flexibility, the scenarios that were related

referred also to the ability to apply knowledge to new situations as well as the willingness to learn.

It has emerged through the interviews that the respondents think that the institution under investigation can do more in instilling some of the skills in students during their undergraduate training. The interviews showed that the work preparedness programme that the students currently undergo could be expanded to include employability skills. Suggestions from a number of the interviewees were that short one-to-two day workshops could assist in this regard.

Interestingly, the respondents also identified their own responsibility, as mentors, in helping the students to develop some of the required skills.

# Chapter 6
## Interpretation of the results

## 6.1    INTRODUCTION

This study has concentrated on the non-technical skills of analytical chemistry graduates, as the assumption was that all employers would require the relevant technical skills when considering an employee for a specific environment.

In Chapter 2, the researcher, expanding on the work of De Lange (1998), presented a schematic diagram that clustered skills under the broad categories of functional and adaptability skills, and further added the individual skills that in the researcher's view fall under the composite skills that De Lange (1998:40) proposed (see Fig. 2.4 in Chapter 2) Interpretation of the findings in this study was done to elucidate the following:

1. Establish and discuss, briefly, the skills that appear to be extremely important as well as those that are least important.
2. Based on Fig. 2.4, establish the inter-relatedness of the skills in each cluster, based on the mean scores of the different skills.
3. Identify those skills that the graduates from the institution under investigation possessed.
4. Establish whether there is congruence between the skills that the employers identified as important and those that the graduates from the institution under investigation possessed.

In order to answer the above questions, Section 1 of the questionnaire required respondents to rate the importance of skills according to a 5-point Likert scale. An observation in the analysis is that none of the listed skills had mean scores of four (4.00) and above (see Table 1, in Chapter 4). This is an indication that the respondents did not view any of the skills as unimportant or completely unimportant.

Entrepreneurial skills (mean=3.06; SD=0.74), as well as the understanding of business realities (mean=2.58; SD=0.810), had a mean score above 2.5, which indicates that the respondents considered these skills neither important nor unimportant for their environment.

The rest of the skills from the desktop study were indicated to be either important or extremely important with mean scores 2.5 and above.

Although not considered extremely important, the following skills were among those that emerged to be important in the environment under investigation: ability to follow logical arguments (mean=2.18;SD=1.024), ability to summarise key issues (mean=2.22;SD=0.975), research skills (mean=2.34;SD=0.872) and the ability to construct a logical argument (mean=2.36;SD=0.802).

The emergence of the ability to lead (mean=2.40;SD=0.881) also indicated as a skill that is not extremely important, is surprising as laboratory analysts work in teams, and any team requires someone to take the lead in certain situations.

The discussion will now turn to establishing the extent of the congruence between the skills that are considered extremely important or important in this environment (mean scores below 2.50) and those that the students and/or graduates from the institution under investigation demonstrated.

In order to answer the question relating to the skills that Western Cape employers have identified in analytical chemistry students and graduates from the institution under investigation, respondents were provided with a statement that reflected that students and/or graduates from the institution under investigation demonstrated a particular skill. They were asked to express the extent to which they agreed or disagreed with the statement according to a 5-point Likert scale. Mean scores of between 1.00 and 2.50 were considered to indicate that the group under investigation demonstrated the skill, to

a particular degree, while mean scores above 3.50 were considered to mean that the group under investigation did not demonstrate the skill.

Mean scores between 2.5 and 3.5 were taken to indicate that the students did not (effectively) demonstrate the skill to such an extent that the supervisors were unable to agree or disagree as to the presence of the skill.

## 6.2   FUNCTIONAL SKILLS

As depicted in Fig 2.4, the skills used in daily interaction and in the process of furthering the organisation's objectives are communication, problem solving and information management. In order to interpret the findings of this study, the researcher endeavoured to establish what level of importance the respondents had allocated on the different skills under functional skills.

It was noted in this study that, according to mean scores, skills that are inter-related were not considered closely related in their importance. Below is a discussion and interpretation of the mean scores of the skills that are clustered under functional skills.

### 1) The ability to identify, investigate, analyse and solve a problem

The different stages of problem solving, that is, problem identification, investigation, analysis and solving, were treated as separate skills in the investigation in order to establish the extent to which each stage is considered important or not important in the sector as well as the extent to which the graduates from the institution under investigation demonstrated the skill.

### a) The ability to identify a problem

The results of this study indicate that the initial stage in the problem-solving process, that is, the ability to identify a problem, has been identified as one of the skills that are extremely important in the environment under investigation (mean=1.46;SD=0.503). This means that employers in this environment require the graduate to be able to

observe a problem and conceptualise a statement of question. On the other hand, however, the inferential statistics indicate that the respondents could not agree or disagree as to whether the graduates under investigation do possess the skill or not (mean=2.56;SD=1.027). The mean score (mean= -1.083;SD=1.131), with a difference of p=0.00, indicates that there were significant differences, and therefore, there was no congruence between the level of importance of this skill and the extent to which it was demonstrated by the group under investigation.

b) <u>The ability to investigate a problem</u>

Like the problem-identification stage, the ability to investigate a problem (mean=1.46; SD=0.503), is valued by the respondents as it indicates that the graduate is required to have the cognitive skill that allows him or her to sift through information in order to isolate the problem through observation and questioning. The inferential statistics for this skill show that the respondents could not agree or disagree as to whether the graduates under investigation do possess the skill or not (mean = 2.56;SD=1.054). The paired difference (mean= -1.111;SD=1.141), however, conclusively indicates that there is significant difference and, therefore, very little congruence between the level of importance of this skill in this environment and the abilities of the graduates under investigation.

c) <u>The ability to analyse a problem</u>

According to the mean score for the ability to analyse a problem (mean=1.48; SD=0.505), it seems that it is a requirement in this environment for the graduate to have the ability to identify a problem and explore alternatives, thus considering all the facts before taking a position towards implementing a solution (Snyders & Snyders, 2008:90). It also seems as though the respondents did not strongly agree that graduates are able to do the above (mean=2.53;SD=1.055). This is confirmed by the results of the paired difference (mean =-1.028;SD=1.158) for this skill, which indicates that there are significant differences (p=0.00) and therefore no congruence between the extent to which the graduates are deemed to possess this skill and its level of importance in the environment under investigation.

d) <u>The ability to solve a problem</u>

In the analysis, it seems as though the respondents require that new graduates, on identifying a problem, should be able to consider all the facts and take a position towards implementing a solution. As with the other skills in this cluster, the paired difference results (mean= -1.083;SD=1.025) show a significant difference (p=0.00) and therefore, a low level of congruence between the importance of this skill and the extent to which the respondents thought that the group under investigation demonstrate it.

Just as Snyders and Snyders (2008:90) state, the respondents link problem-solving attributes to critical thinking and therefore the ability or inability to troubleshoot as a significant indicator of problem-solving abilities. The interviews revealed that while the students, at their level, are not required to implement solutions to a problem, they are certainly required to be able to do initial problem solving though observation and questioning, as well as by consideration of all the facts at hand, before reporting the problem to a senior staff member. This, according to the interviewees, indicates that the student has thought about the problem before reporting it. The respondents felt that the institution could try to give students activities that challenged them to think "outside the box" in order to help them develop better problem-solving skills. The work preparedness skills programme was indicated as an area that the institution could strengthen by incorporating workshops of short duration to develop this skill.

It became clear during the interviews that the reason why the ability to solve problems had mean scores lower than those of the other phases of problem solving, is that the students and new graduates are not really expected to go beyond identifying that there is a problem and doing some basic troubleshooting.

Emerging from the interviews also, was that because the environment under investigation is highly automated, the ability to note deviations from the standard and to troubleshoot is the main indicator of critical-thinking abilities. The respondents felt that in certain instances the students tended to panic when confronted with a challenge and needed to be guided constantly.

While the lack of critical thinking was highlighted as a challenge by a number of focus groups, one group felt that the concept of co-operative education is precisely for the workplace mentor to help students develop skills that are not taught in class, like critical thinking and problem solving.

The general feeling was that the institution could solve this challenge by ensuring increased exposure of students to instrument handling during practical activities.

The general interpretation of the results for the skills in the problem-solving cluster is that while the employers consider it extremely important for graduates to have the ability to solve a problem through a process of observation, questioning, consideration of all the facts at hand and reaching a conclusion, there was no correlation between the level of importance for these skills and the extent to which the group under investigation demonstrate it.

Further, as per the argument by Snyders and Snyders (2008:90), that problem-solving abilities are closely linked to one's self confidence as well as the ability to think critically, both the quantitative and qualitative results seem to indicate that the respondents would like new graduates to have critical-thinking abilities (mean=1.76;SD=0.591), that is, they must think the problem through before seeking help. Similarly, they must be self-confident (mean=2.28; SD=0.735), that is, they must attempt to solve the problem through basic troubleshooting before seeking help.

While the inferential statistics for self-confidence (mean=2.28;SD=0.735) and ability to think critically (mean=2.44;SD=0.742), clearly indicate that these skills have been demonstrated by the students and/or graduates under investigation, the paired difference results for these skills, that is, self-confidence (mean= -0.500;SD=1.000) and the ability to think critically (mean= -0.722;SD=0.944), show significant differences and therefore low levels of congruence between the level of importance as per the opinion of the respondents, and the extent to which the graduates under investigation demonstrated the skills.

The implication of this result for the curriculum is that perhaps the Department of Analytical Chemistry at the institution under investigation should consider giving the students complex exercises and practical activities that challenge them to think critically.

## 2) <u>Communication skills</u>

In order to discuss communication skills, reference is drawn from Cunningham's (2007:162) interpersonal communication model, as discussed in Chapter 2 of this study (see Fig. 3, below):
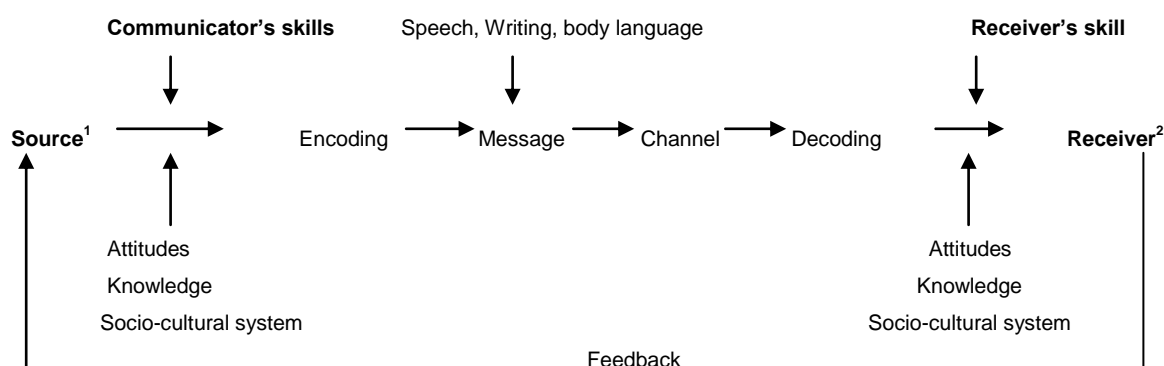


**Fig. 3: Basic interpersonal communication model**

The purpose of clustering oral and written communication, and proficiency in English, as well as ability to present information, was to establish whether the respondents thought it was important for the student to:

a) as a source[1] of information, have abilities to relay information in such a manner that his or her attitude and knowledge of the subject matter ensure that the message is conveyed in such a way that the receiver decodes it easily, and

b) as a receiver[2] of information, have the abilities to decode and understand the message that the source is trying to convey as well as be able to give feedback that will be understandable to the source.

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[1] Person that is initiating the communication
[2] Person that is receiving the communication

True to the model for interpersonal communication by Cunningham's (2007:162), the respondents thought that all the skills are extremely important. The differences between the mean scores of these skills, however, indicate an apparent difference in the levels of importance that the respondents attach to the various modes of communication.

   a)  Oral and written communication
Both oral (mean= 1.68;SD=0.513) and written (1.84;SD=0.584) communication have been indicated by the respondents as important in the environment under investigation. The fact that written communication emerges as important in this environment seems to concur with Cilliers (2000), who argues that report writing is one of the skills that have become significant in the 21$^{st}$ century with the duties of secretaries being scaled down significantly.

Even though both oral communication (mean=1.81;SD=0.577) and written communication (mean=2.06;SD=0.826) are indicated to have been demonstrated by the graduates under investigation, the mean paired difference for oral communication (mean= -0.306;SD=0.822) indicates that there are differences (p=0.032) and, therefore, a low level of congruence between the level of importance of the ability to communicate orally, and the extent to which the group under investigation demonstrated the skill.

Written communication, on the other hand, with a mean paired difference (mean= -0.278;SD=0.849), showed that there are no significant differences (p=0.058), and therefore congruence between the level of importance for this skill and the extent to which the graduates demonstrate it.

   b)  English language proficiency
The mean score for English proficiency (mean= 1.74; SD= 0.443) in the descriptive statistics indicate to the researcher that this environment finds it extremely important for workers to be able to converse in English. Similarly, the inferential statistics indicate that the respondents were comfortable with the graduates' English proficiency  (mean=1.81; SD=0.955). This is confirmed by the mean paired difference results (mean=-0.056;

SD=0.715), with a paired difference of P=0.644, which indicates that there is congruence between the English proficiency (mean=-0.056; SD=0.715) of the group under investigation and the level of importance of this skill in the environment under investigation.

c) The ability to present information

It is not surprising that the ability to present information is indicated to be among the extremely important skills (1.86; SD=0.729), as according to Cilliers (2000:272), large organisations, as they embark on succession planning, have a tendency to call upon new graduates to present to senior management. Given that a presentation may require the ability to not only convey the information, but do so clearly and persuasively (Stewart & Knowles; 1999:374) using different forms of communication, viz. written, oral and technological media, there is perhaps a flaw in the way that the question was posed in that it did not differentiate between the modes of communication to be considered when evaluating presentation skills.

Notwithstanding the above, the respondents were decisive in indicating that the graduates under investigation demonstrated the ability to present information (mean=1.94;SD=0.955) and additionally, the paired differences results indicate that there is no significant difference (P=0.404), and, therefore, congruence (mean=-0.194;SD=0.856) between the level of importance of this skill and the extent to which the graduates demonstrated the skill.

Although oral communication had been flagged as a skill that showed significant differences in the inferential skills interpretation, it emerged in the focus group interviews that the respondents thought that the graduates under investigation demonstrated the skill effectively.

It also emerged in the quantitative phase that at entry level, graduates are not required to give written reports as this responsibility lies with the senior analyst in a section. This explains why written communication had lower mean scores than oral communication in

the quantitative study. Notwithstanding the above, the respondents reported, in the interviews, that they had noticed a lack of this skill in the technical reports that the students produced as part of their course requirements. The respondents cited the incorrect use of terminology as very prevalent. They suggested that the institution should introduce students to technical report writing earlier in their training.

Generally, the study has shown that the industry is satisfied with the proficiency of the group under investigation in respect of communication skills. Apart from the areas where the Afrikaans language is predominantly used, language use was found to be of an acceptable standard.

## 6. 3.  ADAPTABILITY SKILLS

The broad classifications under adaptability skills were organisational effectiveness and leadership, a work-related disposition and attitude, as well as self-management skills. The interpretation of the findings in this study was therefore, based on these clusters.

### 1)  Organisational effectiveness and leadership

De Lange (1998) defines this cluster as those skills that contribute to the success of an organisation through the achievement of its goals. With the view of getting an indication as to whether the students and/or graduates under investigation were able to demonstrate a combination of these skills, the researcher will attempt to interpret the results of time management, understanding of economic and business realities, client focus, professionalism, planning and organising of tasks and understanding of different cultural contexts by establishing the inter-relatedness of these skills as demonstrated by the graduates.

### a)  Time management

While the respondents indicated that time management (mean=1.44;SD=0.577) is valued more than any other skill in this environment, and although they agree that the graduates that they supervised demonstrated a degree of time management (mean= 2.44;SD=0.998), the results of the inferential statistics of the mean paired differences for

time management (mean=-1.056;SD=1.170), indicate that there are significant differences (p=0.00), and therefore a low level of congruence, between the opinions of the respondents with respect to the level of importance and the extent to which the group under investigation demonstrated the skill.

In the qualitative phase, all the respondents placed the ability to adhere to due dates as an indicator of a graduate's ability to manage time. The significance of this is that the quality accreditation of laboratories includes an evaluation of the extent to which a laboratory adheres to deadlines. Because of this, it is important in this environment for workers to understand and adhere to Service-Level Agreements (SLAs) for the issuing of results. The respondents reported that students and new graduates tend not to display an understanding of this.

In summary, although there was not enough literature on time management specifically, the qualitative phase did provide some input with respect to the value that the industry under investigation places on it. Both the quantitative and qualitative phases showed that the group under investigation tends not to demonstrate this skill effectively.

 b)    Planning and organising

Although the ability to plan activities (mean=1.74;SD=0.600), ability to organise tasks (mean=1.80;SD=0.833) and ability to execute a plan (mean=1.64;SD=0.577), are all viewed as extremely important in this environment,  and although the respondents agree that the graduates under investigation demonstrated the ability to plan (mean=2.28;SD=0,882) as well as the ability to organise tasks (mean=2.31; SD=0.882), they do not demonstrate the ability to successfully execute a plan (mean=2.67; SD=1.014).  The mean paired differences for these composite skills show that there are low levels of congruence between the level of importance for the ability to plan (mean = -0.556;SD=0.939) with a paired difference (p=0.001), and the ability to organise tasks (mean=-0.472;SD=1.082) with a paired difference (p=0.013), and the extent to which the graduates under investigation demonstrated these two skills. Likewise, the results show there is an even lower level of congruence in so far as the importance of the

ability to execute a plan (mean= -0.972; SD=1.108) with a paired difference (p=0.00) and the extent to which the graduates demonstrated this ability.

While the respondents confirmed in the qualitative phase interviews, that the students and new graduates are not required to plan the activities of the laboratory, they stressed that they are certainly required to be able organise tasks (associated with the plan) that are allocated to them. The respondents reported that the new graduates tend to struggle with placing and prioritising tasks into categories and breaking them into more detail. While some of the respondents felt that short workshops, as part of the work preparedness programme, could possibly be offered to the students on planning and organising, some felt that the mentors in the workplace had a responsibility to help students through this during their experiential learning.

c)    Appreciation of different cultural contexts

As asserted by Butterwick and Benjamin (2006), it is important for workers to understand that cultural differences have a contribution in shaping one's emotional landscape (Butterwick & Benjamin, 2006). The respondents in this study seem to concur with this notion as they have indicated that they value graduates who have an appreciation of cultural contexts (mean=1.84;SD=0.618). This is also not surprising as, like Cilliers (2000) posits, most employers are now looking for workers that can appreciate different cultural contexts and can work in culturally diverse teams.

The respondents in this study, according to the inferential statistics, are of the opinion that the group under investigation does not appreciate cultural diversity (mean=2.54; SD=0.852).

The paired difference for the ability to appreciate different cultural contexts (mean=0.6; SD=0.976) at P=0.001, also indicates that significant difference exists between the level of importance of this skill and the opinion of the respondents as to the extent to which the students and/or graduates demonstrate it.

In the qualitative phase interviews, the general feeling among the respondents was that while students and new graduates do not portray intolerance of cultural diversity, they often display a lack of understanding of their colleagues' behaviour.  An example that is cited is that graduates tend not to understand the discomfort of older colleagues from some African cultures when they are addressed by their first names by younger graduates. This, according to the respondents, could be attributed to their not understanding the contexts of the different cultural backgrounds of their colleagues.

Apart from cultural diversity, language diversity was highlighted by some respondents as an issue that requires attention. The respondents reported that students and graduates tend to mix only with people who speak a similar language to theirs. There was no indication of this being as a result of not being proficient in the language, especially with respect to the English language, but rather a preference.

In summary, the results show that although the group showed a level of awareness with respect to the need to adapt and be sensitive to issues of cultural diversity, some work needs to be done in entrenching this.  While it is acknowledged that this skill cannot be incorporated into the analytical chemistry curriculum, it is suggested that academic staff encourage students to work in diverse groups during practical activities and for group assignments.

d)      Client focus and the understanding of economic and business realities
Among skills that contribute to an organisation's effectiveness and leadership are client focus and an understanding of economic and business realities, as well as professionalism. The rating of client focus (mean=1.92;SD=0.695) clearly indicates that respondents thought that this skill was valuable in their environment. The results indicate, however, that they do not agree that an understanding of economic and business realities (mean=2.58;SD=0.810), as well as of professionalism (mean=2.61; SD=0.903), is important. This is interesting since one would have thought that client orientation is associated with an understanding of, inter alia, how the business world works and quality management principles, as well as business profitability, especially

now that laboratories are required to subscribe to the quality management principles of the ISO 9000 accreditation (Heras et al., 2002).

A closer look at the scores of the inferential statistics for understanding the economic and business realities (mean=2.92;SD=0.996), indicates that the respondents neither agreed nor disagreed that the graduates demonstrated this skill. Likewise, even though the respondents had identified client focus as extremely important in the environment under investigation, the score for the inferential statistics for client focus abilities (mean=3.03;SD=0.81) of the graduates indicates that the respondents could not agree or disagree that the graduates demonstrated the skill. This finding is confirmed by the paired difference result which showed a significant difference of P=0.000 (mean=-1.143; SD=1.115) and therefore a low level of congruence between the level of importance for this skill and the extent to which the graduates demonstrated the skill.

The paired differences results indicate, however, that there are no significant differences (P=0.091) and that, therefore, there is congruence between the level of importance for understanding the economic and business realities (mean=-0.361; SD=1.246) and the students and/or graduates' abilities in so far as this skill is concerned.

Although the quantitative results show that the respondents did not think that these two skills were extremely important for new graduates in their environment, it emerged during the interviews that they considered it important for new graduates to understand the relationship between the sustainability of a business and the extent to which client relationships are maintained. This is especially so as the chemistry environment has become extremely competitive. The interviewees also attributed the significance of this skill to the fact that students have to include some economic substantiation for recommendations that they make in the projects that they undertake during the course of their placement. As such, the students need to have an understanding of economic and business realities. The general feeling was that, although this is not an important part of the students' training, the institution should make students aware of quality

accreditation, and its impact in the working environment, as well as the relationship that exists between this and the sustainability of jobs.

## 2) **Work-related disposition and attitude**

Introduction

The skills that have been listed under work-related disposition and attitude are team work, self-confidence, adaptability and flexibility, as well as leadership. These skills, according to Curtis and McKenzie (2002) as well as Stewart and Knowles (1999), indicate a worker's attitude to work. In the interpretation, therefore, the researcher seeks to understand whether the respondents thought that it was important for graduates in this environment to have these skills.

a)     Team work, ability to work individually and self-confidence

The mean score for the ability to work effectively within a group (mean=1.64;SD=0.485) indicates that the respondents value team work in this environment and thus view this skill as extremely important. This concurs with Curtis and McKenzie (2002) who assert that employers value this skill as its presence in a worker is indicative of high performance ability. Also, in accordance with Lees's (2002) assertions that individuals who work well in a team are those who are self-assured and have good communication skills, self-confidence (mean=1.70;SD=0.580) is indicated by the respondents to be extremely important in the environment under investigation.

Lees's (2002) assertion is further confirmed by the results of the inferential statistics which indicate that the respondents are also comfortable with the ability of the graduates under investigation to work confidently within a group (mean=1.91; SD=0.577), as well as the level of their self-confidence (mean=2.28; SD=0.741).

This picture changes, however, with the results of the paired differences. While congruence was established between the level of importance of team work and the

extent to which the graduates under investigation possessed the skill (mean = 0.171; SD=1.200), with a paired difference (P=0.404), there were significant differences (P=0.005) and therefore a low level of congruence between the extent to which the graduates demonstrated self-confidence (mean= -0.500; SD=1.000) and the level of importance for this skill  in the environment under investigation.

The respondents confirmed in the interviews that team work is very important in their environment. They attributed this importance to the fact that individuals are dependent on one another for the completion of a series of analyses. The individuals and teams are therefore inter-dependent as the results are issued as a consolidated report.  It is, for this reason, important for individuals to understand their role in the team. Most new graduates from the institution under investigation tend to be unable to do this. Often, the graduates also do not interact with other members in the team. The respondents also reported that students and graduates from the institution under investigation tended to associate with team members of the same language and background. This was attributed to a lack of understanding of diversity issues as well as the existence of language barriers, especially in the Afrikaans-speaking areas of the Western Cape.

While the respondents understand that students are required to work in teams during practical activities, their general feeling was that more could be done to ensure that the groups are small, so that all students are active and the lecturer is able to ensure this.

While team work is crucial in this environment, some respondents felt that the ability to work independently was as important. This is because although the teams work in a production chain, each person has the responsibility to do a complete test run by him or herself. The respondents felt that they valued this skill as it is also a strong indicator of self-confidence. The general indication was also that the lack of this skill becomes evident during the interview stage where students are unable to give examples of how they have applied this skill in their student life. The respondents felt that perhaps more should be done to encourage students to work independently during practical activities.

b)      Adaptability and flexibility

True to what Curtis and McKenzie (2002) posit, that team work forms part of an individual's intellect *and encompasses a number of skills, including the ability to adapt to changing situations,* the descriptive statistics results for adaptability and flexibility (mean=1.52;SD=0.54) indicate that the respondents, as with team work, feel that this skill is extremely important in their environment.

However, even though the descriptive statistics results in this study concur with the findings of Curtis and McKenzie (2002) on the relationship between teamwork ability and adaptability and flexibility, this relationship is not evident in the results of the inferential statistics. Although the respondents strongly agree that the graduates under investigation are able to work confidently in a team and are self-confident, the mean score for adaptability and flexibility (mean=2.53;SD=0.774) indicates that they neither agree nor disagree that the graduates under investigation demonstrate this ability. This could mean that the graduates from the institution under investigation do not convincingly demonstrate this skill. The mean paired differences for adaptability and flexibility (mean= -1.028;SD=0.941) confirm that there is a low level of congruence between the importance of this skill and the extent to which the graduates under investigation demonstrated the skill.

In the qualitative phase interviews, the respondents attributed the significance of this skill to the fact that the work environment is a different environment from that of the university and therefore requires the new graduate to be able to adapt. Linked to this, as well, is that the scientific environment changes constantly. For this reason, the respondents said that they tended to look for this trait in the interview stages. They are of the opinion that students and graduates from the institution under investigation are often unable to demonstrate this ability in the interview. As this is not a skill that can be included in the chemistry curriculum, they recommend short workshops to help students develop this skill.

It is suggested that, to try to remedy this, the work preparedness programme be structured so that it encompasses activities that encourage students to "step out of their comfort zone".

## 3)    Personal self-management skills

Introduction

This section of the interpretation seeks to establish if the respondents thought that it was important for new graduates in this environment to be motivated to learn and continue learning. This begins with the graduate having the skills that, according to Ridgstock (2007), relate to their perceptions and appraisals of themselves in terms of values, abilities, interests and goals, as it is the understanding of one's goals and interests that leads to an understanding of one's developmental needs. It further seeks to establish congruence between the level of importance that the respondents rate the skills at for their environment and the extent to which the graduates under investigation demonstrate the skills.

a)  Willingness to learn and continue learning, motivation and self- management

The mean score for the willingness to learn and continue learning (mean=1.56; SD=0.501) is among the top skills indicated by the respondents as extremely important for their environment. This links with the assertions of Cilliers (2000), Clarke (1997), Hall (1996) and Guest (2006), that the changing work environment requires workers with a self-directed need to learn, as well as those who take responsibility for their own lifelong learning. The mean score of this skill is very close to that of the ability to analyse problems (mean= 1.48; SD=0.505), confirming Cilliers' (2000) assertion that there is inter-relatedness between the willingness to learn and continue learning and higher cognitive skills like analytical abilities.

While the mean score for the willingness to learn and continue learning (mean=2.08; SD=0.140) indicates that the respondents agree that students and/or graduates under investigation demonstrated the inclination towards lifelong learning, the mean score for self-management (mean=2.94; SD=0.132) indicates that the respondents neither agree

nor disagree that the students and/or graduates under investigation demonstrated the skill effectively. This perhaps fails to confirm the assertions by Cilliers (2000) that a willingness to learn and continue learning (mean=1.56; SD=0.501) is also an indication of high self-management skills in a worker.

The interviewees attributed the significance of this skill to the fact that the work environment is different from the university environment and thus requires new entrants to be willing to learn new ways of doing things as applicable in the context of the work environment they are placed in. This skill is also important in that in any work environment there is always a need to increase one's theoretical base and to accumulate knowledge. The group under investigation, according to the interviewees, is unable to demonstrate this understanding.

While the interviewees could not articulate the link between the willingness to learn and self-management, they could clearly see the link between this skill and a high degree of motivation on the part of a worker.

The results for both self management and willingness to learn and continue learning are an indication that the institution under investigation needs to do more in instilling personal self management skills in analytical chemistry students.

## 6.4    ADDITIONAL SKILLS (not included in the survey form)
### 1)    Ability to work independently

While team work is crucial in this environment, some respondents felt that the ability to work independently was as important. This is because although the teams work in a production chain, each person has the responsibility to do a complete test run by him or herself.  The respondents felt that they valued this skill as it is also a strong indicator of self-confidence. The general indication was also that the lack of this skill becomes evident during the interview stage where students are unable to give examples of how they have applied this skill in their student life. The respondents felt that perhaps more should be done to encourage students to work independently during practical activities.

## 2) Interpersonal relations

Although the respondents were not too explicit with respect to whether or not the graduates from the institution under investigation demonstrated this skill, they thought that it was certainly important for them in the working environment. According to the respondents, this skill manifests itself in one's ability to get others to work with him or her. The significance of this skill is attributed to the ability to manage conflict in the workplace as well as to understand and manage diversity.

## 3) Accessing of information

The respondents, whilst admitting that students and graduates are not required to find information in the course of their work, all agreed that this skill was crucial for the students' own development. According to the respondents, they had noticed when checking the students' final projects that they tend to "cut and paste" and that therefore their work is often a regurgitation of information that has been downloaded from the Internet. The respondents felt that the institution needed greater emphasis on issues of plagiarism and ethics in research during the undergraduate studies.

## 6.5. CONCLUSION

This section sought to answer, quantitatively, the three questions that are linked to the problem being investigated. It has provided the researcher with the list of skills that the respondents consider very important for analytical chemistry graduates in the Western Cape.

The study concurs with the desktop study that workers are required to be able to function in a work environment by possessing and demonstrating abilities to problem solve, think analytically and communicate effectively. In addition to this, the worker is expected to adapt to the work environment by contributing to the organisation's effectiveness and leadership, to have a disposition and attitude that contributes positively to a work environment, and to be able to manage him or herself. In light of this, it is important for workers to have the abilities to manage their time effectively, be professional, plan and organise tasks and work effectively in groups. Because work environments (and often their client bases) are diverse in nature, it was indicated that the environment under investigation requires workers to understand cultural diversity and appreciate it. Workers are also required to understand economic and business realities as well as be client focused.

Additionally, some intrinsic skills like motivation towards lifelong learning and self-confidence were cited as important.

On whether the group under investigation demonstrated the skills that the respondents thought were important or not, it is evident from the quantitative phase that the respondents thought that the group did not demonstrate all the skills that allow for a worker to effectively function in a work environment. While the group could clearly demonstrate communication abilities, their problem-solving abilities were not too evident. The group was also found to be able to manage their time, work effectively in teams and to be self-confident.  While the group was deemed to display a willingness to learn and continue learning, their level of self-management abilities was poor.

The respondents also indicated that the group under investigation did not display the ability to plan and organise tasks.

Congruence between the skills indicated as important for the environment under investigation and the extent to which the students and/or graduates from the institution under investigation demonstrated the skill, was found only in English proficiency, the ability to present information, the understanding of economic and business realities, as well as the ability to work effectively in teams. This means that there is a low correlation between the importance of a number of skills and the extent to which students and/or graduates from the institution under investigation demonstrated the skills.

It is acknowledged, however, that the quantitative phase did not give the respondents an opportunity to elaborate on the opinions that they expressed and that the qualitative phase results will be crucial in understanding the underlying reasons for their opinions.

# Chapter 7

## Summary of findings and recommendations

### 7.1    Introduction

In Chapter 1, the problem of a disjuncture between what employers require in new graduates, and the skills with which graduates come equipped, was highlighted.  This led to the question of what exactly employers in the analytical chemistry environment, in the Western Cape, look for in new graduates.

Chapter 2, through a literature study, provided 18 skills as a framework for the required skills across all disciplines.  These were used to formulate a questionnaire, the results of which would, it was hoped, yield a framework of required skills for the environment under investigation.

### 7.2    Reflection on the study

Looking at the study and the results thereof, the researcher is able to conclude that the study has provided answers to the main question, which was reflected in the topic:

*The employability skills of analytical chemistry graduates at an institution of higher learning:  An investigation of their relevance to potential employers in the Western Cape.*

The interrogation of this topic resulted in three sub-questions, which were:

1.  What skills are employers looking for in new analytical chemistry graduates?
2.  What are the skills that Western Cape employers have identified in analytical chemistry students and graduates from the institution under investigation?
3.  To what extent is there congruence between the skills required by potential employers and those demonstrated by analytical chemistry graduates from the institution under investigation?

In order to fully understand the impact of the problem, it was necessary for the researcher to establish a framework of skills that could be used as a basis for the quantitative phase. This was achieved through a desktop study. Through quantitative/qualitative methods of data collection, respondents gave an indication of which of the skills from the desktop study were required in their field as well as whether or not the students and/or graduates under investigation possessed these skills. A qualitative method complemented the findings of the quantitative study and confirmed the following findings:

### 7.2.1   Functional skills

The study revealed that for employers in the Western Cape chemistry environment, it is important that new analytical chemistry graduates have some of the skills that enable them to function in the environment. These are both communication and problem-solving skills.

As far as communication skills are concerned, the study revealed that employers require the graduate to be able to communicate orally and in writing, as well as be able to present information.  Both the quantitative and the qualitative phases revealed that, while the employers did not strongly agree that the graduates possessed all the skills associated with communication, they were comfortable with the students' abilities with regard to oral communication and English language proficiency, as well as presentation of information. Written communication skills, however, were found to be lacking.  Just as the quantitative study showed that written communication skills had higher mean scores than the other forms of communication in respect of importance, the interviews revealed that the shortcomings in this skill were identifiable in the way that the final-year students wrote their projects, with a tendency to plagiarise work downloaded from the Internet. The employers attribute this to a lack of understanding of ethics in research and suggest that the institution does more to educate the students in this respect.

While the chemistry employers require analytical chemistry graduates to have a level of problem-solving skills, new graduates are not required to provide a solution to a

problem beyond doing some troubleshooting. This means that after identifying a problem, they should be able to investigate and analyse it before handing it to a senior analyst for a solution. This also requires them to have critical-thinking abilities. The employers are in consensus that graduates tend not to demonstrate this skill effectively and this is manifested in the way that a minor problem is referred to a senior analyst who often discovers that with a bit of troubleshooting, the student could have established the problem, and in some cases, solved it.

### 7.2.2 Work-related disposition and attitude

Generally, the findings also reveal that it is important in this environment for students to have the skills that help an organisation further its objectives. This is achieved through having a work-related disposition and attitude which is manifested in the ability to work both independently as well as in a team, and to display flexibility and leadership.

While the graduates from the institution under investigation seem to be able to work in a team, they tend to want to work only with a team that they are comfortable with. Although there is a possibility that language barriers can often be a cause of this tendency, there is also a strong indication of a lack of adaptability and flexibility on the part of the students.

As this study did not address language use, other than English proficiency, it is not possible to pre-empt the extent to which language barriers impact on the abilities of the students to interact with others.

### 7.2.3 Personal self-management skills

The findings indicate that the employers in the environment under investigation value workers who are motivated and have the willingness to learn and continue learning. Both the qualitative and quantitative phases in this project revealed that the students do not understand that the changing nature of the work environment they aspire to work in requires them to use embedded knowledge to relate to new situations. As a result, students tend to not demonstrate an eagerness to learn. The advice of the respondents

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is that in the work readiness preparation, students need to be made to understand the importance that Continuous Professional Development (CPD) plays throughout an analyst's career

### 7.2.4  Organisational effectiveness and leadership

The study revealed that the employers in the environment under investigation value graduates who are able to manage themselves and have time-management abilities. Although time management is implied in a number of literature studies, the researcher was unable to find work that explicitly deals with the role of time management in organisational effectiveness; suffice to say that it is an indicator of professionalism in a person.  Certainly in the environment under investigation, the adherence to Service Level Agreements is the significance of this skill.

Linked to the above is the fact that the chemistry environment has become extremely competitive as a number of laboratories become ISO accredited.  This means that the attraction of business to a laboratory could be the ability of that laboratory to thrive, and for any organisation to achieve this, it is important for its clients to be amongst its most important commodities. The supervisors in the environment under investigation, therefore, value graduates who understand that a business's continued existence, and therefore, the sustainability of jobs, are directly linked to satisfied clients.  The graduates under investigation were found lacking in this regard and this was attributed to the fact that while, as students, they hear about the accreditation process, they do not understand the role that they need to play, as professionals, in order for their employer to achieve this accreditation status.

As shown in the discussion on working effectively within a group, the graduates under investigation seem to prefer to work with colleagues with whom they feelcomfortable. While there is no clarity on the reasons behind this, there are indications that the graduates tend not to understand the colleagues' cultural backgrounds and, as a result, fail to understand the influences that culture has on their colleagues' behaviour.

This study also revealed that while the environment under investigation does not expect new graduates to plan the activities of the laboratory, the environment values employees that are able to organise tasks that are related to a plan. This ability was linked to prioritising tasks. The new graduates did not demonstrate this ability effectively. It appears from the study that both the institution and the training workplace mentors have the responsibility to develop this ability in the students. The institution under investigation is advised to tighten the work preparedness programme, while the workplace mentors are reminded of their responsibility to help a student and new graduate to develop this skill in the workplace.

## 7.3    Recommendations

### 7.3.1  Introduction

From the suggestions of the respondents, it seems clear that the preparation of students for the world of work needs to be strengthened. To complement this effort, there should be the realisation that mentors have a responsibility in the three-way partnership of co-operative education.

Although some of the respondents thought that the shortcomings in some of the skills could not be incorporated into the curriculum, but that students might benefit from short workshops, literature suggests otherwise. My recommendations, therefore, are based on the works of Chadha (2006) and Schulz (2008) who suggest that academics need to adopt different teaching styles for developing skills in students. These authors suggest the use of one of the three approaches as suggested by Drummond et al. (1998), namely:

- **Embedding** approach in which the skills are developed as being part of the curriculum throughout the course.
- **Bolting-on** approach in which the skills are developed as a free-standing module.
- **Integrating** approach in which skills are developed explicitly within the core discipline. This approach encourages the development of skills during work placement, along with technical skills.

The recommendations for taking this study forward are made at various levels, namely:

### 7.3.2 The recommendations with regard to the impact of language barriers

As indicated elsewhere in the study, the tendency of students to work effectively only among people with whom they are comfortable, was identified by respondents. Owing to the limitations of the study, it was not possible to establish whether language barriers play a part in this.

Given that:

1. The Western Cape uses three languages, viz. English, Afrikaans and isiXhosa;

2. some of the employers of students are among predominantly Afrikaans speaking communities; and,

3. most of the students from the institution under investigation speak predominantly African vernacular languages and very little, if any, Afrikaans,

it could be useful to understand the impact, if any, that language has on the confidence of the students or new graduates to freely interact across language lines.

### 7.3.3. Recommendations with regard to the development of skills in students

The results of this study clearly indicate that there is a low correlation between the skills that the graduates from the institution under investigation possess and those that the employers in the Western Cape require. As such, it is imperative that the Department of Chemistry at the institution under investigation re-evaluates its teaching styles and explores ways to develop these skills in the students, as suggested by the works of Chadha (2006) and Schulz (2008).In order to do this, the department should investigate the current practices with respect to the curriculum. As further study, it is recommended that a survey of the current practice be taken with regard to the following factors:

1. To what extent the curriculum in the first and second years of study encourages the development of non-technical skills.

2. To what extent the assessment practices within the curriculum allow for the assessment of non-technical skills.

3. To what extent the workplace learning outcomes in respect of the critical cross-field outcomes are successfully met.

4. Considering the three approaches cited earlier, which approach would best suit the Department.

### 7.3.4. Recommendations with regard to the Work Preparedness Skills Programme (WPSP)

The work preparedness programme is run for students that are eligible for work placement. This programme is offered over six weeks in the third semester of training and covers basic job-hunting skills.

The programme is basic and prepares the student for the job application process only. It does not address the readiness of the students with respect to performance in the workplace. In its current form, therefore, this programme cannot claim to be successful in imparting employability skills in students. It is recommended that the WPSP be re-developed to include employability skills that will help the student perform better in the workplace.

### 7.4. Summary of the recommendations

From the findings of the study, the following are recommendations for taking the study forward:

1. <u>Language barriers</u>: It is recommended that a study be conducted on the impact that language could have on the confidence of the students and/or new graduates, thus limiting the students and/or graduates from interacting across language lines.

2. <u>Integration of non-technical skills in teaching and learning as well as assessment practices</u>: It is recommended that a study be conducted to establish the extent to which teaching and learning, as well as assessment practices, encourage the

development of non-technical skills in the undergraduate curriculum of analytical chemistry at the institution under investigation.

3. <u>Student preparation</u>: It is recommended that the institution strengthens the Work Preparedness Programme in order to help students better prepare for work. For this purpose, work readiness and Employability Improvement Programmes should be explored.

## 7.5. Conclusion

The value of this study has been that the researcher was able to expand the understanding of employability and the needs of employers. As this study was limited to one sector, it is believed that if emulated in other disciplines, it can greatly assist the institution under investigation to collate and document the views of employers with the objective of strengthening its co-operative education practice.

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39A Gourits Close
Heemstede Estate
Bellville, 7530

24 February 2011

To whom it may concern

Dear Sir/Madam

I am Fundiswa Nofemela student number 202145123, an MTech Business Administration student at the Cape Peninsula University of Technology.

I hereby request permission to conduct research amongst staff members in your organization.

The purpose of the research is to establish whether there is congruence between the skills required by employers of analytical chemistry students and graduates, and those that final year students and new graduates from the Cape Peninsula University of Technology possess. The results of this study will be used to inform the development of a curriculum that enables the students to acquire the skills required by industry in order to develop into graduates that can contribute positively to any organization that they work for. Data from this research will also be shared with participating organizations should they so wish.

The research will be conducted through the use of interviews and questionnaires while ensuring minimum disturbance.

I undertake to ensure voluntary participation, confidentiality and anonymity of all participants while undertaking this study.

Your assistance in this regard is appreciated.

Yours faithfully

Ms FundiswaNofemela
Tel: 082 2020 638 / E-mail: nofemelaf@cput.ac.za
**Supervisor**: Ms Carly Steyn: Senior Lecturer Business Faculty
        Tel: 021-4609019 / E-mail: steync@cput.ac.za

Cape Peninsula
University of Technology

# Employability Skills Questionnaire

I am Fundiswa Nofemela, an MTech Business Administration student at the Cape Peninsula University of Technology (CPUT). The research on employability skills is being undertaken as a requirement for the completion of the MTech program.

In order to better prepare our students for the challenges of the work place, it is vital that we keep track of the changing needs of employer organisations.

The aim of this research is to find out if the preparation of the analytical chemistry students at CPUT provides the students with the employability skills that the work place needs. Employability skills are a set of skills that are needed to enter, stay in and progress in the world of work. Kindly take about twenty minutes of your time to complete the questionnaire below.Your response to the questions will assist in aligning CPUT's academic planning with work place needs.
The researcher undertakes to maintain the research ethics of confidentiality andrespect throughout this study. The use of language, confidentiality and trust will be held critical.

Please return the questionnaire to Ms FR Nofemela at the following address:
nofemelaf@cput.ac.za
Return date: 05 March 2010

Company ...……………………………………
Designation……………………………

Industry:   Chemical ☐   Cosmetic ☐Petrochemical☐Pharmaceutical ☐

   Food ☐        Nuclear ☐

## SECTION 1:

1.1    Read through the following list and place a tick in the box which represents your opinion about the importance of the skills listed below in your organisation, in the area of Analytical Chemistry.

| In this organization, the following skills are:<br>Please tick ( ✓ ) | Extremely important | Important | Neither important nor unimportant | Unimportant | Completely unimportant |
|---|---|---|---|---|---|
| 1. The ability to work confidently within a group | | | | | |
| 2. Proficiency in English | | | | | |
| 3. Written Communication | | | | | |
| 4. Verbal Communication | | | | | |
| 5. The ability topresent information | | | | | |
| 6. Numeracy and Quantitative literacy | | | | | |
| 7. Willingness to learn and continue learning | | | | | |
| 8. The ability to identify problems | | | | | |
| 9. The ability investigate problems | | | | | |
| 10. The ability  analyse problems | | | | | |
| 11. The ability to solve problems | | | | | |
| 12.The ability to adapt successfully to changing situations and  environments( Flexibility) | | | | | |
| 13. The ability to apply knowledge to new situations | | | | | |
| 14. The ability to access information | | | | | |
| 15. The ability to use information | | | | | |
| 16. Self Confidence | | | | | |
| 17. The ability to plan activities | | | | | |
| 18. The ability to organise tasks | | | | | |
| 19.The ability to execute a plan  successfully | | | | | |
| 20. Entrepreneurial skills | | | | | |
| 21. The ability to lead | | | | | |
| 22. The ability to think critically | | | | | |
| 23. Self management | | | | | |
| 24. Research skills | | | | | |
| 25. The ability to construct logical arguments | | | | | |
| 24. The ability to follow logical arguments | | | | | |
| 25. The ability to summarise key issues | | | | | |
| 26. Understanding of economic and business realities | | | | | |
| 27. The ability to act professionally | | | | | |
| 28. The ability to generate new ideas | | | | | |
| 29.  Time management | | | | | |
| 30. Negotiation and mediation skills | | | | | |

| In this organization, the following skills are:<br>Please tick ( ✓ ) | Extremely important | Important | Neither important nor unimportant | Unimportant | Completely unimportant |
|---|---|---|---|---|---|
| 31.  Client Focus | | | | | |
| 32. Appreciation of different cultural contexts | | | | | |

1.2   List any employability skills that you consider vitally important which are not listed above. Please note: We have purposefully omitted technical or discipline specific skills in order to concentrate on generic skills.

| | |
|---|---|
| 1 | 2 |
| 3 | 4 |
| 5 | 6 |
| 7 | 8 |
| 9 | 10 |

## SECTION 2

**This section aims to establish which of the skills listed below were found to be possessed by CPUT final year students and new graduates.  It is designed to be completed by employers that have employed CPUT students and new graduates in the period 2005 -2009.  Please indicate, according to the scale provided, to what extent you agree or disagree with the statements below.**

| The CPUT students and / or graduates demonstrated the following skills:<br>Please tick( ✓ ) | Strongly agree | Agree | Neither agree nor disagree | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| 1. The ability to work confidently within a group | | | | | |

| The CPUT students and / or graduates demonstrated the following skills: <br> Please tick( ✓) | Strongly agree | Agree | Neither agree nor disagree | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| 2. Proficiency in English | | | | | |
| 3. Written Communication | | | | | |
| 4. Verbal Communication | | | | | |
| 5. The ability topresent information | | | | | |
| 6. Numeracy and Quantitative literacy | | | | | |
| 7. Willingness to learn and continue learning | | | | | |
| 8. The ability to identify problems | | | | | |
| 9. The ability investigate problems | | | | | |
| 10. The ability  analyse problems | | | | | |
| 11. The ability to solve problems | | | | | |
| 12.The ability to adapt successfully to changing situations and environments( Flexibility) | | | | | |
| 13. The ability to apply knowledge to new situations | | | | | |
| 14. The ability to access information | | | | | |
| 15. The ability to use information | | | | | |
| 16. Self Confidence | | | | | |
| 17. The ability to plan activities | | | | | |
| 18. The ability to organise tasks | | | | | |
| 19.The ability to execute a plan successfully | | | | | |
| 20. Entrepreneurial skills | | | | | |
| 21. The ability to lead | | | | | |
| 22. The ability to think critically | | | | | |
| 23. Self management skills | | | | | |
| 24. Research skills | | | | | |
| 25. The ability to construct logical arguments | | | | | |
| 24. The ability to follow logical arguments | | | | | |
| 25. The ability to summarise key issues | | | | | |
| 26. Understanding of economic and business realities | | | | | |
| 27. The ability to act professionally | | | | | |
| 28. The ability to generate new ideas | | | | | |
| 29.  Time management | | | | | |
| 30. Negotiation and mediation skills | | | | | |
| 31.  Client Focus | | | | | |
| 32. Appreciation of different cultural contexts | | | | | |

Thank you for your time in completing this questionnaire.

It is much appreciated.

**Cape Peninsula University of Technology**

I am FundiswaNofemela, an MTech Business Administration student at the Cape Peninsula University of Technology. The research on employability skills is being undertaken as a requirement for the completion of the MTech program.

In order to better prepare our students for the challenges of the work place, it is vital that we keep track of the changing needs of employer organizations.
The aim of this research is to find out if the preparation of the analytical chemistry students at CPUT provides the students with the employability skills that the work place needs.
Employability skills are a set of skills that are needed to enter, stay in and progress in the world of work.
Your response to the following questions will assist in aligning CPUT's academic planning with work place needs.
The author undertakes to maintain the research ethics of confidentiality and respect throughout this study.   The use of language, confidentiality and trust will be held critical.

**Section 1**
The following questions are designed for purposes of establishing categories of employers that employ analytical chemistry students and\or graduates in the western cape.

1.1.    Which industry does you organization operate in? (please mark with X)

| Chemical | □ | Cosmetic | □ | Petrochemical | □ | |
|----------|---|----------|---|---------------|---|---|
| Pharmaceutical | □ | Food | □ | Nuclear | □ | Other ( |
| ) | □ | | | | | |

1.2.    Have you employed or supervised a final year analytical chemistry student or new graduate in the period 2008 to 2010(Yes/No)

1.3.    In what capacity were these students employed?

_____

_____

1.4.    What groups of skills do you look for in potential candidates?
Answer: _____

Trainee Analyst   □    Graduate Development Program candidate □ Permanent employee □

**Section 2**

This section is designed to gain insight into the reasons why employers view certain skills as extremely important in their environment.

Your organization is one of the (x) organizations that rated (skills A, B, C,D E) extremely important.  Please elaborate on your reasons why you think these skills are extremely important in your environment.

2.1.   Skill A: _____
       How is this skill utilized in your environment?

       _____

       Could you please give me a scenario where you would observe a lack of this skill in an employee

       _____
       _____
       _____
       _____

       Why does your organization value this skill over the rest of the other skills?

       _____
       _____
       _____

       In the questionnaire you indicated that CPUT graduates/students that you supervised lacked this skill. Could you perhaps elaborate on this?

       _____
       _____
       _____
       _____

       What is your suggestion with respect to how CPUT can enhance this skill in their students?

       _____
       _____
       _____
       _____

2.2.   Skill B: _____
       How is this skill utilized in your environment?
       _____

       _____

Could you please give me a scenario where you would observe a lack of this skill in an employee

_____

_____

_____

_____

Why does your organization value this skill over the rest of the other skills?

_____

_____

_____

_____

In the questionnaire you indicated that CPUT graduates/students that you supervised lacked this skill. Could you perhaps elaborate on this?

_____

_____

_____

_____

What is your suggestion with respect to how CPUT can enhance this skill in their students?

_____

_____

_____

_____

2.3.    Skill C: _____
How is this skill utilized in your environment?

_____

Could you please give me a scenario where you would observe a lack of this skill in an employee

_____

_____

_____

_____

Why does your organization value this skill over the rest of the other skills?

_____

_____

_____

_____

In the questionnaire you indicated that CPUT graduates/students that you supervised lacked this skill. Could you perhaps elaborate on this?

_____

_____

_____

_____

What is your suggestion with respect to how CPUT can enhance this skill in their students?

_____

_____

_____

_____

2.4.    Skill D: _____

How is this skill utilized in your environment?

_____

_____

Could you please give me a scenario where you would observe a lack of this skill in an employee

_____

_____

_____

_____

Why does your organization value this skill over the rest of the other skills?

_____

_____

_____

_____

In the questionnaire you indicated that CPUT graduates/students that you supervised lacked this skill. Could you perhaps elaborate on this?

_____

_____

_____

What is your suggestion with respect to how CPUT can enhance this skill in their students?

_____

_____

_____

_____

2.5.    Skill E: _____
        How is this skill utilized in your environment?
        _____

        Could you please give me a scenario where you would observe a lack of this skill in an
        employee

        _____

        _____

        _____

        _____


        Why does your organization value this skill over the rest of the other skills?

        _____

        In the questionnaire you indicated that CPUT graduates/students that you supervised
        lacked this skill. Could you perhaps elaborate on this?

        _____

        _____

        What is your suggestion with respect to how CPUT can enhance this skill in their
        students?

        _____

        _____

        _____

        _____

        _____

2.6.    Skill F: _____

        How is this skill utilized in your environment?
        _____

        Could you please give me a scenario where you would observe a lack of this skill in an
        employee

        _____

        _____

        _____

        _____

        Why does your organization value this skill over the rest of the other skills?

        _____

        _____

In the questionnaire you indicated that CPUT graduates/students that you supervised lacked this skill. Could you perhaps elaborate on this?

What is your suggestion with respect to how CPUT can enhance this skill in their students?

2.7.    Skill G: _____

How is this skill utilized in your environment?

_____

Could you please give me a scenario where you would observe a lack of this skill in an employee

Why does your organization value this skill over the rest of the other skills?

In the questionnaire you indicated that CPUT graduates/students that you supervised lacked this skill. Could you perhaps elaborate on this?

What is your suggestion with respect to how CPUT can enhance this skill in their students?

2.8.   Skill H: _____
How is this skill utilized in your environment?

_____

Could you please give me a scenario where you would observe a lack of this skill in an employee

_____

_____

_____

_____

Why does your organization value this skill over the rest of the other skills?

_____

_____

_____

_____

In the questionnaire you indicated that CPUT graduates/students that you supervised lacked this skill. Could you perhaps elaborate on this?

_____

_____

_____

_____

What is your suggestion with respect to how CPUT can enhance this skill in their students?

_____

_____

_____

_____


**Section 3**

This section is directed at those interviewees that listed additional skills that they thought were important in their specific environments.

In the questionnaire you listed additional skills and indicated that they are important in your environment.  Kindly elaborate on these skills:

3.1.   Skill A: _____
How is this skill utilized in your environment?

_____

Could you please give me a scenario where you would observe a lack of this skill in an employee

_____

_____

Why does your organization value this skill over the rest of the other skills?

_____

_____

_____

In the questionnaire you indicated that CPUT graduates/students that you supervised lacked this skill. Could you perhaps elaborate on this?

_____

_____

_____

What is your suggestion with respect to how CPUT can enhance this skill in their students?

_____

_____

_____

_____

3.2.    Skill B: _____

How is this skill utilized in your environment?

_____

Could you please give me a scenario where you would observe a lack of this skill in an employee

_____

_____

_____

Why does your organization value this skill over the rest of the other skills?

_____

_____

_____

In the questionnaire you indicated that CPUT graduates/students that you supervised lacked this skill. Could you perhaps elaborate on this?

_____

_____

_____

What is your suggestion with respect to how CPUT can enhance this skill in their students?

3.3.    Skill C: _____

How is this skill utilized in your environment?

_____

Could you please give me a scenario where you would observe a lack of this skill in an employee

Why does your organization value this skill over the rest of the other skills?

In the questionnaire you indicated that CPUT graduates/students that you supervised lacked this skill. Could you perhaps elaborate on this?

What is your suggestion with respect to how CPUT can enhance this skill in their students?

3.4.    Skill D: _____

How is this skill utilized in your environment?

_____

Could you please give me a scenario where you would observe a lack of this skill in an employee

Why does your organization value this skill over the rest of the other skills?

_____

_____

_____

In the questionnaire you indicated that CPUT graduates/students that you supervised lacked this skill. Could you perhaps elaborate on this?

_____

_____

_____

What is your suggestion with respect to how CPUT can enhance this skill in their students?

_____

_____

_____

3.5.　　Skill E: _____

How is this skill utilized in your environment?

_____

Could you please give me a scenario where you would observe a lack of this skill in an employee

_____

_____

_____

Why does your organization value this skill over the rest of the other skills?

_____

_____

_____

In the questionnaire you indicated that CPUT graduates/students that you supervised lacked this skill. Could you perhaps elaborate on this?

_____

_____

_____

Thank you for your time.
Ms Fundiswa Nofemela (Student Number: 202145123)
**Supervisor:** Dr Carly Steyn, Senior Lecturer: Business Faculty
　　　　Tel: 021-4609019

FREQUENCIES VARIABLES=Company Designation Industry IndustryOther Employer Q1.1
Q1.2 Q1.3 Q1.4 Q1.5 Q1.6 Q1.7 Q1.8 Q1.9 Q1.10 Q1.11 Q1.12 Q1.13 Q1.14 Q1.15 Q1.16
Q1.17 Q1.18 Q1.19 Q1.20 Q1.21 Q1.22 Q1.23 Q1.24 Q1.25 Q1.26 Q1.27 Q1.28 Q1.29 Q1.30
Q1.31
Q1.32 Q1.33 Q1.34 Skills1 Skills2 Skills3 Skills4 Skills5 Skills6 Skills7 Skills8 Skills9 Skills10
Skills11 Skills12 Skills13 Skills14 Q2.1 Q2.2 Q2.3 Q2.4 Q2.5 Q2.6 Q2.7 Q2.8 Q2.9 Q2.10
Q2.11 Q2.12 Q2.13 Q2.14 Q2.15 Q2.16 Q2.17 Q2.18 Q2.19 Q2.20 Q2.21
Q2.22 Q2.23 Q2.24 Q2.25 Q2.26 Q2.27 Q2.28 Q2.29 Q2.30 Q2.31 Q2.32 Q2.33 Q2.34
  /ORDER=ANALYSIS.

## Frequencies

[DataSet1] C:\@LaCie\Research\Research
PostGraduate\MTech\CPUT\NofemelaFundiswa\Employability Data 4.sav

## Frequency Table

| Company | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Alcolin | 1 | 2.0 | 2.0 | 2.0 |
| | Appletiser | 3 | 6.0 | 6.0 | 8.0 |
| | BAT | 4 | 8.0 | 8.0 | 16.0 |
| | Chevron Refinery Lab | 3 | 6.0 | 6.0 | 22.0 |
| | CSIR | 1 | 2.0 | 2.0 | 24.0 |
| | Dept of Water Affairs | 1 | 2.0 | 2.0 | 26.0 |
| | Dept Water Affairs | 2 | 4.0 | 4.0 | 30.0 |
| | Engen Petroleum | 3 | 6.0 | 6.0 | 36.0 |
| | Fine Chemicals Corporation | 2 | 4.0 | 4.0 | 40.0 |
| | iThemba LABS | 4 | 8.0 | 8.0 | 48.0 |
| | Johns & Johnson | 1 | 2.0 | 2.0 | 50.0 |
| | Johnson & Johnson | 1 | 2.0 | 2.0 | 52.0 |
| | Johnsons and Johnson | 1 | 2.0 | 2.0 | 54.0 |
| | Nampak | 2 | 4.0 | 4.0 | 58.0 |
| | Nestle | 2 | 4.0 | 4.0 | 62.0 |
| | Oceana Brands | 3 | 6.0 | 6.0 | 68.0 |
| | Permoseal | 3 | 6.0 | 6.0 | 74.0 |
| | Rheinmetal Denel Munition | 1 | 2.0 | 2.0 | 76.0 |
| | Rheinmetall Denel Munition | 2 | 4.0 | 4.0 | 80.0 |
| | SAB | 1 | 2.0 | 2.0 | 82.0 |

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| | Sappi CApe Kraft | 1 | 2.0 | 2.0 | 84.0 |
| | Sappi CapeKraft | 1 | 2.0 | 2.0 | 86.0 |
| | Sappi Caper Kraft | 1 | 2.0 | 2.0 | 88.0 |
| | Scientific Services | 4 | 8.0 | 8.0 | 96.0 |
| | Tonstarch | 1 | 2.0 | 2.0 | 98.0 |
| | Woolworths | 1 | 2.0 | 2.0 | 100.0 |
| | Total | 50 | 100.0 | 100.0 | |

**Designation**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Analyst | 2 | 4.0 | 4.0 | 4.0 |
| | Chemist | 4 | 8.0 | 8.0 | 12.0 |
| | HOD R&D | 1 | 2.0 | 2.0 | 14.0 |
| | HOD Radionuclide | 1 | 2.0 | 2.0 | 16.0 |
| | HR Consultant | 1 | 2.0 | 2.0 | 18.0 |
| | HR Manager | 2 | 4.0 | 4.0 | 22.0 |
| | HR Practitioner | 4 | 8.0 | 8.0 | 30.0 |
| | L&D Coordinator | 1 | 2.0 | 2.0 | 32.0 |
| | L&D officer | 1 | 2.0 | 2.0 | 34.0 |
| | Lab Technician | 1 | 2.0 | 2.0 | 36.0 |
| | Plant Supervisor | 1 | 2.0 | 2.0 | 38.0 |
| | Polymer Plant Manager | 1 | 2.0 | 2.0 | 40.0 |
| | Polymer Plant Officer | 1 | 2.0 | 2.0 | 42.0 |
| | Process Engineer | 1 | 2.0 | 2.0 | 44.0 |
| | Process Specialist | 3 | 6.0 | 6.0 | 50.0 |
| | Process Technician | 4 | 8.0 | 8.0 | 58.0 |
| | Professional Officer | 1 | 2.0 | 2.0 | 60.0 |
| | Professional Officer1 | 1 | 2.0 | 2.0 | 62.0 |
| | Professional Officer2 | 1 | 2.0 | 2.0 | 64.0 |
| | Professional Officer3 | 1 | 2.0 | 2.0 | 66.0 |
| | R&D Officer | 1 | 2.0 | 2.0 | 68.0 |
| | Researcher | 4 | 8.0 | 8.0 | 76.0 |
| | SHEQ Manager | 1 | 2.0 | 2.0 | 78.0 |
| | SHEQ Officer | 1 | 2.0 | 2.0 | 80.0 |
| | Snr Chemist | 2 | 4.0 | 4.0 | 84.0 |
| | Snr Process Specialist | 1 | 2.0 | 2.0 | 86.0 |
| | Snr Research Chemist | 1 | 2.0 | 2.0 | 88.0 |
| | Strategic Support Manager | 1 | 2.0 | 2.0 | 90.0 |
| | Technical Assistant | 1 | 2.0 | 2.0 | 92.0 |
| | Technician | 1 | 2.0 | 2.0 | 94.0 |
| | Training and Develoopment Officer | 1 | 2.0 | 2.0 | 96.0 |
| | Training manager | 1 | 2.0 | 2.0 | 98.0 |
| | Training Officer | 1 | 2.0 | 2.0 | 100.0 |
| | Total | 50 | 100.0 | 100.0 | |

**Industry**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Chemical | 17 | 34.0 | 37.8 | 37.8 |
| | Petrochemi cal | 6 | 12.0 | 13.3 | 51.1 |
| | Pharmaceut ical | 3 | 6.0 | 6.7 | 57.8 |
| | Food | 10 | 20.0 | 22.2 | 80.0 |
| | Nuclear | 4 | 8.0 | 8.9 | 88.9 |
| | Other | 5 | 10.0 | 11.1 | 100.0 |
| | Total | 45 | 90.0 | 100.0 | |
| Missing | System | 5 | 10.0 | | |
| Total | | 50 | 100.0 | | |

**Other industries**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | | 40 | 80.0 | 80.0 | 80.0 |
| | Governm ent | 3 | 6.0 | 6.0 | 86.0 |
| | Pulp/Pap er | 4 | 8.0 | 8.0 | 94.0 |
| | Pupl/Pap er | 1 | 2.0 | 2.0 | 96.0 |
| | Research | 1 | 2.0 | 2.0 | 98.0 |
| | Retail | 1 | 2.0 | 2.0 | 100.0 |
| | Total | 50 | 100.0 | 100.0 | |

**Employer**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Students | 28 | 56.0 | 57.1 | 57.1 |
| | Graduates | 1 | 2.0 | 2.0 | 59.2 |
| | Neither students nor graduates | 11 | 22.0 | 22.4 | 81.6 |
| | Both students and graduates | 9 | 18.0 | 18.4 | 100.0 |
| | Total | 49 | 98.0 | 100.0 | |
| Missing | System | 1 | 2.0 | | |
| Total | | 50 | 100.0 | | |

DESCRIPTIVES VARIABLES=Q1.1 Q1.2 Q1.3 Q1.4 Q1.5 Q1.6 Q1.7 Q1.8 Q1.9 Q1.10 Q1.11 Q1.12 Q1.13 Q1.14 Q1.15 Q1.16 Q1.17 Q1.18 Q1.19 Q1.20 Q1.21 Q1.22 Q1.23 Q1.24 Q1.25 Q1.26 Q1.27 Q1.28 Q1.29 Q1.30 Q1.31 Q1.32 Q1.33 Q1.34 Q2.1 Q2.2 Q2.3 Q2.4 Q2.5 Q2.6 Q2.7

Q2.8 Q2.9 Q2.10 Q2.11 Q2.12 Q2.13 Q2.14 Q2.15 Q2.16 Q2.17 Q2.18 Q2.19 Q2.20 Q2.21 Q2.22 Q2.23 Q2.24 Q2.25 Q2.26 Q2.27 Q2.28 Q2.29 Q2.30 Q2.31 Q2.32 Q2.33 Q2.34
 /STATISTICS=MEAN STDDEV MIN MAX SEMEAN.

# Descriptives

[DataSet1] C:\@LaCie\Research\Research
PostGraduate\MTech\CPUT\NofemelaFundiswa\Employability Data 4.sav

| Descriptive Statistics | | | | | | |
|---|---|---|---|---|---|---|
| | N | Minimum | Maximum | Mean | | Std. Deviation |
| | Statistic | Statistic | Statistic | Statistic | Std. Error | Statistic |
| The ability to work confidently within a group | 50 | 1 | 2 | 1.64 | .069 | .485 |
| Proficiency in English | 50 | 1 | 3 | 1.74 | .075 | .527 |
| Written Communication | 50 | 1 | 4 | 1.84 | .083 | .584 |
| Verbal Communication | 50 | 1 | 3 | 1.68 | .073 | .513 |
| The ability to present information | 50 | 1 | 4 | 1.86 | .103 | .729 |
| Numeracy and Quantitative literacy | 50 | 1 | 3 | 1.52 | .087 | .614 |
| Willingness to learn and continue learning | 50 | 1 | 2 | 1.56 | .071 | .501 |
| The ability to identify problems | 50 | 1 | 2 | 1.46 | .071 | .503 |
| The ability to identify problems | 50 | 1 | 2 | 1.46 | .071 | .503 |
| The ability analyse problems | 50 | 1 | 2 | 1.48 | .071 | .505 |
| The ability to solve problems | 50 | 1 | 3 | 1.62 | .103 | .725 |
| Adaptability and Flexibiligy | 50 | 1 | 3 | 1.52 | .077 | .544 |
| The ability to apply knowledge to new situations | 50 | 1 | 3 | 1.72 | .095 | .671 |
| The ability to access information | 50 | 1 | 3 | 1.74 | .075 | .527 |
| The ability to use information | 50 | 1 | 3 | 1.68 | .073 | .513 |
| Self Confidence | 50 | 1 | 3 | 1.70 | .082 | .580 |
| The ability to plan activities | 50 | 1 | 3 | 1.74 | .085 | .600 |
| The ability to organise tasks | 50 | 1 | 5 | 1.80 | .118 | .833 |
| The ability to execute a plan successfully | 50 | 1 | 3 | 1.64 | .080 | .563 |
| Entrepreneurial skills | 50 | 1 | 5 | 3.06 | .105 | .740 |
| The ability to lead | 50 | 1 | 4 | 2.40 | .125 | .881 |
| The ability to think critically | 50 | 1 | 4 | 1.76 | .084 | .591 |
| Self management | 50 | 1 | 3 | 1.60 | .090 | .639 |
| Research skills | 50 | 1 | 4 | 2.34 | .123 | .872 |
| The ability to construct logical arguments | 50 | 1 | 4 | 2.36 | .113 | .802 |
| The ability to follow logical arguments | 50 | 1 | 4 | 2.18 | .145 | 1.024 |
| The ability to summarise key issues | 50 | 1 | 4 | 2.22 | .138 | .975 |
| Understanding of economic and business realities | 50 | 1 | 5 | 2.58 | .115 | .810 |
| The ability to act professionally | 50 | 1 | 4 | 1.80 | .095 | .670 |
| The ability to generate new ideas | 50 | 1 | 3 | 1.94 | .097 | .682 |
| Time management | 50 | 1 | 3 | 1.44 | .082 | .577 |
| Negotiation and mediation skills | 50 | 1 | 5 | 2.74 | .133 | .944 |
| Client Focus | 50 | 1 | 4 | 1.92 | .098 | .695 |
| Appreciation of different cultural contexts | 50 | 1 | 3 | 1.84 | .087 | .618 |
| The ability to work confidently within a group | 35 | 1 | 4 | 1.91 | .161 | .951 |
| Proficiency in English | 36 | 1 | 3 | 1.81 | .096 | .577 |
| Written Communication | 36 | 1 | 4 | 2.06 | .138 | .826 |
| Verbal Communication | 36 | 1 | 4 | 2.03 | .123 | .736 |
| The ability to present information | 36 | 1 | 4 | 1.94 | .159 | .955 |
| Numeracy and Quantitative literacy | 36 | 1 | 3 | 2.06 | .079 | .475 |
| Willingness to learn and continue learning | 36 | 1 | 4 | 2.08 | .140 | .841 |
| The ability to identify problems | 36 | 1 | 4 | 2.56 | .171 | 1.027 |
| The ability investigate problems | 36 | 1 | 4 | 2.56 | .176 | 1.054 |

| | | | | | | |
|---|---|---|---|---|---|---|
| The ability  analyse problems | 36 | 1 | 4 | 2.53 | .176 | 1.055 |
| The ability to solve problems | 36 | 1 | 4 | 2.81 | .158 | .951 |
| The ability to adapt successfully to changing situations and environments( Flexibility) | 36 | 1 | 4 | 2.53 | .129 | .774 |
| The ability to apply knowledge to new situations | 36 | 2 | 4 | 2.61 | .121 | .728 |
| The ability to access information | 36 | 1 | 4 | 2.61 | .175 | 1.050 |
| The ability to use information | 36 | 1 | 4 | 2.39 | .134 | .803 |
| Self Confidence | 36 | 1 | 4 | 2.28 | .124 | .741 |
| The ability to plan activities | 36 | 1 | 4 | 2.28 | .147 | .882 |
| The ability to organise tasks | 36 | 1 | 4 | 2.31 | .148 | .889 |
| The ability to execute a plan successfully | 36 | 1 | 4 | 2.67 | .169 | 1.014 |
| Entrepreneurial skills | 36 | 1 | 5 | 2.92 | .134 | .806 |
| The ability to lead | 36 | 1 | 4 | 2.83 | .129 | .775 |
| The ability to think critically | 36 | 1 | 4 | 2.44 | .122 | .735 |
| Self management | 36 | 1 | 4 | 2.94 | .132 | .791 |
| Research skills | 36 | 1 | 4 | 2.61 | .175 | 1.050 |
| The ability to construct logical arguments | 36 | 1 | 4 | 2.92 | .151 | .906 |
| The ability to follow logical arguments | 36 | 1 | 4 | 2.58 | .140 | .841 |
| The ability to summarise key issues | 36 | 1 | 4 | 2.83 | .141 | .845 |
| Understanding of economic and business realities | 36 | 1 | 5 | 2.92 | .166 | .996 |
| The ability to act professionally | 36 | 1 | 4 | 2.61 | .151 | .903 |
| The ability to generate new ideas | 36 | 1 | 4 | 2.58 | .156 | .937 |
| Time management | 36 | 1 | 4 | 2.44 | .166 | .998 |
| Negotiation and mediation skills | 35 | 1 | 4 | 3.34 | .123 | .725 |
| Client Focus | 35 | 1 | 5 | 3.03 | .151 | .891 |
| Appreciation of different cultural contexts | 35 | 1 | 4 | 2.54 | .144 | .852 |
| Valid N (listwise) | 34 | | | | | |

SORT CASES  BY Industry.
SPLIT FILE SEPARATE BY Industry.
DESCRIPTIVES VARIABLES=Q1.1 Q1.2 Q1.3 Q1.4 Q1.5 Q1.6 Q1.7 Q1.8 Q1.9 Q1.10 Q1.11
Q1.12 Q1.13 Q1.14 Q1.15 Q1.16 Q1.17 Q1.18 Q1.19 Q1.20 Q1.21 Q1.22 Q1.23 Q1.24 Q1.25
Q1.26 Q1.27 Q1.28 Q1.29 Q1.30 Q1.31 Q1.32 Q1.33 Q1.34 Q2.1 Q2.2 Q2.3 Q2.4 Q2.5 Q2.6
Q2.7
Q2.8 Q2.9 Q2.10 Q2.11 Q2.12 Q2.13 Q2.14 Q2.15 Q2.16 Q2.17 Q2.18 Q2.19 Q2.20 Q2.21
Q2.22 Q2.23 Q2.24 Q2.25 Q2.26 Q2.27 Q2.28 Q2.29 Q2.30 Q2.31 Q2.32 Q2.33 Q2.34
 /STATISTICS=MEAN STDDEV MIN MAX SEMEAN.

## Descriptives

[DataSet1] C:\@LaCie\Research\Research
PostGraduate\MTech\CPUT\NofemelaFundiswa\Employability Data 4.sav

## T-Test

[DataSet1] C:\@LaCie\Research\Research
PostGraduate\MTech\CPUT\NofemelaFundiswa\Employability Data 4.sav

**Paired Samples Statistics**

| | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | The ability to work confidently within a group | 1.74 | 35 | .443 | .075 |
| | The ability to work confidently within a group | 1.91 | 35 | .951 | .161 |
| Pair 2 | Proficiency in English | 1.75 | 36 | .500 | .083 |
| | Proficiency in English | 1.81 | 36 | .577 | .096 |
| Pair 3 | Written Communication | 1.78 | 36 | .637 | .106 |
| | Written Communication | 2.06 | 36 | .826 | .138 |
| Pair 4 | Verbal Communication | 1.72 | 36 | .513 | .086 |
| | Verbal Communication | 2.03 | 36 | .736 | .123 |
| Pair 5 | The ability to present information | 1.75 | 36 | .732 | .122 |
| | The ability to present information | 1.94 | 36 | .955 | .159 |
| Pair 6 | Numeracy and Quantitative literacy | 1.42 | 36 | .500 | .083 |
| | Numeracy and Quantitative literacy | 2.06 | 36 | .475 | .079 |
| Pair 7 | Willingness to learn and continue learning | 1.64 | 36 | .487 | .081 |
| | Willingness to learn and continue learning | 2.08 | 36 | .841 | .140 |
| Pair 8 | The ability to identify problems | 1.47 | 36 | .506 | .084 |
| | The ability to identify problems | 2.56 | 36 | 1.027 | .171 |
| Pair 9 | The ability to identify problems | 1.44 | 36 | .504 | .084 |
| | The ability investigate problems | 2.56 | 36 | 1.054 | .176 |
| Pair 10 | The ability analyse problems | 1.50 | 36 | .507 | .085 |
| | The ability analyse problems | 2.53 | 36 | 1.055 | .176 |
| Pair 11 | The ability to solve problems | 1.72 | 36 | .741 | .124 |
| | The ability to solve problems | 2.81 | 36 | .951 | .158 |
| Pair 12 | Adaptability and Flexibiligy | 1.50 | 36 | .561 | .093 |
| | The ability to adapt successfully to changing situations and environments( Flexibility) | 2.53 | 36 | .774 | .129 |
| Pair 13 | The ability to apply knowledge to new situations | 1.83 | 36 | .697 | .116 |
| | The ability to apply knowledge to new situations | 2.61 | 36 | .728 | .121 |
| Pair 14 | The ability to access information | 1.72 | 36 | .513 | .086 |
| | The ability to access information | 2.61 | 36 | 1.050 | .175 |
| Pair 15 | The ability to use information | 1.67 | 36 | .478 | .080 |
| | The ability to use information | 2.39 | 36 | .803 | .134 |
| Pair 16 | Self Confidence | 1.78 | 36 | .591 | .098 |
| | Self Confidence | 2.28 | 36 | .741 | .124 |
| Pair 17 | The ability to plan activities | 1.72 | 36 | .659 | .110 |
| | The ability to plan activities | 2.28 | 36 | .882 | .147 |
| Pair 18 | The ability to organise tasks | 1.83 | 36 | .941 | .157 |
| | The ability to organise tasks | 2.31 | 36 | .889 | .148 |
| Pair 19 | The ability to execute a plan successfully | 1.69 | 36 | .577 | .096 |
| | The ability to execute a plan successfully | 2.67 | 36 | 1.014 | .169 |
| Pair 20 | Entrepreneurial skills | 3.17 | 36 | .811 | .135 |
| | Entrepreneurial skills | 2.92 | 36 | .806 | .134 |
| Pair 21 | The ability to lead | 2.50 | 36 | .971 | .162 |
| | The ability to lead | 2.83 | 36 | .775 | .129 |
| Pair 22 | The ability to think critically | 1.72 | 36 | .659 | .110 |
| | The ability to think critically | 2.44 | 36 | .735 | .122 |
| Pair 23 | Self management | 1.64 | 36 | .683 | .114 |
| | Self management | 2.94 | 36 | .791 | .132 |
| Pair 24 | Research skills | 2.28 | 36 | .914 | .152 |
| | Research skills | 2.61 | 36 | 1.050 | .175 |
| Pair 25 | The ability to construct logical arguments | 2.36 | 36 | .899 | .150 |

|  |  | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
|  | The ability to construct logical arguments | 2.92 | 36 | .906 | .151 |
| Pair 26 | The ability to follow logical arguments | 2.06 | 36 | 1.040 | .173 |
|  | The ability to follow logical arguments | 2.58 | 36 | .841 | .140 |
| Pair 27 | The ability to summarise key issues | 2.08 | 36 | .967 | .161 |
|  | The ability to summarise key issues | 2.83 | 36 | .845 | .141 |
| Pair 28 | Understanding of economic and business realities | 2.56 | 36 | .809 | .135 |
|  | Understanding of economic and business realities | 2.92 | 36 | .996 | .166 |
| Pair 29 | The ability to act professionally | 1.81 | 36 | .710 | .118 |
|  | The ability to act professionally | 2.61 | 36 | .903 | .151 |
| Pair 30 | The ability to generate new ideas | 1.97 | 36 | .696 | .116 |
|  | The ability to generate new ideas | 2.58 | 36 | .937 | .156 |
| Pair 31 | Time management | 1.39 | 36 | .599 | .100 |
|  | Time management | 2.44 | 36 | .998 | .166 |
| Pair 32 | Negotiation and mediation skills | 2.83 | 35 | .985 | .166 |
|  | Negotiation and mediation skills | 3.34 | 35 | .725 | .123 |
| Pair 33 | Client Focus | 1.89 | 35 | .758 | .128 |
|  | Client Focus | 3.03 | 35 | .891 | .151 |
| Pair 34 | Appreciation of different cultural contexts | 1.94 | 35 | .639 | .108 |
|  | Appreciation of different cultural contexts | 2.54 | 35 | .852 | .144 |

**Paired Samples Test**

|  |  | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
|  |  | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
|  |  |  |  |  | Lower | Upper | | | |
| Pair 1 | The ability to work confidently within a group - The ability to work confidently within a group | -.171 | 1.200 | .203 | -.584 | .241 | -.845 | 34 | .404 |
| Pair 2 | Proficiency in English - Proficiency in English | -.056 | .715 | .119 | -.297 | .186 | -.466 | 35 | .644 |
| Pair 3 | Written Communication - Written Communication | -.278 | .849 | .141 | -.565 | .009 | -1.963 | 35 | .058 |
| Pair 4 | Verbal Communication - Verbal Communication | -.306 | .822 | .137 | -.584 | -.027 | -2.231 | 35 | .032 |
| Pair 5 | The ability to present information - The ability to present information | -.194 | .856 | .143 | -.484 | .095 | -1.363 | 35 | .182 |
| Pair 6 | Numeracy and Quantitative literacy - Numeracy and Quantitative literacy | -.639 | .639 | .107 | -.855 | -.423 | -5.996 | 35 | .000 |
| Pair 7 | Willingness to learn and continue learning - Willingness to learn and continue learning | -.444 | .998 | .166 | -.782 | -.107 | -2.671 | 35 | .011 |
| Pair 8 | The ability to identify problems - The ability to identify problems | -1.083 | 1.131 | .188 | -1.466 | -.701 | -5.748 | 35 | .000 |
| Pair 9 | The ability to identify problems - The ability investigate problems | -1.111 | 1.141 | .190 | -1.497 | -.725 | -5.843 | 35 | .000 |
| Pair 10 | The ability analyse problems - The ability analyse problems | -1.028 | 1.158 | .193 | -1.420 | -.636 | -5.323 | 35 | .000 |

| | | Mean | Std. Dev | Std. Error Mean | Lower | Upper | t | df | Sig. |
|---|---|---|---|---|---|---|---|---|---|
| Pair 11 | The ability to solve problems - The ability to solve problems | -1.083 | 1.025 | .171 | -1.430 | -.737 | -6.343 | 35 | .000 |
| Pair 12 | Adaptability and Flexibiligy - The ability to adapt successfully to changing situations and environments( Flexibility) | -1.028 | .941 | .157 | -1.346 | -.709 | -6.555 | 35 | .000 |
| Pair 13 | The ability to apply knowledge to new situations - The ability to apply knowledge to new situations | -.778 | .989 | .165 | -1.112 | -.443 | -4.719 | 35 | .000 |
| Pair 14 | The ability to access information - The ability to access information | -.889 | 1.141 | .190 | -1.275 | -.503 | -4.675 | 35 | .000 |
| Pair 15 | The ability to use information - The ability to use information | -.722 | 1.003 | .167 | -1.062 | -.383 | -4.320 | 35 | .000 |
| Pair 16 | Self Confidence - Self Confidence | -.500 | 1.000 | .167 | -.838 | -.162 | -3.000 | 35 | .005 |
| Pair 17 | The ability to plan activities - The ability to plan activities | -.556 | .939 | .157 | -.873 | -.238 | -3.548 | 35 | .001 |
| Pair 18 | The ability to organise tasks - The ability to organise tasks | -.472 | 1.082 | .180 | -.838 | -.106 | -2.619 | 35 | .013 |
| Pair 19 | The ability to execute a plan successfully - The ability to execute a plan successfully | -.972 | 1.108 | .185 | -1.347 | -.597 | -5.264 | 35 | .000 |
| Pair 20 | Entrepreneurial skills - Entrepreneurial skills | .250 | .770 | .128 | -.011 | .511 | 1.948 | 35 | .059 |
| Pair 21 | The ability to lead - The ability to lead | -.333 | 1.069 | .178 | -.695 | .028 | -1.871 | 35 | .070 |
| Pair 22 | The ability to think critically - The ability to think critically | -.722 | .944 | .157 | -1.042 | -.403 | -4.588 | 35 | .000 |
| Pair 23 | Self management - Self management | -1.306 | .951 | .158 | -1.627 | -.984 | -8.239 | 35 | .000 |
| Pair 24 | Research skills - Research skills | -.333 | 1.121 | .187 | -.713 | .046 | -1.784 | 35 | .083 |
| Pair 25 | The ability to construct logical arguments - The ability to construct logical arguments | -.556 | 1.054 | .176 | -.912 | -.199 | -3.162 | 35 | .003 |
| Pair 26 | The ability to follow logical arguments - The ability to follow logical arguments | -.528 | 1.000 | .167 | -.866 | -.190 | -3.168 | 35 | .003 |
| Pair 27 | The ability to summarise key issues - The ability to summarise key issues | -.750 | .967 | .161 | -1.077 | -.423 | -4.652 | 35 | .000 |
| Pair 28 | Understanding of economic and business realities - Understanding of economic and business realities | -.361 | 1.246 | .208 | -.783 | .060 | -1.739 | 35 | .091 |
| Pair 29 | The ability to act professionally - The ability to act professionally | -.806 | 1.091 | .182 | -1.175 | -.437 | -4.431 | 35 | .000 |
| Pair 30 | The ability to generate new ideas - The ability to generate new ideas | -.611 | .903 | .151 | -.917 | -.305 | -4.059 | 35 | .000 |
| Pair 31 | Time management - Time management | -1.056 | 1.170 | .195 | -1.451 | -.660 | -5.414 | 35 | .000 |
| Pair 32 | Negotiation and mediation skills - Negotiation and mediation skills | -.514 | .818 | .138 | -.795 | -.233 | -3.720 | 34 | .001 |
| Pair 33 | Client Focus - Client Focus | -1.143 | 1.115 | .189 | -1.526 | -.760 | -6.063 | 34 | .000 |
| Pair 34 | Appreciation of different cultural contexts - Appreciation of different cultural contexts | -.600 | .976 | .165 | -.935 | -.265 | -3.636 | 34 | .001 |