

**A framework to integrate the formal learning with the informal  
workplace learning of statisticians in a Developmental state**

by

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## ABSTRACT

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# A FRAMEWORK TO INTEGRATE THE FORMAL LEARNING WITH THE INFORMAL WORKPLACE LEARNING OF STATISTICIANS IN A DEVELOPMENTAL STATE

by

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The topic of integrating the formal learning of graduates with their informal workplace learning has been debated for many years. In practice, however, these two types of learning still exist as two polar opposites, especially in the field of statistics. This study examined the effectiveness of an internship programme as a means to integrate the formal learning of statisticians with their informal workplace learning. Based on the findings, a framework was proposed to ensure integration between the formal and informal workplace learning of statisticians.

The study employed a mixed-method approach that combined quantitative and qualitative data collection. Quantitative data were collected from respondents (statisticians who participated in the internship programme and were permanently employed at the time of the study) through an online survey, and qualitative data were collected from managers (who served as mentors to the interns) through conducting semi-structured, one-on-one

interviews. Documents pertaining to the internship programme in place at Statistics South Africa were also studied.

Many developing countries still lack the capacity to produce, analyse and use the range of quality statistics required to support effective development progress. This study suggested a new way of integrating the formal learning with the informal workplace learning of statisticians, which involved adding a practical component (an internship) to the formal learning of statisticians, therefore, combining an internship during formal learning with an internship upon the completion of formal learning. In this way, statisticians are better capacitated because they can apply their formally obtained knowledge and skills in practice both while being engaged in their formal studies as well as after completing their studies, ensuring integration between formal and informal workplace learning. Crucial factors that would play a role in ensuring success are, for instance, if intern statisticians are placed in areas that are commensurate with their formal learning (thus ensuring utilisation of their skills) and if the level of the tasks assigned to them matches their cognitive ability. Support for interns' informal learning in the form of mentorship, developmental assignments and training and development opportunities are also crucial to ensure integration between their formal learning and informal workplace learning.

**Keywords:** Formal learning; informal workplace learning; statisticians; higher education institutions, Statistics South Africa, mentors; interns; internship programme; utilisation of skills; relevant placement.

## DECLARATION

I, Gwendoline Hilary van der Berg, (student number: 35642726), declare as follows:

I declare that **A framework to integrate the formal learning with the informal workplace learning of statisticians in a developmental state** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

---

SIGNATURE

(Ms)

---

DATE

## DEDICATION

*I dedicate this thesis to my two beautiful blessings from God, my daughters*

**MEAGAN VAN DER BERG AND ROBYN VAN DER BERG**

*and to my late parents*

**DINAH AND PETER McCLUNE**

*and to my late grandmother*

**ANNIE SMITH**

*I am eternally grateful to God, my Heavenly Father, to whom all the glory and praise belong, who led and guided me on this journey and without whom completing this thesis would not have been possible.*

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## Key concepts

Formal learning
Higher education institutions
Informal workplace learning
Interns
Internship programme
Mentors
Relevant placement
Statisticians
Statistics South Africa
Utilisation of skills

## List of abbreviations

Abbreviation	Meaning
ENSEA	L'Ecole Nationale Supérieure de Statistique et d'Economie Appliquée
EASTC	Eastern Africa Statistical Training Centre
NDP	National Development Plan
NSS	National Statistical System
SADC	Southern African Development Community
Stats SA	Statistics South Africa
UKZN	University of KwaZulu-Natal

# CHAPTER 1: GENERAL ORIENTATION

## 1.1 INTRODUCTION

Preparing students adequately for a successful life and career after graduation is of great concern to today's higher education institutions. Universities and colleges struggle to keep up with the demands of a business world that is changing rapidly, new technologies that are being introduced and knowledge bases that are expanding. Graduates may end up being underprepared or incorrectly prepared to enter the world of work if the programmes of higher education institutions and the jobs in the market do not align (Alvarado 2012).

In a talent shortage survey conducted in 2012 it was found that a large number of employers worldwide identified a lack of available skilled talent as having a negative effect on business performance (Manpower Group 2012). The respondents in the survey indicated that it was difficult to fill positions because of a lack of available candidates with the right technical expertise and employability skills. The greatest talent shortage was reported to be experienced in Japan and Brazil where 81% and 71% of employers respectively indicated that they had difficulty finding people with the right profile (Manpower Group 2012). In response to a question about the way in which they planned to overcome the shortages experienced, employers proposed partnering with educational institutions to make sure they provided students with the necessary skills so that the skills gaps could be closed. Educational institutions play a crucial role in producing graduates who have the skills and knowledge that are needed in the marketplace.

The situation in Africa and South Africa is no different to that in the rest of the world. Although there are large numbers of unemployed young people, many organisations still struggle to fill open positions. About 1,5 million young people are unemployed in Egypt but private sector firms cannot fill 600 000 vacancies. In South Africa the situation is even more dire: 3 million young people (of which 600 000 are university graduates) are unemployed whereas there are 800 000 vacancies in the job market (African Economic Outlook). Mr Howard Gabriels, the chairperson of the Statistics

Council, stressed the great need to invest in human resource capacity by saying that “much more needs to be done, and already this work is exposing the challenge of human resource capacity in both Statistics South Africa (Stats SA) and the participating departments. Stats SA will have to make capacity development a priority in the next few years if we want to succeed in building a national statistical system in the country” (Statistics South Africa 2013:1).

It is clear that institutions of higher learning and organisations need to focus their attention not only on ensuring that graduates develop competencies to make them more employable but on ensuring that they continue learning while they are employed so that they stay employable and make a significant contribution in the workplace.

The Oxford Dictionary defines organisations as places where organised groups of people, all with specific purposes, congregate (Oxford Learner’s Dictionary. n.d.) and they all strive towards achieving one goal, i.e. the vision or the reason for the organisations’ existence (Cronje, Hugo, Neuland and Van Reenen, 1995). Organisations also produce physical products or services (Fogarty, Hoffmann and Stonebraker, 1989) Examples of organisations are businesses or government departments. One government department that features in this research is Statistics South Africa (commonly referred to as Stats SA), a government institution that is tasked with collecting, analysing and disseminating official South African statistics.

Globalisation and changes in organisational environments and technology demand new solutions to the question of how best to organise work. Environments change, organisations grow and new technologies emerge, leading to altered work practices that might derail the stability and routines of an organisation (Hatch & Cunliffe 2006:295).

To assist organisations in dealing with these changes, institutions of higher learning need to properly prepare new labour market entrants by offering formal learning content that suits the needs of organisations. Graduates need to have the necessary knowledge, skills, competencies and attitudes to function in an organisational context.

Although several studies have focused on professional competencies of graduates as determinants of how employable they are (Teijeiro, Rungo & Freire 2013), few studies have investigated whether graduates who are appointed are equipped enough to make a significant contribution in terms of technical knowledge and skills (i.e., the knowledge and skills specific to a particular occupation, which, for the purpose of this study, are referred to as statistical skills). There is also not enough evidence about the continued learning of graduates after appointment, learning that would ensure they remain employable. Hui and Fatt (2008) reiterate that workplace learning is critical in human capital development and therefore in the economic performance of an organisation and even a nation.

A shortage of mathematical and statistical skills was identified in the Human Capacity Development strategy of Statistics South Africa as a major challenge that faced South Africa (Statistics South Africa 2005). In this strategy it was pointed out that South African institutions of higher learning were not producing graduates with the requisite statistical skills and knowledge to prepare and disseminate official statistics (Statistics South Africa 2005). To address this shortage, not only in the organisation itself but also in the broader national statistical system (NSS) and the countries of the Southern African Development Community (SADC), Stats SA embarked on a number of initiatives (Statistics South Africa 2010a). Some of these initiatives are discussed from sections 1.1.1 to 1.1.4.

### **1.1.1 Maths4stats**

The maths4stats project seeks to encourage the development of mathematics education as mathematics is crucial to the understanding and application of statistics. The project further sets out to improve numeracy and statistical literacy in South Africa. Educators are trained in data handling and probability so that they are empowered to transfer this knowledge to learners.

### **1.1.2 Census@School**

Census@School is part of an international education project that focuses mainly on the basics of data handling. This project, which is run in collaboration with the Department of Basic Education, has the following outcomes:

- Teacher development
  - To train teachers to interpret and further develop learning programmes related to data handling
  - To enhance teachers' knowledge and skills in relation to data handling
  - To improve teachers' ability to effectively interact with learners when teaching data handling using Census@School data.
  
- Learner development
  - To educate learners on gathering, analysing, interpreting and disseminating data
  - To educate learners about census and sample surveys and their benefits
  - To involve learners in collecting data about themselves.

### **1.1.3 Projects at institutions of higher learning**

#### **1.1.3.1 University of the Witwatersrand**

Stats SA initiated a programme in data mining at the University of the Witwatersrand to train staff members at honours and master's levels. Although a number of staff members managed to complete their honours degrees, few completed the master's degrees. This could be ascribed to the workload of full-time staff members. Many of the staff members on the master's programme switched to postgraduate diplomas in data mining (Statistics South Africa 2010a).

### **1.1.3.2 Stellenbosch University and University of Fort Hare**

University chairs in two study areas were established in an effort to address the shortage of specialised skills identified by Statistics South Africa, namely a Chair in Urban and Regional Planning at Stellenbosch University (offering a master's programme) and a Chair in Agricultural Statistics at the University of Fort Hare (Statistics South Africa 2010a).

### **1.1.3.3 University of KwaZulu-Natal**

Statistics South Africa supported two projects at the University of KwaZulu-Natal (UKZN). In the first instance it was recognised that there was an exodus of statistics lecturers at academic institutions and that this would have a negative impact on statistical development (Statistics South Africa 2010a). Therefore, Stats SA supported a research programme in statistics initiated by the Department of Statistics and Actuarial Sciences to try and curb this exodus.

In the second instance, Stats SA soon realised that its project to train all teachers of mathematics in the country to teach the statistics component in the mathematics curriculum would be very difficult, expensive and time-consuming. Therefore, it elicited the help of the Department of Statistics and Actuarial Sciences to start teaching data handling and probability (Statistics South Africa 2010a).

## **1.1.4 Internal projects of Statistics South Africa**

### **1.1.4.1 Internship programme**

South Africa's Skills Development Act, No. 97 of 1998 as well as its National Skills Development Strategy 1 of 2005 (Department of Labour 2007) promote the use of internships as an effective approach to enhance students' employability and career development. Stats SA drew on these two pieces of legislation as mechanisms to address the statistical skills shortage within its own organisation, especially in the core areas of statistical production. Since 2005, graduates with the requisite qualifications mostly in the areas of statistics and economics have been recruited, trained and

assessed to ascertain their suitability for permanent employment not only within Stats SA but also in the broader national statistical system (NSS) (Statistics South Africa 2010b). Mentors, learning plans, assessment plans and in-house training or short courses are all crucial elements of this internship programme.

Information regarding the qualifications and the number of interns who participated in the Stats SA internship programme since its inception is depicted in table 1 below:

**Table 1: Internship programme**

<b>Year</b>	<b>Number of interns recruited</b>	<b>Statistical qualifications</b>	<b>Non-statistical qualifications</b>
2005	15	10	5
2006	17	12	5
2007	33	23	10
2008	34	19	15
2009	43	23	20
2010	43	30	13
2011	57	37	20
2012	41	22	19
2013	55	35	20

Source: Statistics South Africa (2010)

#### **1.1.4.2 Learnership programme**

The South African Qualifications Authority Act, No. 58 of 1995 defines a learnership as a work-based learning programme that is directly related to an occupation or field of work and that leads to a qualification that is accredited in terms of the National Qualifications Framework. Through the learnership programme implemented by Stats SA, a certificate in official statistics (NQF level 5) could be obtained. The focus of the programme was on statistics and economics and its aim was to address statistical skills shortages in the organisation, therefore employees were encouraged to participate in this learnership programme (Statistics South Africa 2010a).

#### **1.1.4.3 SADC survey methodology programme**

The South African Development Community (SADC) survey methodology training programme, which was started in 2006, consisted of a series of workshops that covered topics such as sampling, questionnaire design and exposure to fieldwork. Stats SA launched this initiative to develop the skills not only of its own employees but also of national statistics officers from SADC countries and South Africa's broader NSS to produce timely and high-quality demographic, economic and social statistics (Statistics South Africa 2010a).

#### **1.1.4.4 Master Maths programme**

This programme is based on the Master Maths software programme and is intended for use by employees who do not possess the necessary mathematical skills to qualify for the bursaries Stats SA offers to students to study mathematics at the Eastern Africa Statistical Training Centre (EASTC) in Dar es Salaam. The programme is open to all employees who wish to better their mathematical skills and also those who want to prepare for their Grade 12 (matric) exams (Statistics South Africa 2010a).

#### **1.1.4.5 Foreign studies programme**

To develop a pool of highly skilled employees, Stats SA offers bursaries to its employees and to promising students who wish to study in the fields of statistics or economics at any local university. Upon completion of their studies, these students are recruited for the Stats SA internship programme. Besides this offering, Stats SA also offers bursaries to students who wish to study for a qualification in official statistics at diploma level at EASTC or the National School of Statistics and Applied Economics (ENSEA) in Abidjan. Employees of Stats SA are also afforded an opportunity to apply for bursaries to better their qualifications at EASTC, ENSEA or Makerere University in Kampala (Statistics South Africa 2010a).

All these initiatives that Stats SA has embarked upon are useful to build statistical capacity. However, it will be very difficult for Stats SA to build sufficient capacity on its own to meet the huge skills demand that needs to be met to produce, disseminate

and utilise official statistical information and to close the statistical skills gaps being experienced not only in Stats SA, but also in the broader NSS. Besides the indicators for which Stats SA collects information by conducting censuses and surveys, there are process and output indicators for which information must be collected by other government departments and agencies. Also, in order to meet South Africa's Millennium Development Goals and the goals of the Education for All programme, Stats SA is under pressure to produce a wider range of statistical information (Statistics South Africa 2010a). Stats SA needs a strong and reliable partnership with institutions of higher learning in South Africa to ensure that it is met halfway in winning this battle. This will only be possible if these institutions of higher learning offer learning content that is relevant to the needs of Stats SA so that once statisticians enter the workplace, Stats SA can ensure they build on their formally acquired knowledge and skills and continue their learning.

## **1.2 PROBLEM FORMULATION**

Despite several interventions by higher education institutions to address the needs of organisations in the public and private sectors, the integration between formal and future informal workplace learning to address a particular skills gap remains a challenge. Attention is drawn in existing literature (Hansen 2000; Lettmayr & Riihimäki 2011; Teijeiro et al 2013) to the distinction between formal and informal learning.

Formal learning represents learning of which the outcome is usually a certificate or degree whereas informal learning takes place in the workplace through participation in, for instance, development projects, staff meetings, job rotation and team-based work. In this context, informal learning refers to learning that takes place in the working environment as well as in everyday life. The learning itself is not the primary goal and it happens almost accidentally while participants are engaged in work-related activities (Kock & Ellström 2011). From this definition it can be concluded that the learning process is not necessarily a planned activity. However, the use of an integrated strategy may increase employees' ability to perform in their daily work and to make increased use of the, usually unplanned, opportunities for employees to cooperate, share experiences and reflect on their own work. Such a strategy can include

consciously planning to expose learners to, for example, team-based work, staff meetings and developmental projects (Kock & Ellström 2011).

As a learning process, informal learning in and through daily work is characterised by a low degree of planning and organising. This is due to the fact that most people will be unaware they are busy learning on the job, either because this kind of learning is taken for granted or the learning that is taking place in this way is not recognised as learning (Eraut 2010).

The main focus of this study was addressing the problem of integrating the formal learning and informal workplace learning of statisticians through internships, both while they are engaged in a formal learning process (i.e., by adding a practical component to the formal learning) and upon their completion of a formal learning process. Such integration would be facilitated by means of a framework guiding both institutions of higher learning in South Africa and Stats SA.

A secondary focus was to provide assistance to institutions of higher learning in South Africa to produce graduates who would possess the necessary and needed statistical skills that would enable them to continue learning informally in the workplace, which would address the identified statistical skills shortages. To accomplish this, Stats SA could make recommendations to institutions of higher learning about their needs relating to learning content. The current perception of Stats SA, which is the major employer of statisticians in South Africa, is that the learning content taught to students in statistics at institutions of higher learning is far removed from what they need in the workplace and that their formal learning is not necessarily contextualised. Therefore, integration between the formal learning that graduates receive and the informal workplace learning that they are exposed to do not necessarily take place.

### **1.3 PURPOSE STATEMENT**

The main purpose of this study was to create a framework through which the formal learning of statisticians could be integrated with their future informal workplace learning in order to address the statistical skills shortages in Statistics South Africa.

Furthermore, the study also aimed to reach an understanding of this particular case (Statistics South Africa).

## **1.4 RESEARCH QUESTIONS**

The main research question in the current study was as follows:

How can the formal learning of statisticians be integrated with their informal workplace learning to ensure that statistical graduates are equipped to fill areas where statistical shortages are experienced?

This research study investigated the problem of the integration between the formal learning and informal workplace learning of statisticians by probing the following sub-questions:

- What are respondents' (intern statisticians) and participants' (mentors) views about the role of institutions of higher learning in South Africa in the work readiness of statisticians?
- What are respondent's views and experiences regarding the integration between their formal and informal workplace learning?
- How is the informal learning of statisticians supported in the workplace?
- What suggestions can be made to both Stats SA and institutions of higher learning to ensure integration between the formal and informal workplace learning of statisticians?

## **1.5 AIM AND OBJECTIVES OF THE STUDY**

### **1.5.1 Aim**

I was interested to understand how the formal learning of statisticians in South Africa could be integrated with their informal workplace learning. The aim of this study was

therefore to examine and understand both the formal and informal learning processes of statisticians in South Africa and to develop an integrative framework to facilitate the integration between the formal learning and the future informal workplace learning of statisticians.

### **1.5.2 Objectives**

To achieve the purpose of this study to examine and understand how the formal learning of statisticians in South Africa could be integrated with their informal workplace learning and to suggest a framework through which such integration could be attained, thereby contributing to the work readiness of statisticians, the following objectives of the study were formulated:

- To obtain respondents' and participants' views and experiences about the role of institutions of higher learning in South Africa in the work readiness of statisticians
- To establish respondents' views and experiences regarding the integration between their formal learning and informal workplace learning
- To understand how the informal learning of statisticians is supported in the workplace
- To make suggestions to both Stats SA and institutions of higher learning in South Africa to ensure integration between the formal learning and informal workplace learning of statisticians.

## **1.6 RESEARCH DESIGN**

A research design, which is described by Kumar (2005:84) as a plan, structure or strategy of investigation, was utilised to obtain answers to the research questions. De Vos and Fouché (1998:123) and Bryman (2012:46) regard a research design as the framework that is used to guide how data are to be collected and analysed in order to orchestrate the investigation of the research question. The research design also describes the procedures involved during data collection, data analysis and report writing (Creswell 2008:59).

The research design and methodology chosen for the current study emanated from my practical experience in the field under study, the literature examined and the problem formulated for this study (Henning, Van Rensburg & Smit 2004:12). I wanted to obtain objective knowledge about the phenomenon of the integration between the formal learning and informal workplace learning of statisticians as well as to understand this phenomenon from the participants' perspectives. The research was conducted against the background of the known ontology of learning. Kolb (1984:38) defines learning as a human adaptation process and as "a process whereby knowledge is created through the transformation of experience". A number of scholars in the field of adult education (Chickering 1977; Jarvis 1987; Keeton 1976; Kolb 2014; Merriam & Clark 1993) are of the opinion that adults learn through experience. This definition of learning formed the basis of the current study since I am of the opinion that in order to integrate the formal learning of statisticians with their informal learning, greater attention should be paid firstly to what and how statisticians are taught at a higher education institution (which includes exposing them to real-life situations through the inclusion of a practical component during their formal learning) and secondly to the support of informal learning in the workplace, which grants statisticians the opportunity to put into practice the theory they learnt during their formal education.

My epistemological perspective was informed by existing research on applying learning through experience. The focus was on creating a framework to facilitate the integration between formal learning and informal learning, thereby enhancing the learning experience.

A mixed-method research approach was used to conduct this study since it allowed me to explore in depth the central phenomenon of the integration between statisticians' formal learning and informal workplace learning from the perspective of both interns and their mentors (Creswell 2008:53).

An interpretivist paradigm was used in approaching this study in order to achieve the aim of this research and to ensure the validity of its findings and conclusions. The interpretivist paradigm focuses on people's subjective experiences of the world and is based on the ontological belief that reality is socially constructed (Bryman 2012). Because I wanted to understand how people experienced their reality in a social

situation (Guba 1996), in other words, “understand the subjective world of human experience” (Cohen, Manion & Morrison 2011:17), I found the interpretivist paradigm the most suitable to achieve this aim.

I anticipated that developing a framework to integrate the formal learning of statisticians with their future informal workplace learning would contribute to the existing body of knowledge by providing empirical evidence that the addition of a practical component to the existing formal learning component of statisticians, in that way combining an internship during formal learning and an internship after completing formal learning, would lead to the integration between the formal learning and the workplace learning of statisticians.

Secondly I anticipated that the current research will contribute to the field of official statistics by assisting higher education institutions and Stats SA, the official statistics agency in South Africa, to follow a more integrated approach to the training of statisticians in South Africa.

### **1.6.1 Research methodology**

Bryman (2012:46) describes a research method as the technique for collecting data. In this study, I collected both quantitative and qualitative data simultaneously. Creswell (2014:220) refers to this concurrent collection of both quantitative and qualitative data as the “convergent parallel mixed-method approach”. I chose this approach in order to integrate the information during the interpretation of the results, and also to be in a position to explain or probe contradictions in the findings (Cresswell, 2014:44)

The research methods used in this study are listed in Table 2.

**Table 2: Research methods used in this study**

Interviews	Interviews with managers who served as mentors (A)
Surveys	Questionnaires (intern statisticians) (B)
Document analysis	Job descriptions of statisticians, internship documents such as placement documents, training documents, learning plans and assessment plans, work programmes, strategy documents and annual reports (C)

## **1.7 RESEARCH POPULATION, SAMPLE AND SAMPLING METHOD**

According to Strydom and De Vos (2005:193), population in research refers to individuals who possess specific characteristics that the researcher might be interested in. Population may also refer to groups, organisations, human products or events (Welman & Kruger 1999:47) or to a target population that possesses specific criteria and to which the results of the research can be generalised (McMillan & Schumacher 2006:119).

I firstly identified the site (Stats South Africa) and the population (statisticians; managers who were their mentors) to be involved in this study. The population chosen for this research consisted of the statisticians who worked with official statistics at Stats SA and their managers who also served as their mentors. Stats SA is the official statistics organisation in South Africa.

A sample is defined as elements of the population that are included in the actual study so as to understand the population as a whole (Strydom & De Vos 2005:194). The respondents making up the sample of this study (phase 1 – quantitative data collection phase) consisted of all the statisticians who had joined Stats SA through the internship programme and were permanently in the employ of this organisation at the time of the study. They are referred to in this study as intern statisticians (A). The participants taking part in phase 2 (qualitative data collection phase) of the research consisted of all the managers who acted as mentors for intern statisticians and who worked with official statistics at Stats SA at the time of the study. These managers are referred to in this study as (B). Both these samples constituted primary data sources since they

provided either oral or written accounts about people who were involved in the formal and informal learning of statisticians (McMillan & Schumacher 2006:428). I obtained this primary data from the respondents through mailed, self-administered questionnaires (phase 1) as well as through semi-structured, one-on-one interviews with participants (phase 2).

I also made use of secondary data sources, which, according to Mouton (2001:71), can consist of documents such as books, journals, government publications and legislation and which can be seen as data collected by someone else (Stewart & Kamins 1984:1). I obtained the secondary data through doing an extensive literature review and through analysing the content of relevant documentation of Stats SA and legislation (C) (see Chapter 2).

Table 3 summarises the steps that I followed in conducting the sampling process for the various research methods:

**Table 3: Summary of steps followed in the sampling process**

<b>Approach</b>	<b>Description</b>		
	<b>A</b>	<b>B</b>	<b>C</b>
<b>Strategy</b>	Purposive sampling	Purposive sampling	Purposive sampling
<b>Population</b>	334 statisticians <sup>1</sup>	52 managers	Documents and legislation pertaining to the internship programme of Stats SA
<b>Sample</b>	95 statisticians <sup>2</sup>	10 managers	5 documents
<b>Data collection Method</b>	Online survey	Semi-structured interviews	Document study

<sup>1</sup> Excluding managers

<sup>2</sup> Only those statisticians who had joined the organisation through an internship programme

## 1.8 VALIDITY

Establishing the validity of this research concerned mainly the mixed-method design of the study since this was the main or dominant design of the research. Wagner, Kawulich and Garner (2012) distinguish between the following three types of validity:

**Content validity** – Assessing content validity entails establishing whether the questions actually measure the phenomenon under investigation. In measuring the validity of the content, strong reliance is placed on the knowledge and inputs of those who are familiar with the construct under investigation, in this instance the intern statisticians and their mentors.

**Criterion validity** – The best way to determine criterion validity is by drawing a comparison between a criterion and a standard already known or, alternatively, by using the criterion itself as a basis for comparison.

**Construct validity** – This type of validity refers to assessing how well an experiment measures up to what it claims, that is, whether the construct is measured accurately. The nature of the research design provided a great deal of verification or validity as multiple data sources were compared in investigating the relevant themes. These data sources included individual interviews, questionnaires and documents that supported the mixed-method design. Besides the comparison of data sources, this research also relied on additional strategies to verify the qualitative design such as the use of respondent validation and feedback and opinions of experts in the field. A representative sample of the community of statisticians at Stats SA and managers/mentors was obtained to enhance external validity.

## 1.9 SIGNIFICANCE OF THE STUDY

Statisticians are of critical importance in areas such as research, planning and decision-making (Ocaña-Riola, 2016). In most developing countries where financial resources are very limited, statistics plays a vital role in, amongst other things, poverty reduction (Chenais 2008; Shangodoyin & Lasisi 2011). An important function of statistics is its use in developing and implementing poverty reduction strategies and

monitoring progress in terms of achieving the internationally agreed Millennium Development Goals. Reliable statistics are useful in that they describe the reality of people's everyday lives – authorities get to know where the poor are, why they are poor and what their lives are like. The reality is that many developing countries still lack the capacity to produce, analyse and use the range and quality of statistics required to support effective development progress (Paris21 2007). South Africa is classified as a developmental state, i.e. an entity in which the policies and practices are deliberately designed and enforced to lead to development (Tshishonga & Maphunye 2011; Mbabazi & Taylor 2005). Statisticians are deemed crucial to provide information to inform such policies and practices, (Jerven 2013; Shangodoyin and Lasisi 2011:131; Khan 2007) which implies that South Africa cannot do without a pool of readily available and skilled statisticians to fulfil this important role.

The importance of official statistical information is further elaborated on by Chenais (2008) when he reiterates that official statistics are essential for development in the economic, demographic, social and environmental fields and for mutual knowledge and trade among the states and peoples of the world.

The above statement that statistics are essential for development can be elaborated upon by stating that education, and therefore education in statistics, is one of the vehicles of development. Thus, the current study, in which it is argued that a smooth integration between the formal learning and future informal workplace learning of graduates in statistics is critical to ensure that they are ready to meet relevant needs identified in the workplace, can make an important contribution to South Africa's development. The aims of this study were to build a framework to facilitate the smooth integration between the formal learning and future informal workplace learning of statisticians and to aid managers to understand and manage the complexities of such integration. Furthermore, the study provided institutions of higher learning with clear insights into the needs of South Africa's official statistics agency and made suggestions to ensure the integration between the formal learning and informal workplace learning of statisticians.

## **1.10 DELIMITATIONS AND ASSUMPTIONS OF THE STUDY**

### **1.10.1 Delimitations**

This study was limited to an examination of statisticians working in one government organisation (Stats SA) that is responsible for producing South Africa's official statistics. The research focused primarily on an understanding of the formal training and informal workplace training of statisticians and on the development of a framework that could facilitate the integration between both forms of learning.

It was anticipated that a representative sample from this one government organisation should be sufficient to cover all demographic variables (age, race, gender, seniority, position) that were important to obtain answers to the research questions.

One factor that might have affected the representativeness of the sample was the fact that Stats SA is the only government organisation in South Africa that is mandated to collect and disseminate official statistics. Nevertheless, it can be argued that the way in which formal and informal learning is supposed to be integrated should be standardised across all government departments. Since the majority of statisticians in South Africa are employed by Stats SA it can be argued that the sample was representative. The results and findings of this study were therefore representative of the training of statisticians in South Africa.

The study only focused on the training of statisticians in the context of the integration between the formal and informal learning that statisticians were exposed to.

### **1.10.2 Assumptions**

I made assumptions about the training of statisticians, the organisation from which the sample was drawn, the training that statisticians were exposed to and the individual participants.

Firstly, it was assumed that statisticians had a basic understanding of the best way in which their formal learning and informal workplace learning could be integrated and that they would be in the best position to provide input and recommendations regarding a framework to facilitate such integration.

The second assumption was that all statisticians would, with hindsight, be able to provide inputs regarding the formal content of the training of statisticians at institutions of higher learning in South Africa.

Thirdly it was assumed that the current content of the formal component of the training of statisticians at institutions of higher learning in South Africa was insufficient to address the needs of the government's statistical organisation.

The fourth assumption was that statisticians and mentors would agree to participate fully in the interviews knowing that their confidentiality would be respected.

In the fifth place, it was assumed that respondents and participants would actively and willingly participate in the data collection and that the sample would be representative of the whole organisation.

The sixth assumption was that no proper integration between formal learning and informal workplace learning of statisticians was in place at the time of the study, contributing to the fact that the available skills did not allow the existing statistical skills gaps to be closed.

Finally it was assumed that the management of the relevant organisation would grant permission for the study to be conducted.

## 1.11 OUTLINE OF CHAPTERS

The layout of the chapters of this study is outlined in Table 4 below.

**Table 4: Outline of the chapters of the study**

Chapter 1: General orientation	This chapter sets the scene for the research and provides background information on the purpose, aim and layout of this research
Chapter 2: Literature review	Chapter 2 provides an in-depth review of the available relevant literature on formal learning and informal workplace learning as well the integration thereof. The development of a conceptual framework to guide the collection of data to meet the aim of integrating the formal learning of statisticians with their informal workplace learning is discussed.
Chapter 3: Research methodology	The research design and methods applied in this research are described in detail, which include the grounding of the research, sampling, type of data collection, methods of analysis and quality and rigour tests. Lastly, ethical considerations are outlined.
Chapter 4: Presentation and analysis of the findings	Chapter 4 contains the research findings as well as an in-depth analysis of the results obtained in this study. The findings of the quantitative approach are presented first, followed by the findings of the qualitative approach, and lastly the findings of the document studies are presented.
Chapter 5: Discussion of the findings	In Chapter 5, an integrated approach is followed to discuss the findings of this study in detail. Comparisons between the different data sources are also drawn.
Chapter 6: Evaluation of the research, conclusion, limitations and recommendations	This chapter concludes the research study by providing an evaluation of the research by experts and key stakeholders in the field of statistics, followed by a discussion of the limitations of the study and the recommendations made in respect of both theory and practice.

## 1.12 SUMMARY

The formal and informal learning of adults has been extensively researched, but these two types of learning have been studied in isolation, and the suggestions for integration have focused mostly on internships during formal learning or on completion of formal learning. No framework could be found to integrate formal learning with informal workplace learning by combining both internships, that is, combining an internship during formal learning (experiential learning) with an internship on completion of formal learning (workplace learning). There is not necessarily a shortage of statistics graduates but those who are available do not necessarily possess the necessary skills to close the existing skills gaps in the sector. Furthermore, no research of this nature has been done in a South African context. This study provides meaningful insights into the roles of both institutions of higher learning and of the workplace, insights that are necessary for facilitating the integration between formal learning and informal workplace learning to ensure that graduates can start contributing to the crucial field of statistics as soon as possible.

The point of departure of this study was the recognition of the urgent need to prepare graduates who were ready and capable to fill the statistical skills gaps experienced in the labour market. In Chapter 1, the integration between formal learning and informal workplace learning as the foundation to bring this integration about was outlined. Current training initiatives that statisticians were exposed to were also focused upon. In Chapter 1, the research questions, research objectives, research design and methodology were discussed. I further indicated the contribution and significance of the study and identified important assumptions and delimitations of this study. In conclusion, an outline of the chapters of this thesis was provided.

In Chapter 2, the relevant literature that was reviewed for this study is discussed.

## **CHAPTER 2: INTEGRATING THE FORMAL LEARNING OF STATISTICIANS WITH THEIR INFORMAL WORKPLACE LEARNING**

### **2.1 INTRODUCTION**

This chapter presents a review of the literature that is aligned with the recommendation of Creswell (2009) that the works of scholars, researchers and practitioners relating to the topic under discussion, in this case the integration between formal and informal workplace learning, be examined. I analysed literature on formal and informal workplace learning as well as literature on the integration between formal and informal workplace learning in order to gain insight into studies that were closely related to this study (Creswell 2009). A conceptual framework for the integration between formal and informal workplace learning was then developed based on the main themes that emerged from the reviewed literature and this framework was used to guide the data collection process.

The topics relating to the literature review is discussed in the following order: (a) the importance of statistics for national development and the need to develop statisticians; (b) theories relevant to formal learning; (c) formal learning; (d) theories relevant to workplace learning; (e) workplace learning; (f) integration between formal and informal workplace learning; and (g) conceptual framework for the integration between formal and informal workplace learning.

### **2.2 THE IMPORTANCE OF STATISTICS FOR NATIONAL DEVELOPMENT AND THE NEED FOR DEVELOPING STATISTICIANS**

Chenais (2008:13) is of the opinion that a foundation of statistics is essential for economic, demographic, social and environmental development and for knowledge-sharing and trade among the states and peoples of the world. This sentiment is echoed by several authors. Jerven (2013), Shangodoyin and Lasisi (2011:131) and Khan (2007) see statistics as an indispensable tool for national development, growth and planning and they state that governments that lack the skills to generate, disseminate and use statistics cannot properly plan, monitor and evaluate

development programmes or make proper decisions regarding government policy formulation.

### **Fundamental principles of statistics**

Stats SA, in striving to provide their users with relevant statistics, has adopted the following principles developed by the Statistical Commission of the United Nations Economic and Social Council (Statistics South Africa 2015:2):

Principle 1: Relevance, impartiality and equal access

Principle 2: Professional standards and ethics

Principle 3: Accountability and transparency

Principle 4: Prevention of misuse

Principle 5: Cost-effectiveness

Principle 6: Confidentiality

Principle 7: Legislation

Principle 8: National coordination

Principle 9: International standards

Principle 10: International cooperation

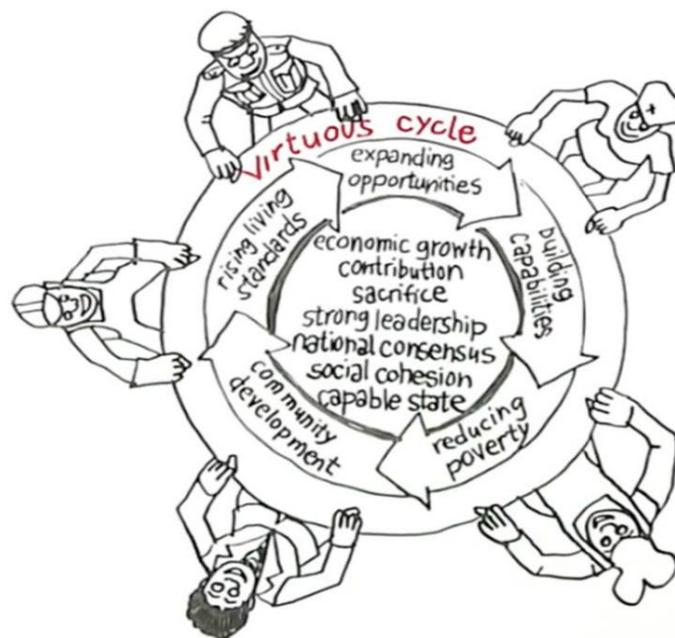
As reflected in the principles developed by the UN Statistical Commission, statistical information is needed to make complex, evidence-based national decisions. Planning a nation's economic and social development involves a complex process that include constructing, executing and checking interrelated decisions. This process is normally contained in a national development plan (Shangodoyin & Lasisi 2011). These authors highlight the fact that statistical planning and national goals should be linked if the statistical system is to play a meaningful role in the planning and delivery of the designed and desired statistical data.

The six pillars of South Africa's National Development Plan (NDP) are as follows:

- Mobilization of all South Africans;
- Active engagement of citizens in their own development;

- Expand and grow the economy and changing the ownership patterns;
- Building of key capabilities (human, physical and institutional);
- Building a capable and developmental state; and
- Fostering of strong leadership throughout society” (National Planning Commission 2013:26).

The six pillars, which draw on the notion of the three key enablers of strong leadership, active citizenry and effective government, are depicted in Figure 1.



**Figure 1: Six pillars of South Africa’s NDP**

Source: National Planning Commission (2013:37)

The fundamental principles of statistics portray the importance of statistics and the rising demand for official statistics in a highly integrated and complex global, continental and national environment. As stated in the Statistics Act, No. 6 of 1999, a statistical system addresses the need to produce official statistics, employ a code of ethics and sound practices, harmonise the production and dissemination of statistics, promote the use of official statistics in policy development, policy monitoring and evaluation as well as decision-making efforts, elevate the sustainability of official statistics throughout the organs of state and civil society and provide the framework

for the development of the country as contained in the NDP. Statistical systems, which are also mentioned in the African Charter on Statistics (Statistics South Africa 2015:152-153), are in alignment with the fundamental principles of official statistics that play a meaningful role in the outcomes of the NDP. This role includes, but are not limited to the following:

- Statistics are used by the nation and other stakeholders for knowledge, information and evidence-based decisions. Statistical products and services are continuously expanded to better meet planning, monitoring and evaluation and policy needs through coordination, integration and innovation.
- Statistics are based on sound statistical quality principles in line with international standards and classifications, engendering trust in their products and services.
- Collaborative partnerships actively participate in statistical coordination structures, establishing statistics units to improve the quality of statistics generated and increase the use of statistics as evidence to inform policy processes.
- Legislative frameworks, which enable effective statistical coordination through good governance practices and systems, are complemented by accountability.
- Investing in programmes increases statistical skills, capability and literacy, enabling a better understanding of statistical concepts and application.

The discussion above highlights the importance of statistics in a country and the subsequent need to ensure that statisticians are sufficiently capacitated to fulfil their crucial role.

The Skills Development Act, No. 97 of 1998 defines a skills shortage as a situation in which employers are unable to fill, or experience difficulty in filling, vacancies in a specific occupation of specialisation due to an insufficient number of workers with the required qualifications and experience. In Government Gazette No. 37651 of May 2014, scarce skills are specified as areas or occupations where a scarcity of qualified and experienced people exists either a) because such skilled people are not available

or (b) they are available but do not meet employment criteria. Evidence suggests that the latter definition applies to Stats SA (Statistics South Africa 2015:10).

In a talent shortage survey conducted in 2012 it was found that a large number of employers worldwide identified a lack of available skilled talent with the right technical expertise and employability skills as the reason for their being unable to fill vacant positions (Manpower Group 2012). Obviously this had a negative impact on their business performance. The most urgent talent shortage was reported in Japan and Brazil where 81% and 71% of employers respectively indicated that they had difficulty finding people with the right profile (Manpower Group 2012:4). In response to an inquiry as to how they planned to overcome the shortages experienced, organisations proposed partnering with educational institutions to make sure candidates were equipped with the necessary skills to close the skills gaps. This indicates that educational institutions play a crucial role in producing graduates with the needed skills, knowledge and attitudes (Cord & Clements 2010).

South Africa played a leading role in the establishment of the African Symposium on Statistical Development and was also elected as a non-permanent member of the Security Council of the United Nations (Statistics South Africa 2010b). Therefore, the global image of the country is favourable but it could be tarnished if its statistical skills shortages are not addressed and if the country lags behind in terms of statistical capacity development (Statistics South Africa 2010b).

In order to deal with the social and economic development needs of the country as discussed above, it is important that South Africa produces graduates who are ready to take on the challenge. However, it seems that the country's urgent need to develop its statistical capacity is not being met. In a study that tracked undergraduates over a number of years it was found that although there was an increase in the enrolment figures at higher education institutions, the graduate output still did not address the country's needs (Fisher & Scott 2011).

It is also evident from the discussion above that institutions of higher learning and organisations need to focus on ensuring that graduates not only develop competencies to make them more employable but that they continue learning while

they are employed so that they stay employable and make a significant contribution in the workplace. Lettmayr and Riihimäki (2011) stress that individuals will be in a relatively safe position in their careers if they are adaptable and preferably also highly skilled. Once again, this highlights the need for formal and informal workplace learning to be integrated in order for statisticians to make a meaningful contribution.

Table 5 depicts the characteristics and features distinctive to formal and informal workplace learning. In order to understand how to integrate formal and informal workplace learning, it is important to consider the features unique to each form of learning.

**Table 5: Characteristics and features distinctive to formal and informal workplace learning**

<b>Formal learning</b>	<b>Workplace learning</b>
Teacher in authority	No teacher involved
Educational premises	Non-education premises
Teacher control	Learner control
Planned and structured	Organic and evolving
Summative assessment/accreditation	No assessment
Externally determined objectives/outcomes	Internally determined objectives
Interests of powerful and dominant groups	Interests of oppressed groups
Open to all groups, according to published criteria	Preserves inequality and sponsorship
Propositional knowledge	Practical and process knowledge
High status	Low status
Education	Not education
Measured outcomes	Imprecise, unmeasurable outcomes
Learning predominantly individual	Learning predominantly communal
Learning to preserve status quo	Learning for resistance and empowerment
Pedagogy of transmission and control	Learner-centred, negotiated pedagogy
Learning mediated through agents of authority	Learning mediated through leader democracy
Fixed and mediated timeframe	Open-ended engagement
Learning is the main, explicit purpose	Learning is either of secondary significance or is implicit

Learning is applicable to a range of contexts	Learning is context-specific
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Source: Colley, Hodkinson and Malcolm (2002)

According to the characteristics of formal and informal workplace learning that are summarised in Table 5, these two types of learning are seen as polar opposites. Workplace learning is also depicted as being inferior to formal learning. Authors such as Eraut (2010) and Marsick and Watkins (1990) also state that formal learning is based on formal educational activities that are planned and that contain an element of intentionality whereas learning at work is mostly informal and not necessarily planned. Coffield (2008:8) is of the opinion that workplace learning is as important as formal learning and that the one complements the other. I support this view and through this study I want to demonstrate that formal and informal workplace learning can be successfully integrated in the workplace only when they complement each other. The relevant learning theories as they relate to both formal and informal workplace learning are discussed next.

### 2.3 FORMAL LEARNING THEORIES

The key concepts and learning paradigms of the formal learning theories of relevant theorists are summarised in Table 6.

**Table 6: Formal learning theories**

Learning theorist	Learning paradigm	Key concepts
Dewey	Experiential education	Process between teacher and student that infuses direct experience with the learning environment and content
Montessori	Scientific pedagogy and Montessori education	Education based on science based on modifying and improving the individual <ul style="list-style-type: none"> <li>- Mixed-aged classrooms</li> <li>- Students' choice of activities from prescribed range of options</li> <li>- Uninterrupted blocks of work time</li> </ul>

		- Constructivist or discovery model – students learn concepts from working with materials, rather than by direct instruction
Hargreaves	Interpersonal relations	Teacher types: lion tamer, entertainer and new romantic
Freire	Critical pedagogy	An educational movement guided by passion and principle to help students develop consciousness of freedom, recognise authoritarian tendencies, connect knowledge to power and be able to take constructive action
Holt	Home schooling, unschooling	Students learn naturally if given the freedom to follow own interests and use a rich assortment of resources
Illich	De-schooling society	School is damaging to education: “The student is thereby ‘schooled’ to confuse teaching with learning, grade advancement with education, a diploma with competence, and fluency with the ability to say something new”
Fleming	Learning styles	Optimal learning demands that students receive instruction tailored to their learning styles

Source: Adapted from HoTEL (2013)

The learning theories presented in Table 6 all have relevance to formal learning. However, due to the fact that this study focuses specifically on the integration between formal and informal workplace learning through experience, I decided that a combination of Dewey’s model of experiential learning theory was the most relevant for proposing a framework for such integration mainly because Dewey suggests that “education must be conceived as a continuing reconstruction of experience” (1938:79). The current study was informed by my opinion that this continuing reconstruction of experience could be achieved by integrating the formal learning of statisticians with their informal workplace learning. As suggested by Dewey, formal learning should

contain a component of experiential learning. Learners' experiential learning should be continued after completion of a formal qualification but this time in the form of full-time workplace learning through an internship programme.

Dewey's model of experiential learning reflects his belief that "all genuine education comes through experience" (1938:25) and he describes experiential learning as a process between a teacher and a student that integrates experience with the learning environment and the content. The following four key concepts form part of Dewey's theory (1938) and are related to aspects of education: 1) the relationships among teachers, learning, the curriculum and community; 2) the ways in which learning occurs; 3) the preparation of students as citizens and individuals; and 4) cognition of learning. As illustrated in Dewey's model, a teacher organises knowledge into smaller logical pieces. Experiences for students are then facilitated according to their readiness. The end goal of these experiences is learning, which in turn leads to learner readiness and knowledge.

## **2.4 FORMAL LEARNING**

It is important to explore the importance of formal learning that precedes workplace learning because in order to put knowledge into practice it must first be obtained formally or theoretically. Eraut (2000:12) is of the opinion that in order to classify learning as being formal, the following conditions need to exist and be present: a prescribed learning framework or schedule; specified learning tasks; facilitation or tuition by a professional educator; and formal accreditation. Enos, Kehrhahn and Bell (2003) concur that formal learning is based on direct instruction and learners' engagement in activities like lectures, discussions, simulations, role plays and other pre-determined and structured activities. These authors agree with Eraut that these activities do not just happen – they are based on specific learning objectives and pre-determined outcomes. Gerber, Marek and Cavallo (2001) concur by emphasising the highly structured nature of formal learning. Structured learning normally occurs in formal educational institutions and is therefore different from learning that occurs in the workplace.

### 2.4.1 The importance of relevant content in formal learning

Scheffler (1978:75) points out that the important question to ask in terms of relevance is “relevant to what, how, and why?” because, according to him, relevance in itself is not an absolute property and nothing is either relevant or irrelevant in itself. Eagleton (2015) and Dachner and Polin (2016) argue that in the field of education, relevance should be considered from the point of view of the learner. Kember, Ho and Hong (2008:249) concur with this view by stating that if the relevance of theory is not explicit, then students could easily become demotivated to learn. Students therefore need to see how they will be able to apply the theory in real life, and the theoretical material needs to be relevant to local cases they can understand and relate to (Kember et al 2008:249).

Ranaweera (1990:15) puts forward the following criteria against which the relevance of content can be measured:

- “what is regarded as educationally worthwhile;
- what is regarded as relevant; and
- what is regarded as teachable”.

Relevant content will result in learning that is focused, contextualised and situated (Lave & Wenger 1991), which will benefit both the workplace and the learners. The need for relevance in terms of content is necessitated by the requirement for people to become experts in their work through the development of situation-specific competence, which can only be developed in authentic situations (Tynjälä 2008:133). Stenström (2006) states that most graduates are of the opinion that their working-life skills are inadequate.

It would, however, be short-sighted if the point of view of organisations in terms of the relevance of formal learning is not considered, since they are ultimately the employers of the learners. According to Tynjälä (2008:131), consultation with the workplace to determine this relevance is currently not happening. She confirms that there is a gap between what the workplace needs and what is supplied through formal education.

Institutions of higher learning could therefore benefit by assessing the needs of organisations, because, according to Gordon (1999:12), through a needs assessment societal expectations with regard to the curriculum and barriers to achieving curricular goals can be determined. The views of potential beneficiaries about the curriculum and the needs of possible target groups are also considered when a needs assessment is done.

Surveys conducted in Europe aimed to establish what the conditions of graduate employment and the links between universities and the labour market were as well as what role competencies played in this relationship (Schomburg 2007). The results of both surveys confirmed that criteria had been established by labour markets long before education systems were in place. Labour markets, therefore, play a critical role in providing inputs relating to the content of formal learning at higher institutions of learning to ensure that graduates have the necessary competencies required in the workplace.

Authors such as Barth, Godeman, Rieckmann and Stoltenberg (2007), Biesma, Pablova, Van Merode and Groot (2007) and Strauss and Sawyer (1986) have all dealt with issues of competence development, but there is no agreement about the best combination of competencies for enhancing or ensuring labour market success. Research by several authors (Ellström & Kock 2009; Jackson & Schuler 1995; Kelliher & Henderson 2006; Salas & Cannon-Bowers 2001) highlight the necessity to consider the contextual conditions influencing competence development in order to truly understand how competence is developed and accomplished.

Although several other authors (García-Aracil & Van der Velden 2008; Hartog 2001; Rychen & Salganik 2003) have also been unable to specify the exact or best combination of competencies to ensure workplace success, they all are in agreement that competencies necessary to become more employable can be obtained through experience, training or more informal means, thereby implying the involvement of organisations to create conditions that will enable employees to acquire these competencies. Adult learning may also influence the employability of newly qualified graduates favourably (Lettmayr & Riihimäki 2011).

The inclusion of the following two objectives in the White Paper for Post-school Education and Training (Department of Higher Education and Training 2013:4) emphasises the importance of forming partnerships between institutions of higher learning and workplaces:

- “a stronger and more cooperative relationship between education and training institutions and the workplace; and
- a post-school education and training system that is responsive to the needs of individual citizens, employers in both public and private sectors, as well as broader societal and developmental objectives”.

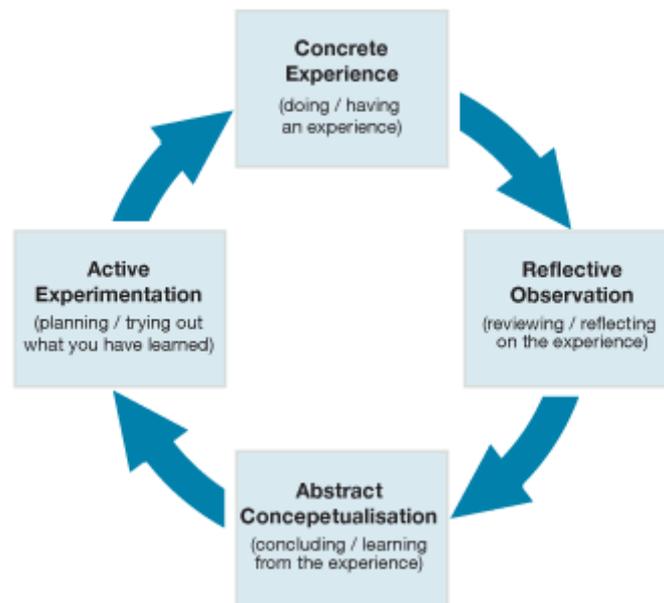
In order for the institutions of higher learning in South Africa to produce work-ready and employable graduates, it is important that they provide content suited to the needs of the job market. This point is highlighted in the aforementioned White Paper (Department of Higher Education and Training 2013:xvi) where the link between education and the workplace is discussed. It is clearly emphasised that the design of training systems (including curricula) requires close cooperation between the providers of training and the workplace. This view is supported by both Slay (2010) and Zieminski (2009) who reiterate that the education sector in many countries is failing to provide learners with the skills needed by the production sector and that, as work gets more complex, employers are looking for more specific skills that graduates should be equipped with during their formal studies. Both these authors suggest a rectification of this mismatch between what the job market demands and what the education sector supplies.

## **2.5 EXPERIENTIAL LEARNING THEORIES OF WORKPLACE LEARNING**

Although there are a number of experiential learning theories to be found in the literature, the work of the following authors, especially as it relates to organisations or the workplace, stands out in this regard and will be briefly discussed: Kolb (1984, 2014), Nonaka and Takeuchi (1995) and Lave and Wenger (1991).

The theory of experiential learning developed by Kolb (1984, 2014) emphasises the process of “generating an action theory from your own experiences, and then continually modifying it to improve your effectiveness” (1984:53). The model operates

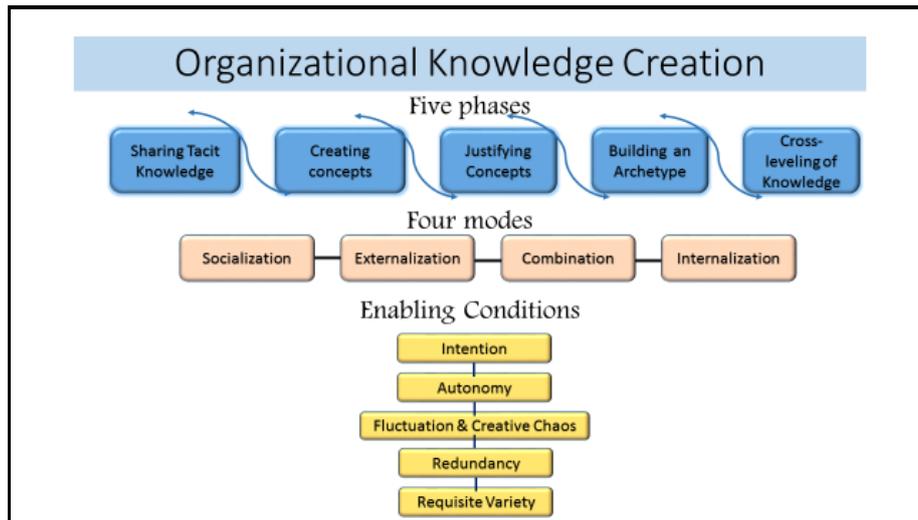
from the premise that a person can continuously gain knowledge through both personal and environmental experiences (concrete experience), and that a learner should be able to a) reflect on the experience (reflective observation); b) conceptualise the experience through the use of analytical skills (abstract conceptualisation); and c) be able to use the ideas gained through the experience to make decisions and solve problems (active experimentation) (2014:236).



**Figure 2: Kolb's experiential learning model**

Source: Adapted from Kolb (1984)

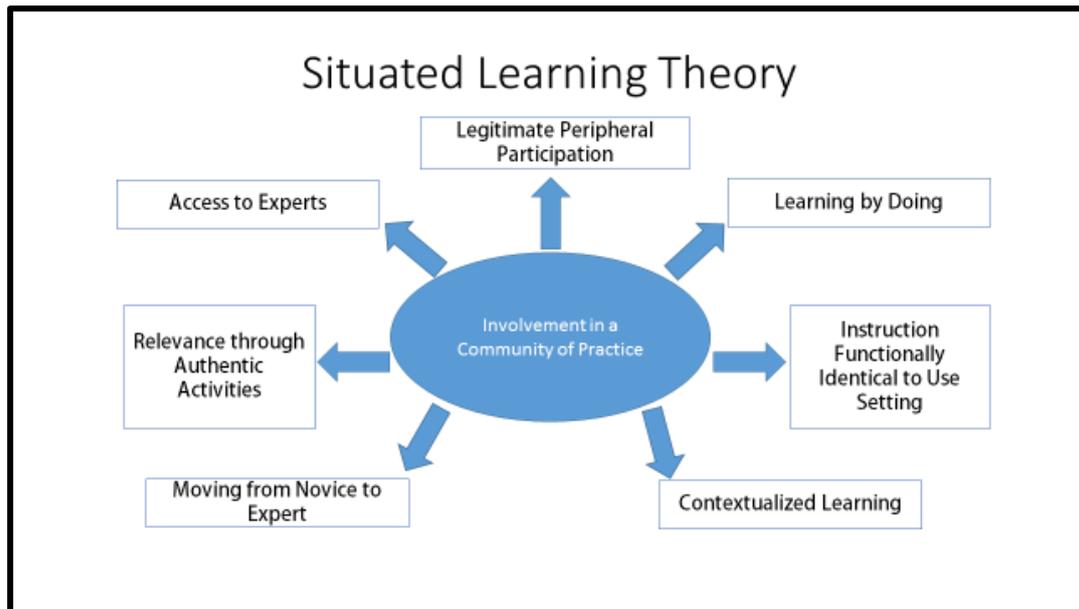
In their theory of organisational learning, Nonaka and Takeuchi define knowledge as “justified true belief” (1995:21). They describe an adaptive organisation as one that can adapt and respond to changes in its environment, and they posit that individuals create knowledge that later becomes organisational knowledge (1995:3). These authors distinguish between tacit knowledge (created by experience) and explicit knowledge (theoretical and transferrable) (1995:57) and according to them, “A spiral emerges when the interaction between tacit and explicit knowledge is elevated dynamically from a lower ontological level to higher levels” (Nonaka & Takeuchi 1995:57). The authors also believe that organisational knowledge is created in the following five phases: 1) sharing tacit knowledge, 2) creating concepts, 3) justifying concepts, 4) building an archetype, and 5) cross-levelling knowledge.



**Figure 3: Nonaka and Takeuchi's organisational learning model**

Source: Adapted from Nonaka and Takeuchi (1995:57)

Lave and Wenger (1991), in their theory of situated learning, emphasise that learning is a social process that happens in everyday settings and through interaction between co-workers and their environment. These authors see learning as co-constructed and situated in a specific context. Situated learning as such suggests that learning does occur in a workplace context (Billett 1996; Lave & Wenger 1991). An important component of situated learning is the construction of knowledge within the social and cultural circumstances in which learning occurs, namely the social context. Another crucial concept of situated learning is communities of practice, which is based on the idea that communities with similar mindsets and who have faced challenges together, work collectively and collaboratively towards a common goal while developing practices (Lave 1996; Wenger 1998, Wenger 2000; Wenger, McDermott & Snyder 2002). The authors describe the process of legitimate peripheral participation as the critical process during which learners move from participating in communities of practice toward participating fully in the sociocultural practices of a particular community.



**Figure 4: Lave and Wenger’s situated learning model**

Source: Adapted from Lave and Wenger (1991)

Even though the models of both formal and informal workplace learning referred to above are all appropriate for this study, I chose to utilise a combination of Dewey’s experiential learning theory and Lave and Wenger’s situated learning theory for this study. These theories focus on experience, contextualised learning, relevance through authentic activities, access to experts and learning by doing, components that are all regarded as crucial to integrating formal and informal learning. These theories were also most appropriate for the current research since a case study approach was used to investigate a framework to integrate the formal learning of statisticians at Stats SA with their workplace learning, an approach that focused on the situated learning of statisticians in a social context and the workplace as well as learning in a formal context.

Several studies that attempted to suggest ways to integrate formal learning with informal (workplace) learning, utilised Lave and Wenger’s situated learning theory (Hung, Lee & Lim 2012; Jones & Dexter 2014).

## **2.6 WORKPLACE LEARNING**

Many scholars are of the opinion that the workplace is an environment that is very conducive to learning new skills and knowledge, enabling co-workers to better participate in everyday, work-related activities (Beckett & Hager 2002; Boud & Middleton 2003; Hager 2001). Several other authors concur and surmise that skill acquisition is dependent on purposeful learning experiences where knowledge connects with its uses in the real world (Gott 1988; Kolb 2014; Robinson & Dearmon 2013). The workplace therefore provides opportunities for co-workers to gain knowledge that connects theory to practice (Billet 2002; Wyborn 2015), and this workplace learning includes experience-based learning and workplace learning (Foley 1999; Hager & Halliday 2006; Knowles, Holton & Swanson 2015; Kolb 2014; Marsick & Watkins 2015). Workplace learning can either be utilised to address individual development in order to achieve individual and/or organisational performance or it can be utilised to achieve personal or professional goals (Jacobs & Park 2009).

### **2.6.1 Experience**

Early authors such as Knowles (1970) and Kolb (1984) started writing about the importance of experience and set the scene for other authors to investigate the importance of experience and the phenomenon that adults learn and benefit most from experientially based constructivist learning environments (Ayling, Owen & Flagg 2013).

Kolb (1984:38) alludes to the fact that “learning is the process whereby knowledge is created through the transformation of experience”. Schon (1983) concurs by emphasising that the real power of experiential learning is evident when it enables students to comprehend previously learned material in new and different ways. This ideally takes place in the workplace when people get the opportunity to put into practice the theoretical knowledge they acquired through formal learning. Experiential learning can only take place in the work environment or in a simulated work environment; therefore, for the purpose of this study, experiential learning will be regarded as constituting workplace learning.

Several authors (Chickering 1977; Jarvis 1987; Keeton 1976; Kolb 2014; Merriam & Clark 1993) reinforce the belief that adults learn through experience. Lewin and Cartwright (1951) is of the opinion that learning takes place when someone interacts with or is stimulated by the environment. Jarvis (1987:164) adds his voice to this definition by stating that we first have to relate our own experiences to a situation before it bears any meaning to us. Dewey (1933/1989) reiterates that people are in constant interaction with the environment through performing tasks, making assertions and solving problems, and that this interaction forms the basis for the learning process. Freire (2006:378) is convinced that all human beings can engage in critical dialogue with others and, when equipped with the right tools, they are able to perceive contradictions in personal and social realities. He is of the opinion that “people educate each other through the mediation of the world” (Freire 2006:376).

The key element in all these definitions of workplace learning is experience. It is, however, important to note that although this informal acquisition of knowledge is important, it is not sufficient to acquire knowledge, and it needs to be supported by formal education (Ellstrom 2001). The opposite is also true (Ivanova & Popova 2009). It is necessary for formal education to be supplemented by workplace learning in order for it to be effective (Barnett 1999; Ellstrom 2001).

Jarvis (in Frick, Albertyn & Rutgers 2010:78) defines experiential learning as “a combination of processes whereby whole persons construct experiences of situations and transform them into knowledge, skills, attitudes, beliefs, values, emotions and senses, and integrate the outcomes into their own biographies”. This definition substantiates the four principles of experiential learning, which include the personal involvement in and complete control over the learning activity by learners themselves, the initiation of learning activities by learners themselves, the self-assessment of the learning by learners themselves, and the importance of the experience of learners themselves during the learning activity (Leonard 2002:69).

The informal acquisition of expertise would benefit the apprentice the most, since learning and knowledge are enriched through experience which constitutes applied knowledge. This view is supported by Boud and Garrick (1999), Siemens (2007) as well as Marsick and Watkins (1999, 2015) who recognise and acknowledge informal

interaction with colleagues as the predominant way of gaining knowledge and skills in the workplace. Therefore, it is of importance that the workplace be utilised optimally for experiential or workplace learning and that this learning should preferably support the formal learning obtained by the apprentice.

Contrary to the opinion of authors such as Marsick and Watkins (1999, 2015), Boud and Garrick (1999) and Billet (1996) who believe that workplace learning is an activity that happens unconsciously while engaging in everyday work activities, Foley (2004) is of the opinion that workplace learning is a conscious activity whereby a person is deliberately trying to learn from an experience. Like the authors mentioned above, he also acknowledges the role that co-workers and experts play in the informal acquisition of knowledge in their areas. Foley refers to the unconscious learning that happens while engaged in other activities as unintentional and incidental – rather than workplace learning.

Folkestad (2006) cites the definition of Ziehe (1982) of informal learning as being common and uncommon in which the latter refers to learning that happens without the person being aware of it, which supports Foley's definition of incidental learning. Folkestad (2006:137) differs from the other authors in that he is of the opinion that it is not *where* but *how* learning occurs that is of importance. Like Foley, he highlights intentionality but goes one step further by stating that in the formal learning situation both teacher and student focus on the "how" whereas the focus in the workplace learning situation is on the actual performance of the task or the actual experience. McGivney (1999, 2006:102) also highlights the intentionality in her definition of workplace learning by reiterating that workplace learning takes place outside a dedicated working environment and that although it is non-course-based, the learning activities are still intentional.

Folkestad (2006:135) further identifies the following aspects for defining and using formal and informal workplace learning: 1) the situation (where learning takes place); 2) the learning style (the character, nature and quality of the learning process); 3) ownership (who decides what, how, where and when the activity takes place); and 4) intentionality (where the mind is directed towards). What all these authors have in

common though is the fact that experience plays a major, or rather the biggest, role in workplace learning.

### **2.6.2 Factors to enhance workplace learning**

Ashton (2004:47) introduces the very valuable dynamic of the factors that are necessary for enhancing the workplace learning experience. He cites the following factors as invaluable for the workplace learning experience: “access to and availability of relevant information; opportunities to learn and to apply learned skills; availability of support; and feedback of managers and co-workers respectively”. The view of Mattox (2012:40) is similar to that of Ashton but he goes one step further by categorising workplace learning as follows: communities of practice; virtual knowledge sharing; performance support systems; mentoring and coaching; and on-the-job experience. These categories, with the exception of virtual knowledge sharing and performance support systems, are of particular relevance to this study.

Evidence suggests that the scarcity of skills experienced by the relevant organisation (Stats SA) is not due to an insufficient number of statisticians but to an insufficient number of statisticians with the right skills and statisticians who are ready to be employed in the areas where a scarcity exists (Statistics South Africa 2010b). This view is supported by Tynjälä (2008:131) whose research confirms that there is a gap between the knowledge needed by organisations and the knowledge and skills that learners receive from tertiary institutions.

Freire (2006:377) emphasises the fact that as sure as one cannot negate practice in favour of theory, one also cannot negate theory in favour of practice. He advocates integration between theory and practice in order to escape “theoretic elitism or practice ungrounded in theory”. Students should be able to use the knowledge they have already acquired to create new knowledge, and they should also be able to transform their experiences into knowledge (Freire 2006:377).

Students should be allowed to “link theoretical material, perspectives, and ideas to the practical concerns of concrete examples” (Dukes, Petersen & Van Valey 2003:336). Learning in the workplace should ideally allow students to apply learning as well as

acquire new knowledge. In his study, Billet (2002:57) found that effective workplace learning resulted when learners “were engaged in authentic activities, were guided by experts and were engaging with co-workers”. According to him, there is a direct correlation between the quality of learning and the kind of activities engaged in and the support and guidance that learners get in the workplace. Boud and Garrick (1999) add to this when they describe workplace learning as learning from others at work.

The importance of proper guidance on workplace learning by experts in their fields cannot be denied. Their expertise could have been obtained either formally (through a formal qualification) or informally (through workplace experience).

When the intellectual capacity of individuals is stimulated, that is, when the complexity of the tasks matches or challenges individuals’ cognitive abilities, it would correlate positively with their competence development (Ellström 1997:268). The following authors Ellström & Kock 2009; Pettigrew, Hendry & Sparrow 1988; Skule & Reichborn 2002 all confirm this statement by suggesting that if a rich learning environment (e.g., the complexity of the tasks calls for continuous learning) exists in an organisation, the effects of competence development efforts are enhanced. Several authors have alluded to the fact that learning environments can either be enabling or constraining (Ellström 1997, 2001; Ellström, Ekholm & Ellström 2008; Fuller & Unwin 2004) and that they affect the degree and quality of learning (Ellström 2006).

Ellström (2001, 2006) flags the following as characteristics that must be present in order for a workplace learning environment to be considered enabling: the work tasks should have a high degree of learning potential and there should be sufficient opportunities for feedback, evaluation and reflection. If these conditions are not present then the working environment can be considered as constraining.

## **2.7 INTEGRATING THE FORMAL LEARNING OF STATISTICIANS WITH THEIR WORKPLACE LEARNING**

Integrating formal learning with workplace learning has been an ongoing discussion with several models having been proposed in an attempt to facilitate such integration

(e.g., Malcolm, Hodkinson & Colley 2003; Sambrook 2005; Svensson, Ellström & Aberg 2004).

In a policy statement, the Joseph Rowntree Foundation (2007) adds its voice to all those who emphasise the need for learners to develop the critical ability to integrate their formal learning with their workplace learning in order to maximise educational gains as well as to achieve work-ready, employable graduates. This integration is all the more important since competence needs to be accomplished through integrated and not isolated formal and informal workplace learning (Berg & Chyung 2008; Burns, Schaefer & Hayden 2005; Enos et al 2003; Svensson et al 2004).

The integration between formal and informal workplace learning through relevant content with practical application has both individual (Merrit 2005) as well as organisational benefits (Coco 2000).

In regard to the individual benefits of integrating formal learning with workplace learning (of intern statisticians in the case of this study), it has been found that not only are students' maturity levels and self-confidence improved (Merrit 2005:5) but they may also enjoy greater job satisfaction (Gault, Redington & Schlager 2000:47). In addition, the following benefits have been identified (Binder, Baguley, Crook & Miller 2015; Kristiansen, Skille & Hanstad 2014; Maertz, Stoeberl & Marks 2014; Shoenfelt, Stone & Kottke 2013; Simon, Yack & Ott 2013):

- They will be better prepared for the workplace.
- It will take a shorter amount of time for them to adapt to the working environment.
- Since they will be exposed to what is expected of them in the workplace early on in their studies, they can make a choice whether they want to follow that particular career path or not.
- Learners will acquire the relevant and necessary skills to make them more employable.
- The practical exposure is invaluable for the intern statistician.

Many organisational benefits of integrating formal learning with workplace learning (of intern statisticians in the case of the current study) have been identified. Bost and Haddad (1996), Carnes and Gierlasinski (1999), Coco (2000), Filbeck, Skutch and Dwyer (1999), Finkle and Barclay (1979) and Green (1997) are all of the opinion that by giving students the opportunity to apply their theoretical knowledge practically, companies benefit by effectively creating a pool from which they can recruit full-time employees. South African society as a whole as well as the economy can benefit from the integration between formal and informal workplace learning because the goals of the country's NDP can be achieved (Department of Higher Education and Training 2013).

The following additional organisational benefits of integrating formal learning with workplace learning have been identified (Maertz et al 2014):

- Organisations will benefit due to the fact that it will cost them less to get an intern statistician ready to produce
- Organisations will have increased productivity because graduates entering the workplace will be ready to start producing quicker
- Expenditure in terms of training will effectively be reduced.

Collaboration means that people work together to achieve a common goal or purpose (Tynjälä 2008:131). Collaboration has been identified as a factor influencing the integration between formal and informal workplace learning: schools, institutions of higher learning and organisations need to work together to achieve the goal of ensuring that graduates are work ready upon completion of their studies and that there is continuous development of their competence (Tynjälä 2008:131). The following authors support the idea of collaboration because it can result in better learning: Kezar, Chambers and Burkhardt 2015; Eyler and Giles 1999; and Wals 2014.

The literature mostly suggests two sets of approaches to integrating formal and informal workplace learning. The first approach entails creating opportunities for integration through web-based technologies (Abdullah, Hussin & Zakaria 2013; Bartlett-Bragg 2006; Breuer, Konow, Baloian & Zurita 2007; Dettori & Torsani 2013;

Erstad 2012; Eshach 2007; Hall 2009; Malcolm et al, 2003; Hung et al 2012; Jones & Dexter 2014; Lai, Khaddage & Knezek 2013; Lebeničnik, Pitt & Starčič 2015; Lucas & Moreira 2009; Pettenati & Ranieri 2006). This approach mainly focuses on individuals who are already employed and who are engaging in formal learning activities. Most of these formal learning activities are vocationally based and not necessarily linked to a formal qualification. Web-based technologies are suggested to integrate these formal learning activities with workplace activities. For the purpose of this study, this approach is not beneficial because the idea is to create opportunities for integration between formal learning (as defined for this study in section 2.3) and workplace learning (as defined in section 2.4).

The second approach entails integrating formal learning with workplace learning through the use of internships in which participants are supposed to put into practice the theoretical knowledge they have gained formally. This approach is mostly suggested for a situation where the student is either still busy with formal learning, that is, while completing a qualification, or for a situation where the student has completed a qualification (Calvo & D'Amato 2015; Clayton, Hess, Hartman, Edwards, Shackford-Bradley, Harrison & McLaughlin 2015; Lohman, Austin, Borgen & Wolff 2015; Fisher, Means & Corson 2014; Lain, Hadjivassiliou, Corral, Isusi, O'Reilly, Richards & Will 2014; Maertz et al (2014); Sweitzer & King 2013).

Based on the literature review, it appears that the current efforts to integrate formal learning with workplace learning results in only limited integration due to the fact that students are exposed to workplace learning **either** while they are engaged in formal learning **or** upon completion of their formal studies; therefore, there is no continuous integration between formal and informal workplace learning. This study attempts to propose a framework according to which students are exposed to workplace learning both while they are engaged in formal learning as well as upon completion of their formal qualification. Such exposure will provide students with an opportunity to be exposed to informal workplace learning while they are engaged in formal learning, thereby ensuring an integration between both types of learning, namely, formal learning and workplace learning.

## **2.8 INTERNSHIP AS A VEHICLE TO FACILITATE THE INTEGRATION PROCESS**

According to a dictionary definition, an internship is a formal programme that is intended to provide practical experience to beginners in an occupation or profession (Dictionary.com n.d.).

Generally, the idea behind internships is for students to get real-world experience and an opportunity to apply theoretical concepts learned in the classroom and to build professional networks (Lohman et al 2015). Internship programmes in South Africa are regarded as practical programmes aimed at assisting with the continuous development of people. The beneficiaries of these programmes are mainly graduates who have completed their studies and are unemployed (Department of Public Service and Administration 2006).

The journey of an intern statistician begins upon enrolment as a student at an institution of higher learning in South Africa and should ideally end upon employment as a statistician in areas of an organisation where his or her skills can be properly utilised and applied. The scarcity of skills in especially the statistical production and dissemination areas in Stats SA, the largest producer of official statistics in South Africa (Statistics South Africa 2010b:5), requires that institutions of higher learning in the country and organisations employing statisticians work together to integrate the formal learning of statisticians with their workplace learning. The factors discussed in sections 2.7.1 to 2.7.9 have been identified as crucial in ensuring the successful implementation of an internship programme aimed at integrating the formal learning of interns with their workplace learning.

### **2.8.1 Proper placement and utilisation of skills**

If the proper recruitment process has been followed, then the right candidate with the right skills enters the organisation. The next major step in the process of integrating the formal learning of statisticians with their workplace learning is to ensure that interns are placed in areas for which their qualifications and skills are appropriate and where

their competence can be developed (Ellström & Kock 2009; Pettigrew et al 1988; Skule & Reichborn 2002).

If intern statisticians are not placed in areas where they can utilise their formally acquired knowledge and skills optimally, then they cannot perform adequately and might even be perceived as under-achievers. They might not get a chance to demonstrate their capabilities since they are operating in a constraining rather than an enabling environment (Ellström 1997, 2001; Ellström et al 2008; Fuller & Unwin 2004). In order for the learning to be relevant and to ensure that formal learning is integrated with workplace learning, it is important that interns be placed in areas in the workplace that complement their formal qualifications. Relevant placement also has a direct influence on the giving of workplace assignments that stimulate the cognitive abilities of intern statisticians, thereby enhancing their learning experience and competence development (Ellström 1997:268).

Once the learners enter the workplace (in this case through internships) it becomes important that they are placed in areas where they receive meaningful and challenging tasks so that they can complement their prior learning by utilising the knowledge and skills they have gained through their formal studies (Ellström 1997; Ellström et al 2008). This is the step in the process when “knowledge is created through the transformation of experience” (Kolb 1984:38). This is also the first component in the process of learners’ acquisition of relevant workplace learning in the workplace.

The functional areas in the organisation in which interns are placed have a direct influence on whether or not their skills will be utilised or not. This in turn influences whether workplace learning takes place or not, because in order for learning to take place, it is important that the cognitive abilities of learners be stimulated. However, this cannot happen if they do not have the formal qualifications for the positions in which they are placed, and if this does not happen there will be no integration between their formal and informal workplace learning (Ramus (1997), Berger (1991) and Wurfel (1985).

The degree to which intern statisticians can utilise their skills also depends on the **level** of the tasks they are assigned. It is important that interns be given projects that are

challenging and that require a substantial amount of responsibility in order for learning to take place (Ramus 1997). It is further important that the intellectual capacity of individuals be stimulated. The level or complexity of the tasks needs to match or challenge their cognitive abilities in order for learning to take place. This sentiment is shared by Ramus (1997), Berger (1991) and Wurfel (1985) who are all of the opinion that professional-level work, and not mere menial tasks that do not complement formal learning, should be assigned to students.

Young and Baker (2004) also emphasise the importance of engaging learners in situations that require complex, realistic and problem-centered situations in order for them to acquire the desired knowledge. Intern statisticians should therefore be in a position to practise their formally acquired knowledge and skills through relevant workplace assignments.

### **2.8.2 Mentorship**

Eisenberger, Stinglhamber, Vandenberghe, Sucharski and Rhoades (2002) suggest that organisational support involves two types of development resources, namely, organisational support through development policies and programmes offered by the institution, which include training opportunities and which are tangible, and a resource created by a relationship between a subordinate and a supervisor, which includes mentoring.

It is important that the informal workplace learning of intern statisticians in the workplace be supported. There are many ways in which this can be done, for instance, through communities of practice, virtual knowledge sharing and performance support systems, but for the purpose of this study, mentoring and communities of practice are focused on as the preferred methods of support for workplace learning.

Mentoring can be regarded as a relationship in which a senior or more experienced person provides the necessary support, advice and friendship to a younger, more junior or less experienced person (Smith, Howard & Harrington 2005:33). Mentorship can be both a formal process (involving some form of matching done by the company)

and an informal one (involving a relationship that occurs naturally, for example, if people share the same interests) (Ramaswami & Dreher 2007:331).

According to Steinmann (2006:3), mentoring is the process “where a person with a serving and inspirational attitude (the mentor) firstly sees development potential in a still-to-be-developed person (the protégé)”. This author further maintains that a mentor needs to support, guide, advise and influence the protégé and that the mentor should play a significant role in influencing the protégé in realising his or her potential.

Billet (2001:21) is of the opinion that effective workplace learning can be accelerated when learners are guided by experts (mentors) in the field and that there is a direct correlation between the quality of learning and the guidance that learners get in the workplace. The importance of the mentor being an expert in his or her field is further emphasised by Ramaswami and Dreher (2007:334) who highlight the fact that mentors must be highly knowledgeable about the organisation as well as the career path that the intern is interested in if the learning experience is to be meaningful to the intern. Foley (2004) emphasises the fact that workplace learning is a conscious activity engaged in by a person who is deliberately trying to learn from an experience. In a workplace learning situation, the focus of both the learner and the mentor is on the actual performance of the task or the actual experience (Folkestad 2006). Ashton (2004) concurs and adds that managers or mentors need to be available to support and provide feedback to learners in order to optimise workplace learning.

### **2.8.3 Support through Developmental practices**

Several practices can be embarked on in order to support informal learning in the workplace and these are discussed below.

### **2.8.3.1 Learning plans**

A learning plan is basically a contract between a learner and his or her mentor that guides the learning process and clearly specifies the outcomes or objectives to be achieved by a pre-determined and agreed-upon time. Devising a learning plan ensures easier evaluation at the end of a learning period (Knowles 1984). Rothman (2007) points out that a learning plan will provide clarity to both parties (the intern statistician as well as the mentor) of the tasks to be performed.

A properly formulated learning plan for intern statisticians should include the following aspects (Young & Baker 2004):

- Application of formally obtained learning
- Application and acquisition of new skills related to statistics
- Personal developmental goals
- Specification of the learning objectives to be achieved and against which the intern will be assessed

### **2.8.3.2 Assessment**

The establishment of the South African Qualifications Authority (SAQA) gave effect to the provision made for it in the South African Qualifications Authority (SAQA) Act, No. 58 of 1995. The purpose of this body is to assure the quality of education in South Africa. The SAQA Act of 1995 defines assessment as collecting evidence of learners' work in order to make decisions either about learners' achievements or non-achievements, the learning programme and the learning itself. In this Act it is stated that data (which are gathered through assessment) measure knowledge, behaviour/performance and values/attitudes.

SAQA follows an outcomes-based education and training approach in which the emphasis is on whether or not learners have achieved pre-determined learning outcomes. Young and Baker (2004) stress the importance of assessing intern statisticians against pre-determined outcomes/objectives. These outcomes/objectives

should preferably have been specified in the learning plans/contracts of intern statisticians. Van der Berg (2012) advises that the learning plan and assessment plan be developed together since these two documents should be mutually dependent on each other.

It is important that assessments are deemed credible. SAQA subscribes to the following principles in order to ensure that assessments are fair (SAQA 2015:7):

- “Fairness
- Validity
- Reliability
- Practicability”

Van der Berg (2012) also suggests that assessments be accompanied by developmental feedback from the mentor to the intern statistician. This developmental feedback should ideally point out areas for development as well as appropriate steps to address those areas in which interns lack knowledge.

### **2.8.3.3 Feedback**

Wiggins (2012) describes feedback as the information people receive about their progress in reaching their goals. Feedback should be not only a one-off process but an ongoing process between an intern statistician and his or her mentor/coach. The mentor should keep some recommendations in mind when giving feedback (Conn, Bennet, Maneen & Andrew 2015; MindTools 2014; Wiggins 2012) and these are discussed below:

- *“Make it a positive process and experience*

The purpose of giving feedback is to improve the situation or performance. People respond better when the approach to feedback is positive and focused on improvement.”

- *Be timely and make it regular*

If feedback is institutionalised, i.e. practiced regularly and throughout the institution or organization, and it is an ongoing process, then feedback should be provided as soon as possible after the event while information is still fresh in the minds of both the intern and the mentor/coach. When the stakes are high and the situation is emotionally charged, it is, however, better to wait for everyone to calm down before feedback is given.

- *Plan for feedback by preparing your comments and being specific*

Mentors should be clear about what they want to say to help mentees stay on track and stick to the issues at hand. It is also important that mentors point out exactly what they want the mentees to improve upon. By sticking to the facts, mentors leave little room for ambiguity. Mentors should not give feedback based on other people's views but on their own objective observations.

- *Praise in public but criticise in private*

People generally appreciate being praised in public but definitely not being criticised or reprimanded in public. A mentor should avoid labelling or blaming a person by using "I" statements when providing criticism.

- *Limit your focus*

A mentor should try to limit a feedback session to two issues at most or the person might feel attacked and become demoralised. Stick to those behaviours that the person can actually change.

- *Also talk about the positives*

A good rule is to start and end the discussion with something positive. This normally helps to put the person at ease and avoids a situation where the person feels

despondent and worthless. However, a mentor should maintain a realistic balance between praise and criticism.

- *Provide specific suggestions*

It is important to ensure that both the mentor and mentee know what needs to be done to improve the situation. It is important that mentors clearly communicate the message that they care and want to help the mentees grow and develop. Put plans in place to monitor and evaluate progress.

- *Follow up*

Since the purpose of feedback is to improve performance, it is important that mentors measure whether or not performance is improving and that they make adjustments accordingly. Documenting discussions is also important.

#### **2.8.3.4 Training and development**

Training provides employees with very specific skills (Asad & Mahfod 2015) and it can also enhance the way in which they perform their work (Nadler, 1984). Johanson and Adams (2004) are of the opinion that organisations should include short courses in training and development because such courses are important to improve the knowledge, skills and productivity of individuals. Additional benefits of training are that it could lead to increased employee satisfaction and a reduction in supervision required (Asad & Mahfod 2015:701). If an employer, for instance, feels that learners did not get sufficient training in the use of statistical analysis packages during their formal studies, then the employer may provide relevant in-house training. This training would not necessarily be qualification based and could therefore be considered to be a form of workplace learning (see Table 6).

Even though the name in-house short courses suggests that the training happens inside the organisation (Stats SA, in the case of the current study), it does not necessarily mean that the organisation (Stats SA) possesses the necessary skills to

provide this training itself (Statistics South Africa 2015). In many instances Stats SA has to source outside service providers to present these short courses. This can be a very expensive exercise depending on the nature of the training. It is therefore important that the training that interns are exposed to is relevant to their jobs and will lead to the enhancement of their skills, otherwise it will be a wasteful and fruitless expenditure for Stats SA as the organisation will receive no return on its investment. Salas, Tannenbaum, Kraiger and Smith-Jentsch (2012:77) concur with this view by stating that "the goal of training is to create sustainable changes in behaviour and cognition so that individuals possess the competencies they need to perform a job".

A situation should be avoided where intern statisticians are sent on training courses simply to tick the boxes. The training should be relevant to their work situation and should put them in a position to apply their newly acquired knowledge and skills. This training could include, but is not limited to, technical or job-specific training as well as soft-skills training.

#### **2.8.3.5 Job rotation**

Interns are expected to rotate to various components within a division or across different functional areas in order to get exposure to as many processes in their chosen field as possible while at the same time getting exposure to the different organisational goals (Noe & Ford 1992). Job rotation is an important aspect of the internship programme since this rotation can promote employee learning as well as play an important part in the development of employees' careers (Campion, Cheraskin & Stevens 1994) since they are exposed to many different areas in which they can develop their skills.

Keys to successful job rotation are discussed below (Heathfield 2016):

- *Job rotation must start with an end goal*

The job rotation plan must specify upfront all the areas that the intern will rotate to as well as the expected outcome of the relevant rotation.

- *Employees are able to assess whether the job rotation is achieving the goals*

The learning plan of an intern must be adapted for each new role. Therefore, the outcomes for each new role must be specified and can be assessed at the end of the rotation period.

- *Both the employee and the organisation need to benefit from the job rotation*

In order for both the organisation and the employee to gain, it is necessary that interns are not merely assigned menial tasks but that tasks match their cognitive abilities so that their competencies can be developed and the organisation gains a more multi-skilled employee who can be utilised in various areas.

- *A mentor, internal trainer or supervisor/trainer is provided at each step of the job rotation plan*

It is important that a mentor be provided for each new area/function that the intern is rotated to in order for the intern to benefit from the rotation.

- *Tenure in each area must be considered carefully*

An intern should be allowed to stay long enough in a division/area to see a project through. It could cause great frustration on the part of the manager/mentor/coach as well as on the part of the intern if he or she is rotated elsewhere without finishing a project that he or she was assigned. Flexibility of rotation is therefore important: an intern statistician must be allowed to rotate only after completion of a project and not necessarily at a fixed, pre-determined time.

#### **2.8.3.6 Monitoring**

Monitoring in the context of the public service is defined as a continuous process of collecting data on indicators that have been predetermined. These data are used to

advise management and stakeholders about progress and the achievement of set objectives (Public Service Commission 2008).

Once an intern has been placed in a particular division, it becomes crucial to monitor what is happening to the particular intern and to carefully consider the relationship between the mentor and the intern as well as the tasks assigned to the intern (Moore 2013). It is very easy for the intern to be seen as an additional responsibility or burden (Santhou 2016) and this could result in the intern not being properly developed, not being given training opportunities and not being given any developmental assignments. Interns are sometimes also perceived as cheap labour and as impacting on the host's time and resources (Gibson 1998) and are therefore only assigned clerical work, or worse, totally ignored. Maertz et al (2014:129) concur by stating that sometimes interns are kept busy with irrelevant or routine tasks that are unchallenging and unstructured. This could result in the intern becoming demoralised and starting to look for alternative stimulation in the form of applying for other work, and even leaving the organisation, because, as Dewey rightly states: "Absence of participation produces lack of interest on the part of those shut out" (Dewey 1938:128).

It is advised that regular contact with the intern statistician be maintained in order to identify and address problems early on. Relying only on the assessment plans drawn up by mentors is not sufficient, since this might not always be a true reflection of what is actually happening to the intern.

### **2.8.3.7 Absorption/Employment**

The ultimate goal of the internship programme is to prepare a pool of statisticians who are ready to take up positions in the organisation where a critical skills shortage is experienced (Statistics South Africa 2010b). By providing intern statisticians with the necessary support and development during their internship, the organisation can ultimately reap the benefits at the end of the internship when interns are assessed and found to be suitable for permanent employment in the organisation. Organisations can save on the cost of "hunting" for employees by permanently employing interns who served their internships with them and proved during this time that they are

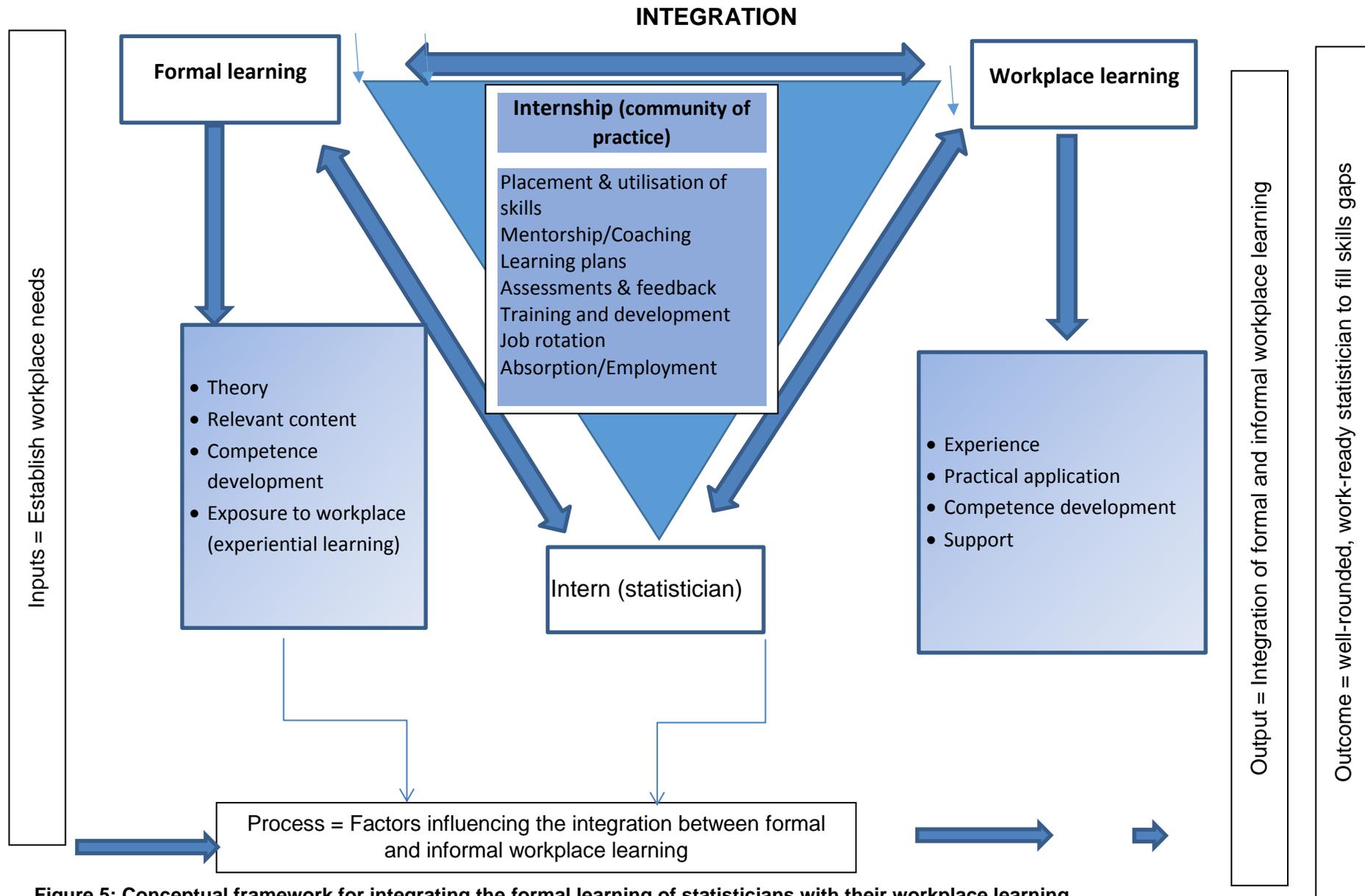
suitable for employment. Therefore, internships can also serve as an extended “try-out” period (Maertz et al 2014).

It is important to follow an umbrella approach to this absorption/employment process. Intern statisticians should compete for vacant positions in the organisation. Their applications should be treated in a fair and unbiased way and should be based on, amongst other things, their previous performance. If their performance was regularly and fairly assessed, these assessments should provide valuable insights into the skills and abilities of the interns (Van der Berg 2012).

From the discussion above, it is clear that the recruitment process to identify the correct candidate with the right skills is crucial. The following aspects are also important: While on the internship programme, intern statisticians must be properly developed through stretch assignments that integrate their formal learning with their workplace learning; proper learning plans with specified outcomes/objectives must be in place; interns must be assessed against what was set out in their learning plans; interns must receive regular feedback and be supported in the workplace by mentors; the development of interns must be constantly monitored and evaluated; interns must be exposed to training that will assist with the development of their skills; and, most importantly, interns must be placed in areas where they can utilise their formally acquired knowledge and skills so that they can integrate their formal learning with their workplace learning.

## **2.9 CONCEPTUAL FRAMEWORK FOR INTEGRATING FORMAL LEARNING WITH WORKPLACE LEARNING**

The conceptual framework that is developed in this study is based on the experiential learning theory of Dewey (1938) and the situated learning theory of Lave and Wenger (1991) as well as the main concepts identified in the literature review. This framework is presented in Figure 5 below:



**Figure 5: Conceptual framework for integrating the formal learning of statisticians with their workplace learning**

Source: Author's own construction derived from the work of Dewey (1938) and Lave and Wenger (1991)

In the conceptual framework depicted in Figure 5 it is posited that the formal learning of statisticians can be integrated with their workplace learning through a combination of internships both during the formal learning process (experiential learning process) as well as upon completion of the formal learning process (workplace learning). This study assessed the success of the current internship programme in Stats SA to facilitate the integration between the formal and informal workplace learning of statisticians.

The development of the conceptual framework helped to shape the study's research questions in the following ways: (a) Subjective questions were designed to collect data directly from the internship graduates to obtain their views and experiences of the integration between their formal and informal workplace learning; (b) Subjective questions were designed to collect data from the internship graduates and mentors to obtain their views about the contribution of institutions of higher learning in South Africa to the work readiness of statisticians; (c) Objective questions were designed to determine the kinds of learning that statisticians were exposed to both formally and in the workplace; and (d) Objective questions were designed to determine how the workplace learning of statisticians was supported in the workplace. The data obtained from the answers to these questions as well as from the literature reviewed were used to evaluate the existing practices of integrating the formal learning of interns with their workplace learning at Stats SA as well as to recommend a framework for such integration.

## **2.10 CONCLUSION**

This chapter reported on I's review of the available literature on formal and informal workplace learning as well the integration thereof. A conceptual framework for integrating the formal learning of statisticians with their workplace learning was developed based on Dewey's experiential learning theory as well as Lave and Wenger's situated learning theory. The purpose of the conceptual framework was to guide the data collection process.

In summary and judging from the existing body of knowledge on the topic under study it can be said that skills shortages exist in certain sectors due to the fact that graduates

who are available in the job market do not necessarily possess the necessary skills to fill the vacancies in the job market (Manpower Group 2012; Schomburg 2007; Slay 2010; Statistics South Africa 2010b; Stenström 2006; Tynjälä 2008; Ziemiński 2009). Institutions of higher learning play a crucial role in providing the foundational and formal knowledge that intern statisticians need for the job market by providing content that is relevant to both the graduates and the job market (Coco 2000; Department of Higher Education and Training 2013; Kember et al 2008; Merrit 2005; Scheffler 1978; Slay 2010; Tynjälä 2008; Ziemiński 2009).

Inputs by organisations in terms of the content provided by institutions of higher learning are crucial to ensure that graduates are equipped with the needed and necessary skills (Barth et al 2007; Biesma et al 2007; García-Aracil & Van der Velden 2008; Hartog 2001; Rychen & Salganik 2003; Schomburg 2007; Strauss & Sawyer 1986). Organisations are keen to join forces with institutions of higher learning in closing the skills gaps (Manpower Group 2012; Tynjälä 2008).

The role that experience plays in acquiring learning in the workplace as well as in integrating formal learning with workplace learning cannot be underestimated (Billet 2002; Chickering 1977; Coco 2000; Gault et al 2000; Jarvis 1987; Keeton 1976; Kolb 1984, 2014; Merriam & Clark 1993; Merrit 2005).

Internships both during the formal learning process (experiential learning) as well as upon completion of the formal learning process (workplace learning) can be utilised successfully to facilitate the integration between formal and informal workplace learning. It is also important that learners are placed in areas or situations in the workplace (contexts) where they can optimally utilise the knowledge and skills they have acquired formally and that they be assigned learning tasks that match their intellectual ability in order to merge formal and informal workplace learning, thereby ensuring a continuation of learning and competence development (Ellström & Kock 2009; Lave & Wenger 1991; Misko 2008; Pettigrew et al 1988; Skule & Reichborn 2002; Stenström 2006; Tynjälä 2008).

Workplace learning needs to be supported by and integrated with formal learning. This can be done by assigning mentors to interns who will provide them with meaningful

work (Ashton 2004; Billet 2001; Boud & Garrick 1999; Eisenberger et al 2002; Folkestad 2006; Marsick & Watkins 1999; Ramaswami & Dreher 2007; Siemens 2007; Smith et al 2005; Steinmann 2006).

More support for learning in the workplace can be provided through developmental practices, which include: (i) learning plans, which should clearly indicate the outcomes to be achieved (Knowles 1984; Rothman 2007; Young & Baker 2004); (ii) assessments and feedback to gather data about the learners' performance to be measured against the stated outcomes in the learning plan as well as to assist learners to achieve outcomes in the case of non-achievement or to encourage and motivate learners to achieve the stated outcomes (MindTools 2014; SAQA 2012; Van der Berg 2012; Young & Baker 2004); (iii) in-house training and development (Asad & Mahfod 2015; Johanson & Adams 2004; Nadler 1984; Salas et al 2012); (iv) job rotation to develop multi-skilled employees (Campion et al 1994; Heathfield 2016; Noe & Ford 1992); and (v) monitoring of the relationship between the intern and the mentor as well as the tasks assigned to the intern (Dewey 1938; Gibson 1998; Maertz et al 2014; Moore 2013).

The absorption process is made easy because employers have had an opportunity to assess the interns' performance during the internship (Maertz et al 2014; Van der Berg 2012).

The next chapter outlines the research design and methodology of this study. A discussion of the inquiry strategy and the specific research design is followed by a discussion of the sample of the study. Thereafter the framework that was used to conduct the data collection, as well as the data analysis method and the steps taken to ensure the quality and rigour of the research are discussed.

## CHAPTER 3: RESEARCH METHODOLOGY

### 3.1 INTRODUCTION

Chapter 1 outlined the general orientation to this study. The rationale for this study and its aims and objectives as well as the research questions guiding the investigation were also presented. A review of the literature in Chapter 2 highlighted the gap between the formal learning (theory) and the informal workplace learning (application of the theory) of statisticians, which served to confirm the need to integrate statisticians' formal learning with their workplace learning. Should this integration not take place, it would be very difficult to close or at least narrow the skills gap experienced in certain statistical areas. In the literature that was reviewed it was stressed that integrating the formal learning of statisticians with their workplace learning was not a mere need but a necessity due to the important role that statisticians fulfil at all levels of society. To this end, this research assessed the effectiveness of an internship programme as a method for integrating the formal learning of statisticians with their workplace learning.

The main research question for this study, as indicated earlier, (see paragraph 1.4) was: *How can the formal learning of statisticians be integrated with their informal workplace learning to ensure that statistical graduates are equipped to fill areas where statistical shortages are experienced?* This study was a convergent, parallel constructivist, mixed-method case study, the purpose of which was to collect data to answer the following research questions about internship programmes for statisticians:

- What are the respondents' (intern statisticians) and participants' (mentors) views and experiences about the role of institutions of higher learning in South Africa in the work readiness of statisticians?
- What are the respondents' views and experiences regarding integration between their formal and informal workplace learning?
- How is the informal learning of statisticians supported in the workplace?

- What suggestions can be made to Stats SA and institutions of higher learning to ensure integration between the formal and informal workplace learning of statisticians?

## **3.2 INQUIRY STRATEGY AND BROAD RESEARCH DESIGN**

### **3.2.1 Research paradigm**

Cohen et al (2011:5) define a research paradigm as “a way of pursuing knowledge” based on principles that guide the researcher as to what phenomena or problems are worth researching and what the best research method would be. Bryman (2012:30) and Cohen et al (2011:5) refer to two views of research in the social sciences, the first of which is the positivist or “established traditional” view according to which research is “essentially the same as the natural sciences” and is “concerned with discovering the natural and universal laws regulating and determining individual and social behaviour”. The second view is the interpretive view that “emphasises how people differ from inanimate natural phenomena, and indeed, from each other” (Cohen et al 2011:5). In order to best explain the view that is appropriate for this study, it is necessary to first investigate the epistemological and ontological assumptions on which these two views are based (Cohen et al 2011:5).

The epistemological position of any study indicates the understanding of the nature of knowledge and how it can be acquired. Cohen et al (2011:5) and Nieuwenhuis (2007:81) see ontology as assumptions which concern the very nature or essence of the social phenomena being investigated.

Epistemology is defined as “the nature of knowledge – its nature and forms, how it can be acquired and how [it can be] communicated to other human beings” (Cohen et al 2011:6). The epistemological position of this study – its understanding of the nature of knowledge and how it can be acquired, is an interpretivist one. The main focus of this paradigm is to understand man’s activity and behaviour, or, as Cohen et al (2011:17) put it, to “understand the subjective world of human experience”.

### **3.2.1.1 The interpretivist paradigm**

In an interpretivist paradigm the focus is on people's subjective experiences of the world, and this paradigm is based on the ontological belief that reality is socially constructed (Bryman 2012:28). I identified the interpretivist paradigm as the most suitable mode of enquiry since the intention of this study was to *understand, describe and interpret* the experiences and views of intern statisticians and their mentors of the integration between formal and informal workplace learning rather than to explain this phenomenon (Cohen et al 2011:17). Since the underlying assumption of this study was that statisticians learnt through experience and while interacting with others (as explained in Chapter 2), the interpretivist approach was deemed to be the most suitable approach for this study. The nature of inquiry based on this paradigm is interpretive and the purpose is to understand a particular phenomenon and not to generalise it to a population (Farzanfar 2005).

The logic of reasoning in this study was inductive since the aim was to understand how both Stats SA and institutions of higher learning approached the formal and informal workplace learning of statisticians with a view to closing the perceived statistical skills gap currently experienced in South Africa.

## **3.3 RESEARCH APPROACH**

A research approach, which can be classified into three major categories, namely, quantitative, qualitative and mixed method (McMillan & Schumacher 2006:22), outlines how a study is conducted. These three research approaches are discussed next.

### **3.3.1 Quantitative approach**

When the aim of the research is to describe a situation exactly as it is, a quantitative approach is usually employed (Leedy & Ormrod 2005:179). This study employed a self-administered online survey to collect quantitative data from participants.

### **3.3.2 Qualitative approach**

Qualitative research is usually employed when one wants to understand the meaning that people assign to a particular problem (Creswell 2014:3). If the intention of a study is to obtain information regarding attitudes, views, opinions or previous experiences of a group or groups of people, then a qualitative research approach would normally be employed (Leedy & Ormrod 2005:183).

### **3.3.3 Mixed-method research approach**

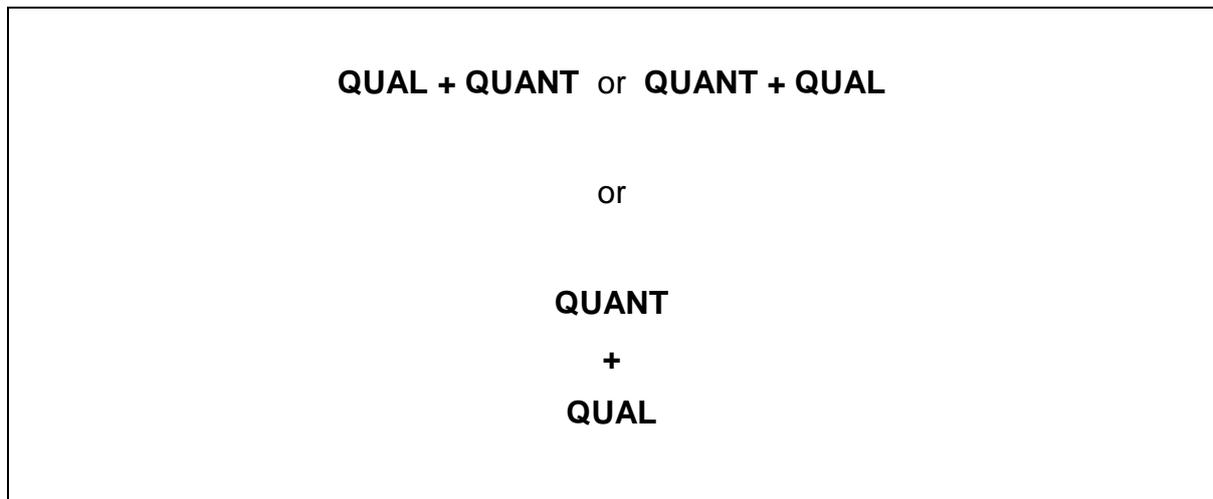
Initially there were only two approaches to data collection, namely, quantitative and qualitative. The mixed-method approach (a combination of both quantitative and qualitative approaches) emerged around the late 1980s and early 1990s when researchers discovered that it might be an excellent approach to answering research questions (Creswell 2014:81; McMillan & Schumacher 2006:401). Creswell (2014:217) is of the opinion that mixing data from both approaches leads to a better understanding of the problem under investigation.

I employed a mixed-method approach for this study. However, the qualitative approach carried more weight than the quantitative approach: interviews were conducted with the mentors in order to obtain rich data since they were the ones who had more experience and could provide more insight into what was needed to inform the framework. Surveys were conducted in order to compare the views of the interns and the mentors in order to obtain rich data to assist in answering the main research question: *How can the formal learning of statisticians be integrated with their informal workplace learning to ensure that statistical graduates are equipped to fill areas where statistical shortages are experienced?*

I collected both quantitative and qualitative data concurrently to provide a more comprehensive understanding of the research problem (Creswell 2014:217), thus a mixed-method research approach was followed. By combining both quantitative and qualitative approaches, I hoped to gain better insight into the problem under investigation. Creswell (2014:217) is of the opinion that by analysing the data obtained

from both quantitative and qualitative sources in the form of responses to research questions, a better understanding of the research problem can be gained.

The different types of mixed-method approaches as illustrated by McMillan and Schumacher (2006:404) are presented in Figure 6 below.

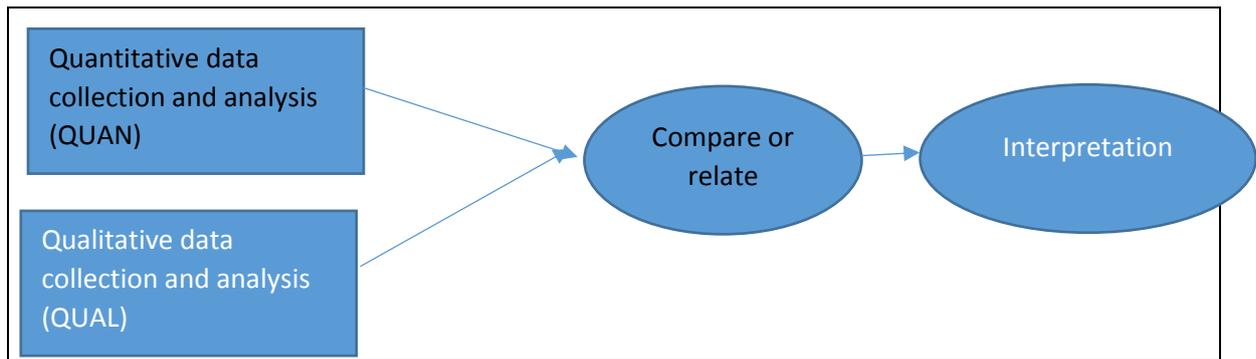


**Figure 6: Types of mixed-method approach**

Source: McMillan and Schumacher (2006:404)

According to the above-mentioned approach, quantitative and qualitative data is gathered simultaneously whereafter both quantitative and qualitative data analysis methods are used to merge the two data sets and then interpreted together. Even though one can follow the other, equal emphasis is give to each method. Both methods can also conducted simultaneously (McMillan and Schumacher 2006:404).

After collecting the quantitative and qualitative data simultaneously as already mentioned, I also interpreted the results concurrently to obtain a better understanding of the phenomenon being investigated, namely, Stats SA's internship programme and its role in terms of the integration between the formal and informal learning of statisticians (McMillan & Schumacher 2006:404). The concurrent collection of both quantitative and qualitative data is referred to by Creswell (2014:220) as the "convergent parallel mixed method approach", which is illustrated in Figure 7.

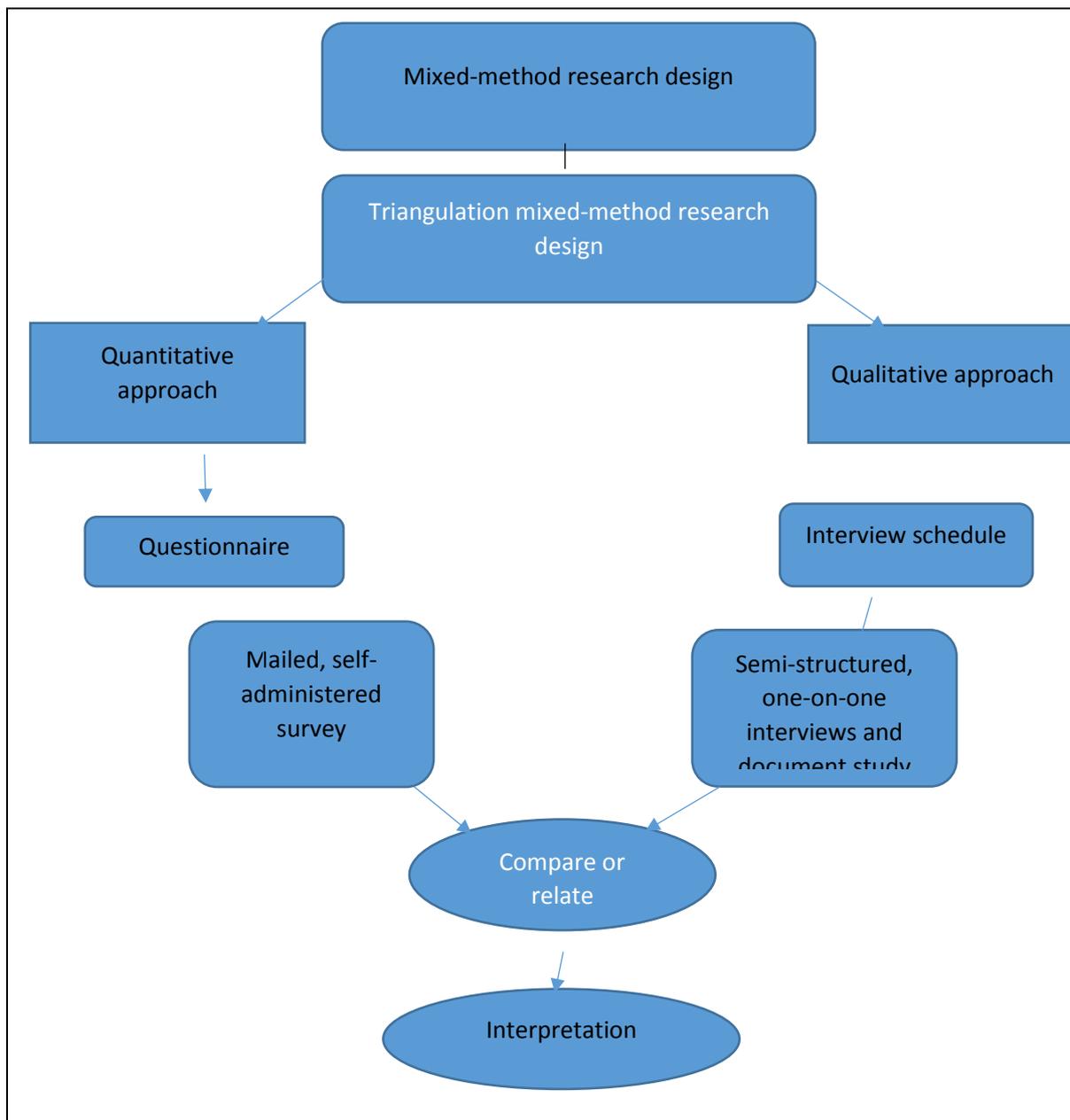


**Figure 7: Concurrent parallel mixed methods**

Source: Creswell (2014:220)

The mixed-method approach allowed me to collect data by means of self-administered questionnaires that were mailed to the respondents (interns) (phase 1). I could continue with conducting interviews with the participants (mentors) in person (phase 2) while awaiting responses requested during the quantitative phase.

McMillan and Schumacher (2006:404) refer to a mixed-method study whereby both quantitative and qualitative data are gathered simultaneously as the triangulation mixed-method approach. In this approach, a researcher merges the data gathered by making use of both quantitative and qualitative data analysis methods and then “interprets the results together” in order to better understand the phenomenon that is being investigated. This process is illustrated in Figure 8.



**Figure 8: Triangulation mixed-method research approach**

Source: Adapted from Creswell's convergent parallel mixed-method diagram (2014:220) and McMillan and Schumacher's triangulation mixed-method diagram (2006:404)

### 3.4 RESEARCH DESIGN

A research design can be seen as a plan, structure or strategy of investigation that provides answers to research questions (Kumar 2005:84). De Vos and Fouché (1998:123) and Bryman (2012:46) see the research design as the framework that guides how data are to be collected and analysed to facilitate the investigation of the

research question(s). The research design also describes the procedures involved during data collection, data analysis and report writing (Creswell 2008:59).

When knowledge is purposefully generated, it constitutes research (Pitts & Smith 2007:4). The purpose is therefore to generate knowledge about a specific problem or problems. The methodology describes how I will go about the research (Silverman 2000:7). Leedy and Ormrod (2005:94) as well as McMillan and Schumacher (2006:23) highlight that a one-size-fits-all approach cannot work, since different research problems call for different research designs and methods.

I used an exploratory and descriptive research design. Mouton (2001:103) and De Vos and Fouche (1998:124) highlight the fact that exploratory research aims to determine the facts, collect new data and establish whether new patterns are presented in the data that could lead to new findings about the phenomenon. This research aimed to establish the current situation, collect new information and determine patterns in the data regarding the merging of the formal and informal learning of statisticians. Human behaviour was studied, which fits in well with the descriptive approach and this approach also makes provision for different data collection strategies (Campion, Cheraskin, & Stevens 1994:59).

The particular design employed in this study was that of a case study. I chose to understand one phenomenon (the Stats SA internship programme) in depth (McMillan & Schumacher 2006:316) and to investigate its dynamics (Welman & Kruger 1999:21) regarding the integration between the formal and informal workplace learning of statisticians.

### **3.4.1 Research site and population**

#### **3.4.1.1 Site**

The first steps I took was to locate the site (Stats SA) and the individuals (statisticians, managers/mentors) who would be involved in this study. This research was conducted at Stats SA, South Africa's largest statistical organisation responsible for producing and disseminating relevant, reliable and quality official statistics. This organisation is

a national government department and is accountable to the Minister in the Presidency responsible for the National Planning Commission. The Statistics Act, No. 6 of 1999 regulates all the activities of the department and also ensures that the said department operates independently and that there is no political interference in its statistical production and dissemination methods and practices (Statistics South Africa 2013). The key stakeholders of Stats SA are the government, the private sector, the non-profit and non-governmental sectors, the international investor community, international agencies and members of the South African public exercising their democratic right to social, political and economic participation (Statistics South Africa 2010b).

The main areas in which Stats SA gathers statistical data are:

- Economic growth
- Price stability
- Employment and job creation
- Life circumstances, service delivery and poverty monitoring
- Population dynamics and demographic profiles (Statistics South Africa 2010b).

The organisation has nine provincial offices, an office in every province of the country as well as 56 district offices. Its head office is located in Pretoria (Statistics South Africa 2013).

#### **3.4.1.2 Population**

According to Strydom and De Vos (2005:193), population in research refers to individuals who possess specific characteristics that are of interest to the researcher. Population may also refer to groups, organisations, human products or events (Welman & Kruger 1999:47) or a target population that possesses specific criteria and to which the results of the research can be generalised (McMillan & Schumacher 2006:119). Population also demarcates the study units (Strydom 2005:223).

This national government department (Stats SA) has a total staff complement of 4 224 of which 3 187 are permanently employed and 1 037 are on contract (as at 30 September 2014).

The population chosen for this research was all the statisticians who worked with official statistics at Stats SA and their managers who also served as their mentors. Stats SA is the official statistics organisation in South Africa. At the time of the study, this national department consisted of eight clusters and 55 divisions and employed approximately 334 statisticians on a permanent basis who were distributed throughout approximately 45 of the 55 divisions. All the statisticians are accountable to managers who usually also fulfil the role of mentors/coaches. These managers in turn report to the executive manager of a division.

### 3.4.2 Sampling

The steps that I followed to obtain a representative sample of this organisation are indicated in Table 8.

**Table 7: Sampling: Steps followed**

Approach	Description		
	A	B	C
Strategy	Purposive sampling	Purposive sampling	Purposive sampling
Population	334 statisticians <sup>3</sup>	52 managers	5 documents
Sample	95 statisticians <sup>4</sup>	10 managers	5 documents
Data collection method	Online survey	Semi-structured interviews	Document study

The next step was to gain access to and build rapport with the individuals involved in the study. Therefore, I contacted the statisticians and their mentors employed at Stats SA at the time to request their participation in the study and to explain the purpose of

<sup>3</sup> Excluding managers

<sup>2</sup> Only those statisticians who joined the organisation through an internship programme

the study to them (see Annexure B), and I also contacted the Statistician-General to obtain permission to conduct the study there (see Annexure C).

Participants/respondents were also given a consent form (Annexure B), which included the following elements:

- Their right to withdraw from the study or not to participate at all
- The purpose of the study and how data will be collected
- The issue of confidentiality – the protection of their identities.

Further to the above-mentioned steps, and in order to gain participants' trust and build rapport with them, I employed the following suggestions by Bachman and Schutt (2014:216-222):

- Participants were informed through a personalised cover letter about the value they would add by participating in this research.
- I built rapport with the participants by introducing herself and explaining what the research was about as well as what value their contribution would add to the organisation (Stats SA).
- Questions were posed clearly and in a way that the participants could understand easily. Clarity was provided if needed.
- I again assured the participants that anonymity and confidentiality would be maintained.

#### **3.4.2.1 Sampling – Quantitative approach (Phase 1)**

According to De Vos, Strydom, Fouché and Delport (2011:329), it is important to clearly identify and formulate relevant criteria for the selection of respondents and participants. Researchers must ensure that rich information can be extracted by making use of sound processes (Erlandson, Harris, Skipper & Allen 1993:33).

Non-probability purposive sampling was used to sample the respondents (interns - A) for phase 1 (quantitative phase) of the study. According to Strydom and Delport

(2005:328), purposive sampling means that a particular case is chosen as it might “illustrate certain features of interest” to conduct a particular study and as it will be representative of the topic of interest (McMillan & Schumacher 2006:126).

I used my own judgement in selecting the respondents (Babbie 2005:486) and based my selection on my “knowledge of the population, as well as ... the purpose of the study” (Babbie 2001:179). The respondents (A) who would complete the quantitative online survey (phase 1) were therefore sampled purposefully.

At the time of the study, the relevant organisation (Stats SA) employed a total of 334 statisticians. Only 95 statisticians were sampled because they had joined the organisation through an internship programme, after which they were permanently employed by the organisation. Therefore, they best demonstrated the characteristics that I was interested in, that is, they had experienced formal learning, acquired their formal qualifications and acquired informal workplace learning through participating in an internship programme designed to provide practical, experienced-based learning (elaborated on in Chapter 2). Much insight could therefore be provided by these statisticians by giving their views about the role of institutions of higher learning regarding the integration between formal and informal workplace learning and the link between such integrated learning and work readiness. The data obtained could address the first objective of this study.

A second objective of this study was to obtain participants’ views on the integration between their formal learning and informal workplace learning. For the same reason as mentioned in the previous paragraph, these participants were in the best position to provide information to address this objective.

A third objective of the study was to understand how the informal learning of statisticians was supported in the workplace. In order to address this aim, it was important for I to get the relevant statisticians’ perspectives on how they experienced support for the development of their skills, as well as on the utilisation of their skills and the practical application of their previously acquired theoretical knowledge. During the literature review phase of this study, these aspects were identified as critical contributing factors in the successful acquisition of informal learning.

The respondents in sample A of this study could also provide information to address the last objective of this study, which was to provide suggestions to Stats SA on how to ensure integration between the formal learning and informal workplace learning of statisticians.

By addressing all these objectives, the main research question could be answered, namely, *How can the formal learning of statisticians be integrated with their informal workplace learning to ensure that statistical graduates possess the required statistical skills to fill the statistical skills gaps that exist in South Africa?*

I ensured that sufficient representation could be attained in respect of sample A by considering the following demographic aspects: the various statistical clusters in the organisation and the qualifications, participation in the internship programme and gender of respondents/participants. Below is an indication of the various clusters of the organisation in which the questionnaires were distributed:

- Economic Statistics
- Population and Social Statistics
- Survey Operations
- Methodology and Standards
- Corporate Relations
- National Statistics Standards

I monitored the completed surveys as they were completed online and checked whether the various statistical clusters were sufficiently represented. In instances where responses had not been received from a particular cluster, the request for participation was resent to ensure that there was even representation of the population based on the set demographic criteria. This allowed for the achievement of a representative sample that was as close as possible to a replica of the population (De Vos et al 2011:207). A total of 78 responses were received back, which represented a final response rate of 82.1%.

### 3.4.2.2 Sampling – Qualitative approach (Phase 2)

For phase 2 of this study, I made use of a qualitative approach to collect data. Similar to phase 1, non-probability purposive sampling (Cohen et al 2011:156; Gay, Mills & Aiasian 2014:135) was used to sample the participants (Mentors - B) for phase 2 (qualitative phase) of the study. Again, participants were selected because they were representative of the topic under investigation (McMillan & Schumacher 2006:126) and they possessed features of interest to this study (Strydom & Delpont 2005:328), that is, they were actively engaged in selecting, managing and training intern statisticians and they were “well informed or informative” (McMillan & Schumacher 2014:152).

In this instance, information was gathered from statisticians and managers who were involved with official statistics either in a mentoring or a managerial capacity. They were deemed to be key stakeholders to provide inputs in answering the main research question, namely, *How can the formal learning of statisticians be integrated with their informal workplace learning to ensure that statistical graduates possess the required statistical skills to fill the statistical skills gaps that exist in the country?* For the purpose of this study, mentors and managers constituted participants B due to the fact that managers fulfilled the role of mentors as well.

Of the 52 managers identified, only 10 were sampled for the collection of qualitative data in the form of interviews. The size of the sample (Cohen et al 2011:144) was determined by the following criteria:

- All the statistical clusters had to be represented.
- The number of years involved in the internship programme was important. Those who had more years of experience were intentionally chosen because I thought they might have more experiences to share, thereby providing richer data.

After conducting eight of the ten interviews with the managers, I found that saturation had been reached, and no further data were collected because, as Charmaz (2006)

points out, if categories or themes are saturated “gathering fresh data would no longer spark new insights”.

Mason (2010) is of the opinion that the quality and not the quantity of the interviews is important for issues of reliability and validity. Eight in-depth, semi-structured interviews were conducted with managers (B) from different departments. All eight interviews were found useful and contained rich data that contributed to this study. These eight interviews represented a response rate of 15.4%, thus more than the required 10%.

Participants in sample B of this study could provide much insight into how they perceived the role of institutions of higher learning in integrating the formal learning of statisticians with their workplace learning, thereby addressing the first objective of this study.

The second objective of this study, to obtain participants’ views on the integration between their formal learning and informal workplace learning could be answered by some of the participants in sample B due to the fact that some of them also participated in the internship programme before becoming managers or mentors.

The third objective of this study was to understand how the informal learning of statisticians was supported in the workplace. In this instance, I wanted to obtain information on how participants in sample B of this study perceived their role in providing support to the intern statisticians. I also wanted to obtain information on how participants supported the development of interns and what opportunities they created for intern statisticians to practically apply their previously acquired theoretical knowledge. These aspects were identified during the literature review phase of this study as critical factors contributing to the successful acquisition of informal learning.

Participants in sample B of this study could also provide information to address the last objective of this study, which was to provide suggestions to Stats SA on how to ensure integration between the formal learning and informal workplace learning of statisticians.

By addressing all these objectives, the main research question could be answered, namely, *How can the formal learning of statisticians be integrated with their informal workplace learning to ensure that statistical graduates possess the required statistical skills to fill the statistical skills gaps that exist in South Africa?*

I collected qualitative data by conducting in-depth, semi-structured interviews with a selected sample of managers (see Table 8). These interviews were guided by the research questions (Table 9) but were flexible enough to allow new ideas and themes to be discovered (Creswell 2013). I chose to conduct these in-depth, semi-structured interviews with the managers (B) of the organisation because they worked closely with the interns either in a managerial or mentoring capacity.

### **3.4.3 Sample**

A sample is defined as elements of the population that are included in the actual study so as “to understand the population as a whole” (Strydom & De Vos 2005:194). A sample should “be well informed and informative” (McMillan & Schumacher 2014:152).

The respondents making up the sample for this research (phase 1 – quantitative data collection phase) consisted of all the statisticians who had joined Stats SA through the organisation’s internship programme and were permanently employed by this organisation. The participants for phase 2 (qualitative data collection phase) of the research consisted of all the managers who acted as mentors for intern statisticians and who worked with official statistics at Stats SA.

Both these samples described above constituted primary data sources since they provided either oral or written accounts about people who were actually involved in the formal and informal learning of statisticians (McMillan & Schumacher 2006:428). I obtained this primary data through responses provided to mailed, self-administered questionnaires (phase 1) and in semi-structured, one-on-one interviews with participants (phase 2). I also made use of secondary data sources, which, according to Mouton (2001:71) can consist of, for instance, books, journals, government publications and legislation and can be seen as data collected by someone else (Stewart & Kamins 1993:1). I obtained the secondary data through doing an extensive

literature review and consulting relevant documentation from Stats SA, legislation and the contents of statistics modules of institutions of higher learning in South Africa (see Chapter 2).

#### **3.4.4 Document analysis**

A purposive sampling procedure was followed to select the documents to be studied, namely, annual reports and strategic plans of Stats SA and documentation specifically pertaining to the internship programme at Stats SA such as learning plans, assessment plans, the database of intern/mentor pairing, internship policy and placement documents. These documents were selected to provide information to address the third aim of this study, which was to understand how the informal learning of statisticians was supported in the workplace.

### **3.5 DATA COLLECTION**

Creswell (2013) provides a broad definition of data collection. He is of the opinion that data collection involves the issues of gaining permission, obtaining a good qualitative sample, recording information both digitally and on paper, implementing data storage and anticipating any ethical issues that may arise.

I paid special attention to the principle of data collection pertaining to the case study design, that is, the use of multiple sources of evidence to ensure triangulation and corroboration (Yin 2013:114). Evidence that shed light on the phenomenon being studied (Stats SA's internship programme) to determine the integration between the formal and informal learning of statisticians was collected through questionnaires, interviews and the analysis of secondary sources, and these methods fit in well with the interpretive paradigm and the case study design followed. Furthermore, inputs were obtained from participants on how the formal learning of statisticians could be integrated with their workplace learning.

I employed both quantitative and qualitative research approaches, techniques and methods for this research study. Because a mixed-method approach to data collection was used, the same research questions had to be used for both methods in order to

collect complementary data as well as to conduct counterpart analysis (Yin 2013:63). I believed that by using both approaches to collect data, a more comprehensive understanding could be reached of the problem under investigation (*How can the formal learning of statisticians be integrated with their informal workplace learning to ensure that graduates possess the required statistical skills to fill the statistical skills gaps that exist in the country?*) (Creswell 2014:217).

Both data collection approaches, that is, quantitative and qualitative approaches, were implemented concurrently. This saved time and I could use the findings of the various data sources (questionnaires, semi-structured interviews, document study and literature review) to inform the answering of the research questions. The two data collection methods are discussed next.

### **3.5.1 Quantitative approach: Phase 1**

Quantitative research is normally used to describe a situation factually, that is, as it is (Leedy & Ormrod 2005:179). Creswell (2014:4) sees quantitative research as an approach to examine the relationship between variables.

In this quantitative phase of the research (phase 1), research was done by means of an online survey to obtain quantitative data from the respondents.

#### **3.5.1.1 Survey/Questionnaire**

Through administering questionnaires, information about a group of individuals, for instance about their characteristics, opinions, attitudes or experiences, can be obtained (Leedy & Ormrod 2005:183). Questionnaires are further intended to obtain facts and opinions from people who are knowledgeable about the phenomenon under study (De Vos, Strydom, Fouché & Delpont 2005:166). Questionnaires can contain as many statements and questions that I requires to determine respondents' attitudes or perspectives (Mouton & Babbie 2001:233). According to Bachman and Schutt (2014:215), most surveys are highly structured and some open-ended questions might be included.

I chose this method of data collection because she believed it could best measure respondents' views on how they perceived the integration between their formal and informal learning. Four main aspects to be measured, which were identified during the literature review phase of this study and which emanated from the conceptual framework, were accordingly employed to gather data on the phenomenon (Stats SA's internship programme) and the integration between the formal and informal learning of statisticians. These aspects were identified as best suited to assist in answering the main research question (*How can the formal learning of statisticians be integrated with their informal workplace learning to ensure that statistical graduates are equipped to fill areas where statistical shortages are experienced in Stats SA?*). These four aspects were work readiness, utilisation of skills, support in the workplace and development/training (informal learning). A breakdown of each aspect is provided hereunder.

### **Work readiness**

A scale was developed to measure the extent to which statisticians perceived that they were being prepared for the world of work by institutions of higher learning. The scale was meant to address the objective of *obtaining participants' views and experiences about the contributions of institutions of higher learning in South Africa to the work readiness of statisticians* as stated in Chapter 1 of this research study.

The scale consisted of the following four items:

- Upon joining Statistics South Africa, did you feel that you were ready to take on the challenges of the world of work?
- Do you feel that you have been sufficiently equipped during your formal studies with the knowledge and skills needed in the workplace?
- What specific skills were you lacking upon joining Stats SA?
- Were these skills taught at the university from which you obtained your qualification?

A five-point Likert-type scale was used to record responses to the first two items, ranging from 1 = strongly disagree to 5 = strongly agree (see Annexure D1). The first two items and the fourth item required respondents to simply mark a “yes” or “no” response whereas the third item required respondents to list the skills that they thought were important for a career in statistics.

### **Utilisation of skills**

This scale intended to provide data to address the objective *to obtain participants’ views and experiences regarding the integration between their formal and informal learning* as stated in Chapter 1 of this research study. The intention was to investigate the variables that influenced such integration as identified in the literature review, namely, relevant placement, utilisation of skills through the assignment of tasks that were on a professional level and that matched the cognitive abilities of intern statisticians, as well as the provision of opportunities to intern statisticians to apply previously acquired knowledge and skills. The scale consisted of the following four items:

- My qualifications were relevant to the area in which I was placed.
- My statistical skills were fully utilised in the area in which I was placed.
- The tasks that were assigned to me as an intern were on a professional level.
- The tasks that were assigned to me gave me an opportunity to fully utilise my statistical skills that I have acquired during my studies.

The above-mentioned items were scored by participants by rating each of the questions against a five-point Likert-type scale ranging from 1 = disagree strongly to 5 = agree strongly (see Annexure D1).

### **Support in the workplace**

This scale was developed to determine to what extent respondents believed that they received support for their development in the workplace and to address the objective *to understand how the informal learning of statisticians is supported in the workplace*

as outlined in Chapter 1 of this study. Support for the informal learning of statisticians in the workplace was also identified in the literature review as a crucial aspect for merging the formal and the informal learning of statisticians. The scale consisted of the following nine items:

- Upon joining the organisation, I was assigned a mentor/coach to guide me.
- My mentor/coach assisted me to perform my duties adequately.
- My mentor/coach was an expert in his or her area of speciality.
- My mentor/coach provided me with regular and constant feedback on my performance.
- A proper, well-developed learning plan was in place for my development.
- I was regularly assessed based on the objectives or outcomes as outlined in my learning plan.
- My learning plan was developed jointly by me and my mentor/coach.
- Areas for development were pointed out to me during my assessments.
- Steps were taken by my mentor/coach to improve my performance in areas where my skills were lacking.

The instrument was scored by participants by rating each of the questions against a five-point scale, namely, strongly disagree, disagree, undecided, agree and strongly agree (see AnnexureD1).

### **Training and development opportunities provided**

This scale was developed to determine to what extent respondents believed that the training/development opportunities that they were exposed to in the workplace were relevant and in support of their informal learning. The responses obtained helped address the following objectives of this study:

- To determine what constituted the formal and informal workplace learning that statisticians were engaged in
- To understand how the informal learning of statisticians was supported in the workplace

The scale consisted of the following four items:

- The training that I was exposed to during my internship was relevant for developing my statistical skills.
- The training that I was exposed to as an intern was targeted, structured and designed to specifically complement my tertiary education.
- The soft-skills training that I was exposed to in the workplace adequately prepared me to function as an employee in the organisation.
- As an intern, I was given ample developmental opportunities through formal courses.

The instrument was scored by participants by rating each of the questions against a five-point scale, namely, strongly disagree, disagree, undecided, agree and strongly agree (see Annexure D1).

### **3.5.2 Qualitative approach: Phase 2**

I wanted to determine the meanings that participants constructed based on their subjective experiences (Wagner et al 2012) and therefore decided to also make use of qualitative research methodologies, which Creswell (2013:22) classifies as inductive and emerging and shaped by I's experience while collecting data.

According to Denzin and Lincoln (1994), qualitative research has a multi-method focus and involves an interpretive, naturalistic approach to its subject matter. By implication, I studies phenomena in their natural settings while trying to understand these phenomena in terms of the meaning people assign to them.

The definitions cited in this section emphasise the importance of studying individuals in their natural environments and understanding the meaning that they assign to their experiences. This ties in with the issue of context, which Hittleman and Simon (1997:43) believe is central to qualitative research because, as was also the case in this instance, I is concerned with understanding individuals' (the statisticians') experiences in their context.

The qualitative phase of the research allowed I to understand the central phenomenon (Stats SA's internship programme) and its role in the integration between formal learning and informal workplace learning (Creswell 2008:53). The use of a qualitative research approach further enabled I to gain an understanding of how the participating statisticians viewed and experienced the development of their skills both formally and informally in the workplace, as well as to gain an understanding of how, as mentors, they supported the informal learning of statisticians in the workplace. Furthermore, views were obtained on how the institutions of higher learning in South Africa contributed to the work readiness of statisticians. Therefore, by employing this qualitative phase, information was obtained to address all the research objectives as stated in Chapter 1 of this study, and complementary data were collected to draw comparisons between responses obtained from interns and responses received from mentors (Yin 2013).

### **3.5.2.1 Interviews**

Creswell (2013) highlights the centrality of interviews during data collection in mixed-method research. Wagner et al (2012) assert that interviews are two-way communications during which data are collected about the ideas, experiences, beliefs and opinions of participants. Although interviews can be time-consuming (Leedy & Ormrod 2005), the interviewer thought it apt to use interviews as a data collection technique due to the fact that the interviewer was able to establish rapport with individuals, leading to open and frank discussions regarding the topic concerned (Leedy & Ormrod 2005).

I conducted semi-structured, one-on-one interviews with the sampled managers/mentors in Stats SA. The interview schedule (see Annexure D) consisted of a set of eight semi-structured questions that were based on the topics covered.

These questions were formulated with a view to understanding exactly how managers/mentors perceived the integration between formal and informal learning to take place (see Annexure D). Managers/mentors participated in semi-structured interviews lasting from 30 to 40 minutes. Interviews were held at the offices of these managers/mentors in order to save time and for the sake of convenience and it also

ensured a better response rate. The interview schedule (Annexure D) and the questions were designed to address the following specific aspects during the interview as indicated in Table 8.

**Table 8: Interview schedule for managers/mentors**

Interview topic	Relevant interview question
Perceived work readiness of statisticians upon completion of qualifications	Question 1
Perceived role of higher education institutions to prepare statisticians for the workplace	Question 2
What are the institutions of higher learning currently doing well in preparing intern statisticians for the workplace and what could they do differently?	Question 3
What is your role in supporting the informal workplace learning of statisticians with particular reference to: <ul style="list-style-type: none"> <li>• mentorship;</li> <li>• in-house training or short courses;</li> <li>• feedback; and</li> <li>• communities of practice?</li> </ul>	Question 4
Suggestions on how Stats SA and institutions of higher learning can work together to integrate the formal learning of statisticians with their workplace learning	Question 5
What do you think the benefits could be of integrating the formal learning of statisticians with their workplace learning?	Question 6

Question 1 sought to gauge the perception of mentors regarding the work readiness of statisticians upon joining the organisation as interns. Question 2 interrogated the views of the participants regarding the role of institutions of higher learning in integrating the formal learning of statisticians with their workplace learning. Questions 3 and 4 probed for suggestions on how institutions of higher learning and Stats SA could collaborate to facilitate greater integration between the formal learning and informal workplace learning of intern statisticians. Question 5 sought to establish the

kind of developmental opportunities that intern statisticians were involved in as part of their informal workplace learning. Question 6 interrogated the role of managers/mentors in supporting the informal workplace learning of statisticians involved in the internship programme.

McMillan and Schumacher (2006:341) point to the common misconception that interviewing is easy despite evidence suggesting that researchers sometimes have difficulty to gain some people's trust and adapt to their individual communication styles. The fact that researchers have to record data while communicating with individuals and trying to understand them is not so easy. I therefore established rapport with the respondents before engaging them formally in an interview. To mitigate the risk of misunderstanding them while trying to record data, I requested their permission to make use of a tape recorder to record the interviews.

### **3.5.2.2 Document analysis**

Yin (2013:103) is of the opinion that the major use of documents in case studies is to corroborate evidence from other sources. This author further asserts that documents could assist with the verification of titles and names as well as with corroborating information obtained from other sources and making inferences. Altheide (1996:2) describes document analysis as a procedure or technique used to locate, identify, retrieve and analyse documents to establish their relevance, significance and meaning. Documentary sources can be crucial to the triangulation of different methods used in research (Noaks & Wincup 2004:107).

The research questions and objectives of the study guided I in terms of the information to look for during the analysis of the documents. The following themes were used to analyse the documents for this study:

- The kinds of developmental opportunities that intern statisticians were exposed to as part of their informal workplace learning

- The integration between the formal learning and informal workplace learning of intern statisticians in terms of relevant placement, level of assigned tasks, and learning plans
- Support for the informal learning of intern statisticians in the workplace in terms of mentors being assigned

The following documents were consulted to search for answers to the above-mentioned themes:

- Annual reports and work programmes of Stats SA
- Strategic plans and job descriptions of statisticians
- Documentation specifically pertaining to the internship programme of Stats SA such as learning plans, assessment plans, database of intern/mentor pairing, internship policy and placement documents

I also coded the words, phrases or sentences in the documents according to themes and subthemes, and the coding was guided by the conceptual framework in order to analyse them (Wagner et al 2012).

### **3.6 DATA ANALYSIS METHODS**

In this research study, two sets of data (both quantitative and qualitative data) were analysed separately and then combined (Creswell 2014:177).

#### **3.6.1 Quantitative data analysis**

Keller (2014:1) describes statistics as “a way to get information from data”. Quantitative data analysis involves statistical techniques to understand what the data reveal (Creswell 2014:177). For this research study, descriptive (or summary) statistics were used to summarise and organise the observations obtained from the online surveys (Keller 2014:12; McMillan & Schumacher 2006:150). During quantitative data analysis, descriptive statistics are used to arrange and summarise the sample and the measures, and the techniques used can include graphical

techniques as well as descriptive measures (Keller 2014:12), which were suitable for this study.

Keller (2014:13) distinguishes between three types of data, namely, interval data, which consist of real numbers (quantitative or numerical), nominal data, which consist of categories (qualitative or categorical), and ordinal data, in which the order of the values has meaning (which usually includes a higher rating).

For the purpose of this study, I used ordinal data because this type of data allowed for the flexibility to assign meaning to the values used (Keller 2014:14) and to use graphs and percentages to report the data (McMillan & Schumacher 2006:154).

The ordinal scale of measurement involved assigning numbers to each option to differentiate the one from the other. For this study, a scale of 1 to 5 was used where 1 represented strongly disagree and 5 represented strongly agree (McMillan & Schumacher 2006:151). Scores were organised from the highest to the lowest (rank-order distribution) and then transformed to a frequency distribution (i.e., indicating the number of times each score was attained) (McMillan & Schumacher 2006:153). The frequencies were tabulated and presented as pie charts.

As indicated earlier, descriptive statistics were used in this study. McMillan and Schumacher (2006:153) distinguish between two types of descriptive analysis, namely, univariate analysis and bivariate analysis. These authors perceive univariate analysis as crucial to descriptive statistics. During univariate analysis, data are summarised based on a single characteristic and the techniques of analysis include determining the mean (establishing the average of all the scores), the median (dividing the rank-ordered distribution in halves containing an equal number of scores) and the mode (establishing the score that occurs most frequently in a distribution). Univariate analysis also allows for percentage analysis, that is, a summary of results based on the percentage of responses for each score (McMillan & Schumacher 2006:153).

Responses (both descriptive and coded) obtained from the online survey using Google Forms were automatically exported into a Microsoft Excel 2013 spreadsheet.

Microsoft Excel 2013 was used due to its popularity and its functionality, as it is more than capable of performing the calculations required for this analysis (Keller 2014:7).

The calculation of the mean (average) for the coded responses involved the summation of all observations divided by the number of observations. In instances where the sample size is an even number, the median is determined by averaging the two middle numbers. In this study, the sample size was an odd number, therefore, the median for the coded responses was determined by placing all observations in ascending order and determining the middle number (Keller 2014:100). The mode was determined by the summation of responses for each code. The code with the most observations was found to be the mode (Keller 2014:101).

### **3.6.2 Qualitative data analysis**

Miles, Huberman and Saldaña (2014:180) describe qualitative data analysis as an interactive process that contains three subprocesses, namely, data reduction, data display and conclusion drawing/verification. According to them, data reduction involves choosing a conceptual framework that guides the analysis and provides broad themes, which are obtained from the literature review, research questions, cases and instruments. They further define data display as the organisation and compression of information, which permit the drawing of conclusions and/or taking of action. The drawing of conclusions and the verification of the data obtained allowed me to interpret the data, in other words, to derive meaning from the displayed data presented.

According to McMillan and Schumacher (2014:221), the aim of the analysis and interpretation of qualitative data is to discover patterns, ideas, explanations and understanding. Therefore, a researcher should systematically search and arrange the interview transcripts plus themes, field notes and other sources to increase one's own understanding thereof and to be able to present the findings to others (Creswell 2009:153).

De Vos et al (2005:333) describe data analysis as the "process of bringing order, structure and meaning to the mass of collected data", whereas Mason (1996) describes data analysis as a range of techniques according to which qualitative data

are sorted, organised and indexed. This process should enable a researcher to identify common themes in people's descriptions of their own experiences (Leedy & Ormrod 2013:140). In analysing these descriptions of data analysis, it can be said that what and how people feel about their experiences are more important than the amount of data gathered. I therefore analysed the views of statisticians and managers on how the integration between formal and informal learning could be facilitated, thereby ensuring that statisticians were ready to make a meaningful contribution when entering the workplace and to continue learning while in the workplace. A data analysis service provider, Emoyeni Research Collaborations, was used to enhance the validity of this research study.

The following three methods of coding (also refer to section 3.6.1 where coding was discussed) were used in this study (De Vos et al 2005):

- Open coding: Data is broken down, examined, compared, conceptualised and categorised.
- Axial coding: Data is put back together in new ways after being open coded through making connections between categories. Account should be taken of conditions, context and action.
- Selective coding: Core categories are selected, systematically related to other categories, validating the relationships and filling in categories that need to be further refined and developed.

It is important to note that the lines between these different types of coding are not very clear and that they do not necessarily take place in sequence (Strauss & Corbin 1990:58). In this research study, I summarised, coded and clustered the data obtained from the interview questions, online questionnaires and documents according to main themes in an effort to understand the way in which learning took place both formally and informally in the workplace.

The conceptual framework developed in Chapter 2 was used to guide the data analysis process. In order to logically analyse the data to explain how the learning, both formal and informal, was taking place and determine what could be done to ensure an

integration between the two, data were arranged according to the work readiness of statisticians upon entering the workplace, the utilisation of their skills, support in the workplace, developmental opportunities received, the training they were exposed to, and suggestions made for merging the formal learning of statisticians with their informal learning. I began analysing the data upon collection and constantly drew comparisons between the information collected and emerging categories (Creswell 2013).

Immediately after the interviews had been conducted, I collated and reviewed the rough notes made and transcribed the audio tape recordings of the interviews. Thereafter, summaries were made of the different documents provided by the management of Stats SA (database with placements and names of mentors, interns, learning plans, assessment plans, internship policy, strategic plans and annual reports). Analysing the documents assisted me in finding links, emerging patterns and sometimes inconsistencies among what had been said during the interviews and the words that had been recorded in the official programme documentation. The collation process also enabled me to see emerging patterns and themes. After the initial field notes had been reviewed and corrected, the relevant data were carried over onto a summary form and encoded. The advantage of using a summary form was that it allowed me to perform a preliminary data reduction without losing any of the basic information. My impressions and reflections of the interviews were captured and data were collapsed for further reflection and analysis (Miles et al 2014:52).

Tesch's method of open coding (as cited in Creswell 2009) was used to analyse transcriptions. This method, which involves seven steps (see outlined below) allows for data to be classified on categorical, analytical and theoretical levels. Making comparisons between different data sets is also facilitated through continually asking who, when, where, what, how, how much and why questions. By utilising this approach, I could interpret the transcribed text meaningfully and gain a better understanding of the theoretical components that could be derived from the data analysis. The seven steps that were followed in this study were:

**Step 1:** I listened to the recorded interviews a few times, jotted down ideas and compared them to her notes.

- Step 2:** The researched grouped the topics according to the themes and subthemes to form an overall picture.
- Step 3:** The topics were abbreviated and coded and then compared and contrasted to ensure that no themes had been omitted. The coding involved the breaking down and conceptualisation of data, which were then put together again in new and different ways.
- Steps 4 and 5:** I used descriptive wording to condense the categories, after which she sorted the codes alphabetically.
- Steps 6 and 7:** Data pertaining to the same category were grouped together and a preliminary analysis was performed.

I started by developing first-order codes, main themes, subthemes and categories and proceeded by reading through the data and developing a set of first-order codes. Thereafter, I identified the main themes and subthemes from the coded data (Gibbs 2008) by moving backwards and forwards in the entire data set. The identification of themes was guided by the conceptual framework developed in Chapter 2. The criteria for the identification of themes included recurrence – where at least two parts of the discourse had the same meaning even if different words were used; forcefulness – which could include aspects such as using follow-up phrases to emphasise importance, using dramatic pauses, putting ideas first in a list and highlighting; and repetition of words, phrases, sentences and statements (Owen 1984).

According to De Vos et al (2005:339), the last step in the analysis of information is the search for alternative explanations. I had to consider the following research objectives of this study as stated in Chapter 1:

- To obtain respondents' and participants' views and experiences about the role of institutions of higher learning in South Africa in the work readiness of statisticians
- To establish respondents' views and experiences regarding the integration between their formal learning and informal workplace learning

- To understand how the informal learning of statisticians is supported in the workplace
- To make suggestions to both Stats SA and institutions of higher learning in South Africa to ensure integration between the formal learning and informal workplace learning of statisticians

Axial coding, which, according to Miles et al (2013:2018), involves relating the categories and concepts to each other through a process of inductive and deductive thinking, was used to make connections between the categories. After having made the connections between the categories, I had to engage in the process of selective coding.

Lastly, selective coding, which involved a process of choosing one category as the core and systematically relating the other categories to that category, was used to piece together the various categories to extract meaning from them. The final result was a proposed framework for the integration between the formal learning of statisticians and their informal workplace learning as well as a summary of suggestions made by Stats SA itself about suitable adaptations to the current content of statistics modules at institutions of higher learning in South Africa.

### **3.7 STEPS TAKEN TO ENSURE THE QUALITY AND RIGOUR OF THE RESEARCH**

Creswell (2014) states that validity, credibility and trustworthiness are crucial components of the quality of any research study. By paying attention to these components as they relate to both the quantitative and qualitative approaches followed, a researcher can ensure that the quality of the data and the interpretation of the data as well as the findings of the study are credible and can be replicated by other researchers.

### **3.7.1 Methods used to ensure the quality of the quantitative approach**

#### **3.7.1.1 Validity and reliability**

According to Denscombe (2012:100), validity concerns the accuracy of the questions asked, the data collected and the explanations offered. Thus, in respect of this research study, the accuracy of the questions asked, the data obtained and analysed and the findings reached had to be validated. Gibbs (2008:91) defines validity as a process “to ensure that an analysis is as close as possible to what is really happening”. I ensured the validity of the data and the analysis thereof by following the measures outlined below.

After the design and development of the online survey, which included all four main themes (work readiness, utilisation of skills, support in the workplace and development through training (informal learning)), the survey was reviewed and evaluated by two different specialists in the field, namely, statisticians working in the field of statistics and serving as mentors to intern statisticians. Based on their input, adjustments were made to the layout, structure and terminology of the survey. These adjustments contributed to achieving the content validity and face validity (subjective testing of whether or not the study will measure what it is supposed to measure) of the survey. Reliability was further enhanced by administering the questionnaires to a selected pilot group. The same method that was used to sample the target group (non-probability purposive sampling) was used to sample the pilot group. The pilot group was selected according to the same criteria relating to demographic characteristics as those laid down for the target sample group. The online survey was administered to the pilot group in exactly the same way as it was intended to be administered to the bigger sample group (all statisticians who had joined Stats SA through an internship programme and were permanently employed by the organisation at the time of the study). Following these steps enhanced the consistency and accuracy of the measurements.

### **3.7.2 Methods used to ensure the quality of the qualitative approach**

#### **Trustworthiness**

To ensure the trustworthiness of the qualitative data, the interview schedule was pilot tested and assessed by two individual experts in the field. After the pilot interview, some questions, which were found to be repetitions of other questions, were omitted so as to prevent possible confusion among the participants. Only upon the successful completion of the pilot interviews were the in-depth, semi-structured interviews conducted according to the amended interview schedule (see Annexure D).

Qualitative data obtained from the interviews were analysed according to four central aspects in order to contribute to the quality, trustworthiness and transparency of the data (Gibbs 2008:90). I applied the following practices:

- In respect of the qualitative data collection methods (semi-structured interviews), the conceptual framework of this study was considered at all times when data were collated, captured, categorised and interpreted.
- The principles of confidentiality and openness were upheld during the interviews (ethical consent was signed by all interviewees). Participants were not guided or led in answering questions and free discussions were encouraged during the interviews.
- Role clarification and the upfront statement of the purpose of the research and its context assured participants of their neutral standing and also dispelled any fears of victimisation.
- Multiple and contradictory descriptions by managers/mentors were included in the study to avoid creating a simple fit between interview data and theoretical underpinning.

Triangulation of the different data collected and sources used for this study to corroborate the same phenomenon was investigated and also contributed to the overall quality and trustworthiness of the data. The findings of the document analysis were corroborated by evidence from the online surveys as well as evidence collected

during the semi-structured interviews. Participant observation was also employed to collect data.

### **Validity, reliability and credibility**

Similar to validity in the case of quantitative approaches, validity in qualitative approaches refers to the accuracy of the questions asked, the data collected and the analysis of the data.

I addressed the validity of the qualitative approach followed by making sure that the questions included in the interview schedule represented what they were supposed to represent.

I further paid attention to the following aspects:

- Use was made of good sampling techniques and procedures.
- Research questions were compiled that related to the topic of the study and the same questions were posed to all participants.
- Clarity was provided in instances where participants were unsure about the questions being asked.
- Participants' answers were recorded as they were received.
- A data analysis service provider, Emoyeni Research Collaborations, was used to further enhance the validity of this research study.

Yin (2013) suggests that qualitative researchers need to pay attention to aspects of reliability to ensure that their approaches are reliable and consistent. The following practices were applied in this study to establish an acceptable reliability standard and to enhance consistency:

- Even before the semi-structured interviews were conducted, I requested permission from the participants to use a tape recorder to record the interviews in order to ensure accuracy of data collection (Trochim & Donnelly 2007:146).

I also took down notes during the interviews to serve as a reminder of what was said. In addition, information was entered on an electronic database.

- Transcripts of the semi-structured interviews were verified and checked for accuracy and obvious mistakes.
- Themes were defined to counter the concept of definitional drift and to assist with consistent interpretations of data obtained from the various data collection methods.
- I conducted all the interviews herself to enhance consistency of practice.

I was careful about generalising interpretations and results and applying them to all statisticians based on a single participant's or respondent's views. By applying these methods, I was confident that the quality of the research would not be compromised.

In terms of credibility, Bryman (2012:273) and McMillan and Schumacher (2014:355) suggest that both formal and informal member checking be done. In this study, I employed formal member checking (upon completion of the transcripts) as well as informal member checking (during the semi-structured interviews) (Cohen et al 2011:185; Creswell 2014:283). Further to these methods to ensure the trustworthiness and credibility of the study, I requested five experts in the field of statistics to evaluate the proposed framework and to give inputs and make suggestions. The results of their evaluation are presented in Chapter 6 of this study.

### **3.8 ETHICAL CONSIDERATIONS**

Creswell (2014:103) highlights the fact that researchers need to adhere to several ethical issues throughout their research projects. Before data collection could commence, I had to obtain ethical clearance from the internal review board of the College of Education of the University of South Africa (Unisa). This is a requirement of the university for all its students who undertake research involving human participants. This process also needs to be followed to ensure that high-quality, scientific and ethical research is produced by the students of the university.

At the beginning of the study, I contacted the participants and informed them of the general purpose of the study. Participants were also informed about their right to decide not to participate in the study (Creswell 2014:103).

I further adhered to the following ethical considerations as outlined by Leedy and Ormrod (2005:101):

- **Professional code of ethics:** Unisa's policy on research ethics (Unisa 2007) was adhered to at all times during this research study.
- **Protection from harm:** The identity of all participants in this research study was protected in order to guarantee that participants could not be identified, victimised or intimidated due to their participation in this study. Each participant received a number to ensure that they could not be identified based on their names.
- **Informed consent:** The purpose and nature of the research study were explained to each participant and respondent and they were given a choice to participate in the study or not. Before interviews were conducted and questionnaires were completed, participants and respondents also received and had to complete an informed consent form that clearly explained their roles. The following information was conveyed in the consent forms (see Annexure B):
  - The nature of the research conducted
  - The role of participants and what was required of them, as well as the duration of participation
  - An explicit indication that participation was voluntary and that respondents/participants could terminate their participation at any time
  - A clear indication that confidentiality would be maintained and that participants would remain anonymous
  - The contact details of I as well as the means by which she could be contacted regarding any clarification, queries or concerns
  - Provision for participants to sign and date the form to indicate their agreement to participate in this study voluntarily

- **Right to privacy:** The participants' right to privacy was respected at all times. Information obtained was presented in a way that protected the identity of participants. This was done by allocating code numbers to questionnaires and interviews.
- **Honesty with professional colleagues:** The findings of this research were reported on in a complete and truthful manner. To prevent misinterpretation, the procedures followed, the methods employed and the findings reached were clearly outlined. I also acknowledged all literature sources.
- **Internal review boards:** The Research Committee of the College of Education of Unisa approved the research proposal, and the Ethics Committee of the College of Education of Unisa granted the ethical clearance for this study. Approval was also obtained from Statistics South Africa to conduct the research in their organisation and to interview statisticians in their employ.

### 3.9 CONCLUSION

To summarise, this chapter outlined the rationale for using an interpretivist paradigm and a mixed-method case study research design for this study. The research population, sample and sampling methods for each of the two research phases (quantitative and qualitative) were discussed. Thereafter, the data collection methods, namely, the online surveys for the quantitative phase, the semi-structured interviews, and the document analysis for the qualitative phase, which were employed for this study, were discussed. A discussion of the data analysis done in respect of both approaches (quantitative and qualitative) was presented and issues around the reliability and validity of the two approaches were discussed separately. In conclusion, the ethical considerations pertaining to this study were discussed.

In the next chapter, the findings relating to both research approaches are presented.

## **CHAPTER 4: PRESENTATION AND ANALYSIS OF THE FINDINGS**

### **4.1 INTRODUCTION**

This chapter presents the findings of the study. The purpose of the study was to determine the effectiveness of an internship programme to integrate the formal learning of statisticians with their informal workplace learning. A convergent parallel mixed-method research design was used to gather data from statisticians who participated in the internship programme as well as statisticians who served as mentors or managers to interns.

The findings reported in this chapter were guided by the conceptual framework that was presented in Chapter 2 (2.9) of this study. The findings of the online surveys (4.2) are reported on first. Thereafter the findings of the semi-structured interviews (4.3) and the document analysis (4.4) are presented.

### **4.2 QUANTITATIVE RESULTS (ONLINE SURVEY)**

#### **Demographic information**

The biographical data of participants were grouped to demonstrate representativeness in terms of the division and cluster in which they were employed as well as their period of employ. Respondents representing 23 of the divisions of the organisation participated in completing the online surveys (A) for this research. Of the statisticians, 65% were males and 35% were females. Of the respondents, 75% were African, 14% were white, and 11% were coloured. No Indians or Asians participated in the study.

The conceptual model that I introduced in this study (2.9) (Figure 5) contained the following themes: work readiness, utilisation of skills, support for informal learning, and developmental practices. The questions for the online surveys were constructed around these four themes. All the themes were tested separately during the online surveys, during the semi-structured interviews, as well as while analysing the

documents. The results of the different methods employed during the quantitative data collection phase are therefore presented under each theme.

A five-point Likert-type scale was used to record responses ranging from 1 = strongly disagree to 5 = strongly agree (see Annexure D1). Two of the items were open-ended questions and another two items required respondents to simply mark a “yes” or “no” response. Responses received were as follows:

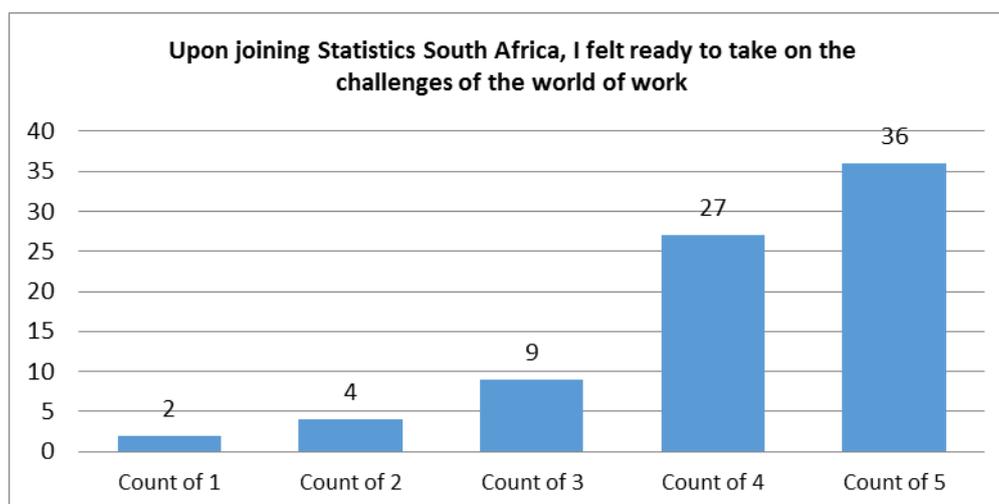
#### 4.2.1 Work readiness

In this study, I firstly wanted to establish the views of respondents on how ready they thought they were when entering the world of work upon completion of their formal studies. The responses of respondents in sample A to the question in the survey relating to work readiness are indicated in Table 9 and Figure 9.

**Table 9: Sample A – Work readiness upon completion of formal qualifications**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
Upon joining Statistics South Africa, I felt ready to take on the challenges of the world of work.	2	4	9	27	36	4.2	4	5	7.7%	11.5%	80.8%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

**Figure 9: Sample A – Work readiness upon completion of formal qualifications**

Of the 78 respondents in sample A, 63 (80.8%) respondents indicated that they were ready to join the world of work upon completion of their studies whereas only six (7.7%) respondents indicated that they did not feel ready to join the world of work upon completion of their studies. The rest of the respondents, nine (11.5%), were undecided as to whether they were ready or not.

In respect of the theme of work readiness, I also wanted to establish the views of respondents on what they thought the institutions of higher learning were doing well in preparing statisticians for the workplace during their formal learning. In the survey questionnaire two separate questions were posed to respondents in sample A. Firstly they had to indicate whether their formal learning covered the statistical knowledge they needed to have in the workplace, and secondly whether the statistical skills they were required to have in the workplace were sufficiently covered during their formal studies. Their responses to these questions are indicated in tables 10 and 11 and figures 10 and 11 below.

**Table 10: Sample A – Statistical knowledge obtained during formal studies**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
My formal studies sufficiently covered the statistical knowledge which was needed from me in the workplace.	0	7	16	25	30	4	4	5	9%	20.5%	70.5%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

**Figure 10: Sample A – Statistical knowledge obtained during formal studies**

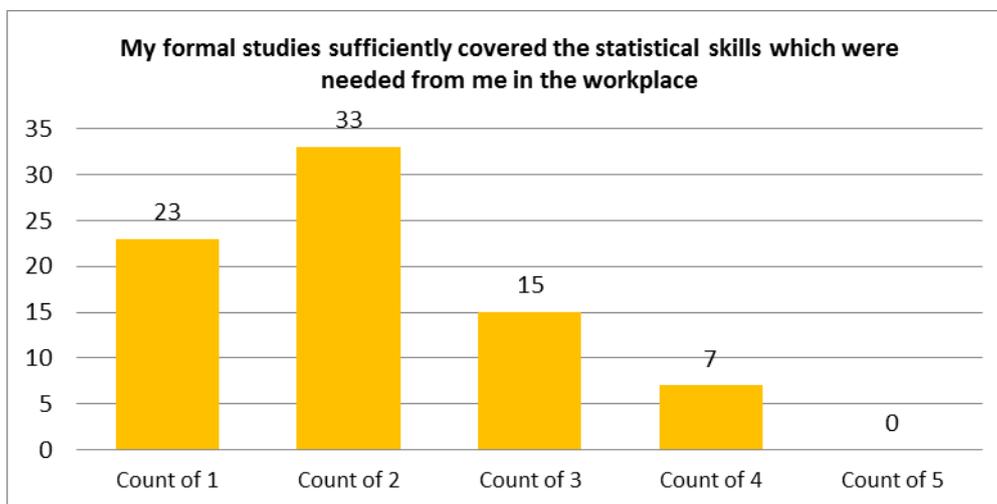
The overwhelming majority of respondents in sample A (70.5%) either agreed or strongly agreed that the institution at which they studied sufficiently covered the statistical knowledge they needed to have in the world of work. Only seven (9%) respondents indicated that they did not agree that the institution at which they studied sufficiently covered the statistical knowledge they needed to have in the workplace. Of the respondents, 16 (20.5%) were undecided whether or not their formal learning sufficiently covered the statistical knowledge they needed to have in the world of work.

These responses are reflected in table 11 and figure 11 below:

**Table 11: Sample A – Statistical skills obtained during formal studies**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
My formal learning sufficiently covered the statistical skills which were needed from me in the workplace.	23	33	15	7	0	3.9	4	4	71.8%	19.2%	9%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

**Figure 11: Sample A – statistical skills obtained during formal studies**

The majority of respondents, 55 (71.8%), indicated that they did not obtain the necessary statistical skills during their formal studies to properly prepare them for the world of work. Only seven (9%) of the respondents felt that they were equipped with the necessary statistical skills during their formal studies. Of the respondents, 15

(19.2%) neither agreed nor disagreed that they were equipped with the necessary statistical skills during their formal studies.

It was also important for me to determine what statisticians thought the key skills were to pursue a career in statistics and whether these skills were covered during their formal learning. Two questions in this regard were posed to respondents in sample A of this research. In the first open-ended question, respondents were requested to list the skills that they thought were key in pursuing a career in statistics. Respondents could provide their own answers to this question and no options were provided from which they should choose. Some of the respondents provided more than one response to this question (the frequency of responses is indicated in brackets).

The second question was a closed-ended question where respondents had to indicate with a “yes” or “no” response whether these skills were covered during their formal studies. Their responses to these two questions are indicated in Table 12 below.

**Table 12: Sample A – Key skills needed for a career in statistics and whether these are covered during formal studies**

	<b>Key skills needed for a career in statistics</b>	<b>Taught during formal studies</b>	
	<b>Sample A</b>	<b>Sample A</b>	
		<b>Yes</b>	<b>No</b>
	ArcGIS (1)		(1)
	Communication (49)		(49)
	Computer skills (58)	(49)	(9)
	Data analysis (56)	(56)	
	Data collection, practical (54)		(54)
	Data interpretation (6)		(6)
	Data processing, practical (6)		(6)
	Data quality (6)		(6)
	Forecasting (57)	(36)	(21)

	Interviewing skills (47)		(47)
	Listing (9)		(9)
	Mathematical skills (61)	(21)	(40)
	Presentation skills (22)		(22)
	Product marketing & publicity (5)		(5)
	Questionnaire design (54)		(54)
	Report writing (24)		(24)
	Research ability (9)	(9)	
	Sampling (55)	(28)	(27)
	SAS (32)		(32)
	SASQAF (24)		(24)
	Small-area statistics (8)		(8)
	SPSS (21)		(21)
	SuperCross (8)		(8)
	Survey methodology (21)		(21)
	Statistical standards (7)		(7)
	Statistical value chain (28)		(28)
	Teamwork (16)		(16)
	Time series (53)	(38)	(15)
	Writing skills (45)		(45)

Note: ArcGIS = A geographic information system for working with maps and geographic information; SAS = Statistical Analysis Software; SASQAF = South African Statistical Quality Assessment Framework; SPSS = Statistical Package for the Social Sciences; SuperCross = A desktop cross tabulation analytics tool for analysing data from raw data to aggregated cross tabulations

#### 4.2.2 Utilisation of skills

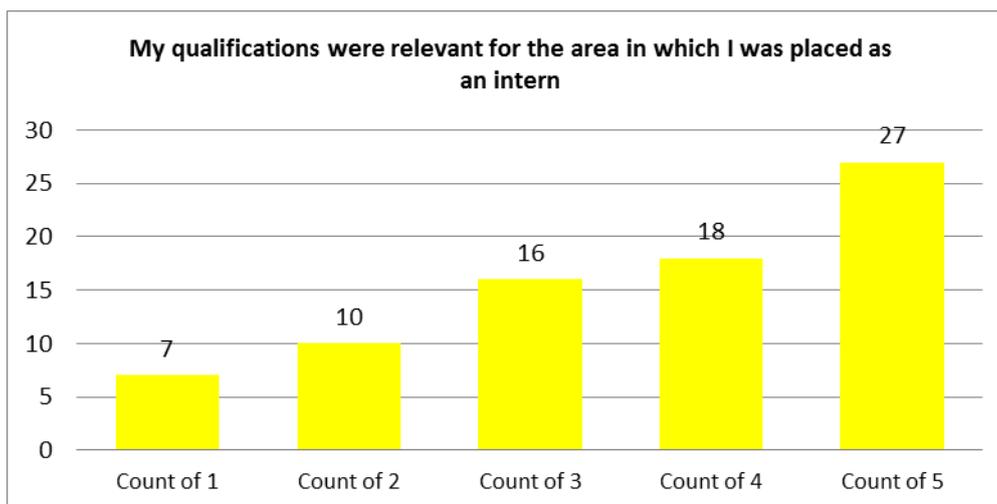
It was important for me to obtain the views of statisticians on whether or not their statistical skills were properly utilised during their placement as interns as well as how their skills were utilised. I posed four questions in the survey questionnaire to respondents in sample A in this regard. In answer to the first question, respondents had to indicate whether they agreed or disagreed that their qualifications were relevant in respect of the areas in which they were placed during their internship. The second question inquired whether or not their statistical skills were fully utilised in the areas in

which they were placed. Again, respondents had to indicate whether or not they agreed or disagreed with this statement. In answer to the third question, respondents had to indicate whether or not the tasks that they received as interns were on a professional level or not. Lastly, respondents were requested to indicate whether or not the tasks that they were assigned gave them the opportunity to practise the statistical skills they had obtained during their formal studies. Their responses to these four questions are indicated in tables 13 to 16 and figures 12 to 15 below.

**Table 13: Sample A – Relevant placement**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
My qualifications were relevant for the area in which I was placed as an intern.	7	10	16	18	27	3.6	4	5	21.8%	20.5%	57.7%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

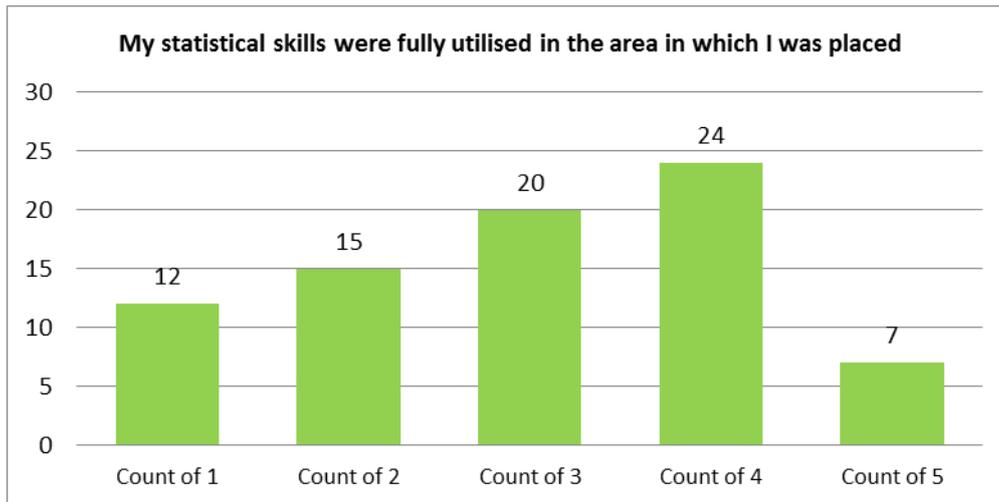
**Figure 12: Sample A – Relevant placement**

Out of all the respondents, 45 (57.7%) indicated that they viewed their placements as relevant to their qualifications. Almost as many respondents, 16 (20.5%), were undecided as to the relevance of their placements in relation to their qualifications as those who thought that their placements were not in line with their qualifications at all (17 (21.8%)).

**Table 14: Sample A – Utilisation of skills**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
My statistical skills were fully utilised in the area in which I was placed.	12	15	20	24	7	3	3	4	34.6%	25.6%	39.7%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

**Figure 13: Sample A – Utilisation of skills**

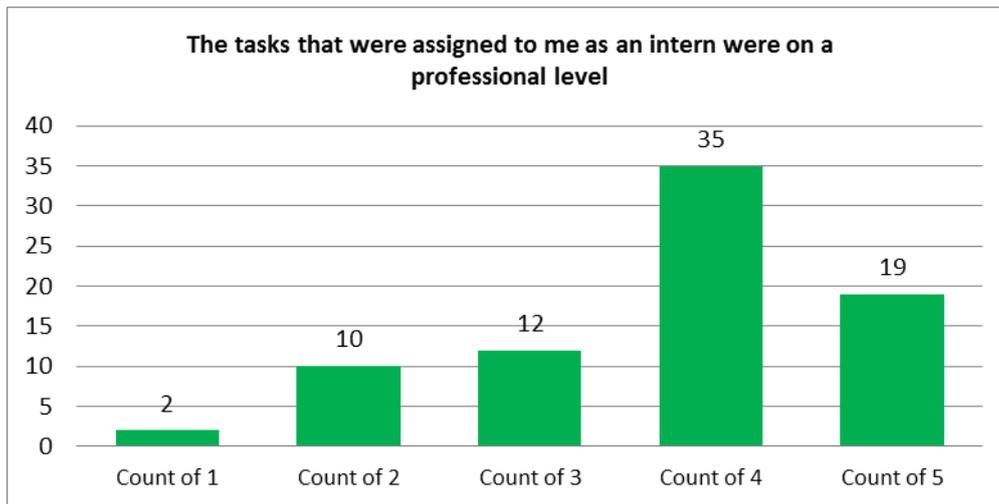
Most of respondents (36 (39.7%)) indicated that their statistical skills were properly utilised in the areas in which they were placed as interns. Of the respondents, 27 (34.6%) felt that their statistical skills were not utilised. The rest of the respondents (20 (25.6%)) were undecided as to whether or not their skills were utilised in the areas in which they were placed during their internship.

In response to the next question, respondents had to indicate whether they thought that the level of the tasks assigned to them was professional or not. Their responses to this question are indicated in Table 15 and Figure 14 below.

**Table 15: Sample A – Level of tasks**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
The tasks that were assigned to me as an intern were on a professional level.	2	10	12	35	19	3.8	4	4	15.4%	15.4%	69.2%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

**Figure 14: Sample A – Level of tasks**

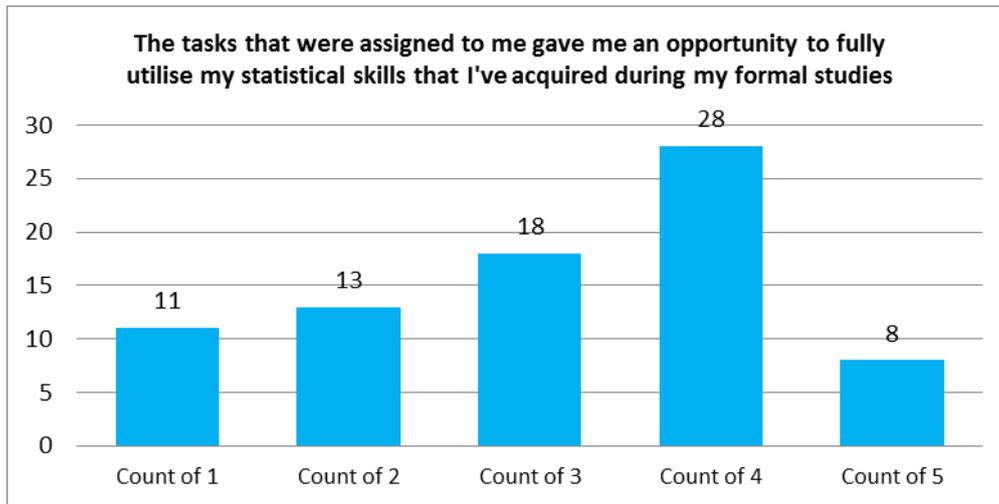
Of the respondents, 54 (69.2%) indicated that the tasks assigned to them were on a professional level. Only 12 (15.4%) of the respondents disagreed that the tasks that they were given as interns were on a professional level. An equal number of respondents (12 (15.4%)) were undecided as to whether or not the level of the tasks that were assigned to them was professional.

The level of the tasks assigned to interns would also influence whether or not they would get the opportunity to practise their formally obtained skills. The next question, therefore, asked for interns' views on whether or not they were given the opportunity to practise their formally obtained skills. Their responses to this question are indicated in Table 16 and Figure 15 below.

**Table 16: Sample A – Opportunity to practise formally obtained skills**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
The tasks that were assigned to me gave me an opportunity to fully utilise my statistical skills that I've acquired during my formal studies.	11	13	18	28	8	3.1	3	4	30.8%	23.1%	46.2%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

**Figure 15: Sample A – Opportunity to practise formally obtained skills**

The majority of the respondents (36 (46.2%)) indicated that the level of the tasks assigned to them afforded them the opportunity to practise their formally obtained skills. Of the respondents, 24 (30.8%) felt that the level of tasks assigned to them did not offer them the opportunity to practise their formally obtained skills. Out of all the respondents, 18 (23.1%) were undecided as to whether or not the level of the tasks assigned to them afforded them the opportunity to practise their formally obtained skills.

#### 4.2.3 Support for informal learning in the workplace

The effectiveness of mentorship as a form of support for the informal learning of interns in the workplace was discussed extensively in Chapter 2 of this research study and it also emerged as a theme of the conceptual framework of this study. The next few

questions, therefore, focused on how respondents in sample A of the study experienced this support in the form of mentoring.

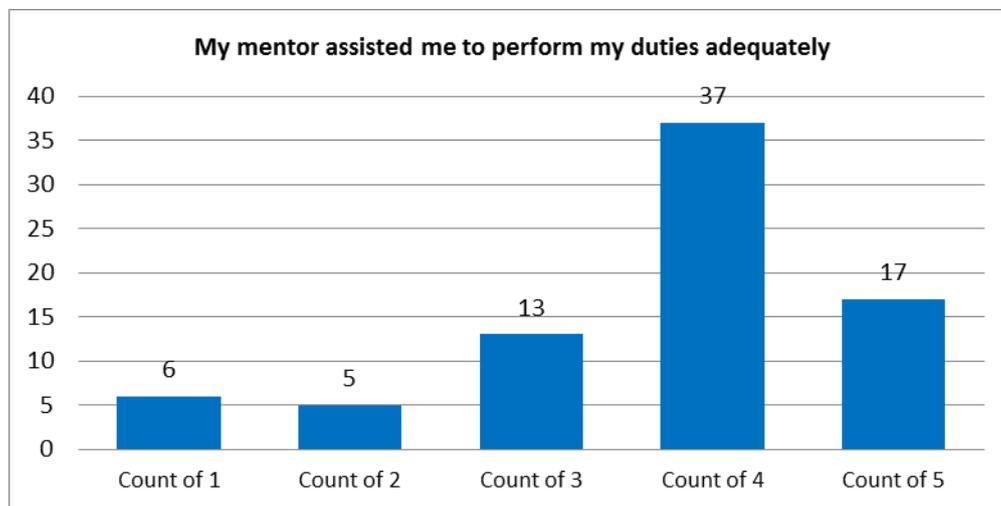
In the first question, respondents in sample A were asked to indicate with a “yes” or a “no” whether they had been assigned a mentor upon joining the organisation. All the respondents (100%) indicated that they had been assigned mentors.

The next question was asked to determine whether respondents received support from their mentors with regard to the performance of their duties. Their responses are recorded in Table 17 and Figure 16.

**Table 17: Sample A – Did mentors assist in performance of duties?**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
My mentor assisted me to perform my duties adequately.	6	5	13	37	17	3.7	4	4	14.1%	16.7%	69.2%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided; 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided; 4 = agree; 5 = strongly agree

**Figure 16: Sample A – Did mentors assist in performance of duties?**

An overwhelming majority of respondents (54 (69.2%)) indicated that their mentors assisted them to perform their duties adequately. Only 11 (14.1%) of the respondents were of the opinion that their mentors did not assist them to perform their duties

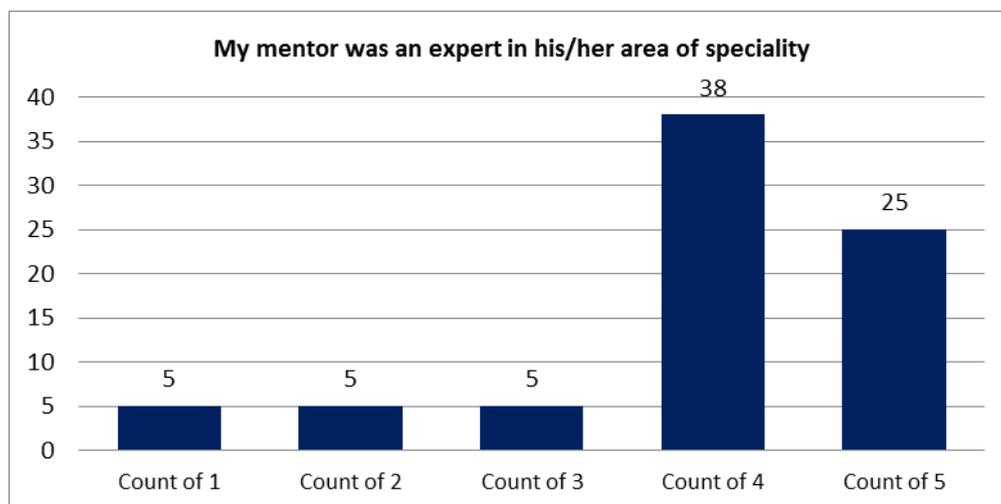
adequately. Of the respondents, 13 (16.7%) were undecided as to whether their mentors assisted them with the performance of their duties.

The next question probed respondents' thoughts on whether their mentors were experts in their areas of speciality. The responses of participants are indicated in Table 18 and Figure 17.

**Table 18: Sample A – Was your mentor an expert in his/her area of speciality?**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
My mentor/coach was an expert in his/her area of speciality	5	5	5	38	25	3.9	4	4	12.8%	6.4%	80.8%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

**Figure 17: Sample A – Was your mentor an expert in his/her area of speciality?**

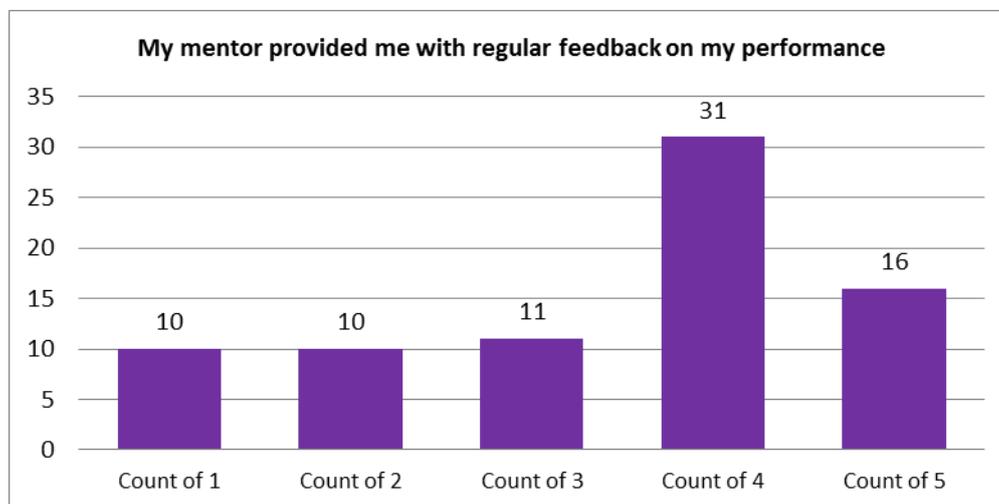
An overwhelming majority of respondents (63 (80.8%)) were of the opinion that their mentors were experts in their areas of speciality. Only 10 (12.8%) of the respondents indicated that they did not think their mentors were experts in their fields of expertise. Of the respondents, five (6.4%) neither agreed nor disagreed that their mentors were experts in their fields.

The next question was asked to determine the support that interns received from their mentors with regard to feedback on their performance. Responses to this question are indicated in Table 19 and Figure 18.

**Table 19: Sample A – Did you receive regular feedback from your mentor on your performance?**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
My mentor provided me with regular feedback on my performance.	10	10	11	31	16	3.4	4	4	25.6%	14.1%	60.3%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

**Figure 18: Sample A – Did you receive regular feedback from your mentor on your performance?**

The majority of the respondents (47 (60.3%)) agreed that their mentors provided them with regular feedback on their performance. Of the respondents, 20 (25.6%) did not agree that they received regular feedback from their mentors. Out of all the respondents, 11 (14.1%) neither agreed nor disagreed that their mentors provided them with regular feedback.

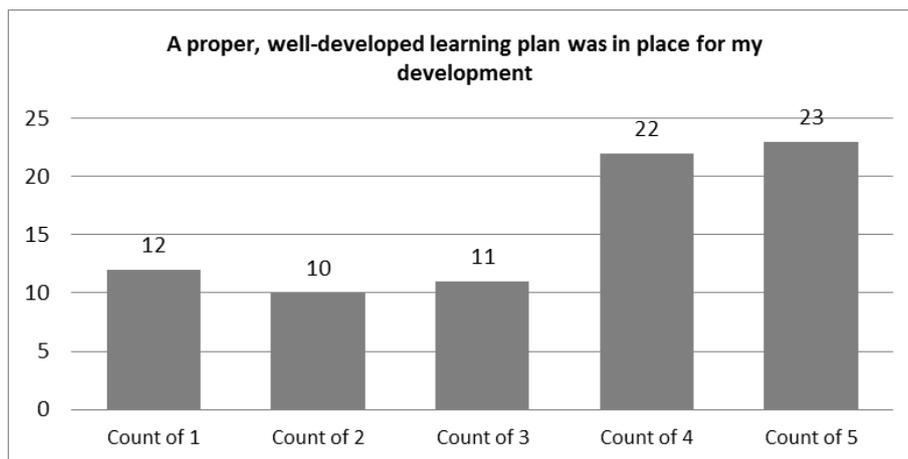
Learning plans are regarded as a necessary component of providing support in areas where interns might need such support. The following three questions, therefore, focused on the role that learning plans played in the Stats SA internship programme.

Respondents had to firstly indicate whether a proper, well-developed learning plan was in place while they were on the internship programme. Secondly, I tried to establish whether the assessments of interns were done based on the outcomes of their learning plans, and lastly, it was important to determine whether the learning plans were developed jointly by both the interns and their mentors. Their responses to these questions are presented in tables 20 to 22 and figures 19 to 21 below:

**Table 20: Sample A – A proper, well-developed learning plan was in place for my development**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
A proper, well-developed learning plan was in place for my development.	12	10	11	22	23	3.4	4	5	28.2%	14.1%	57.7%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

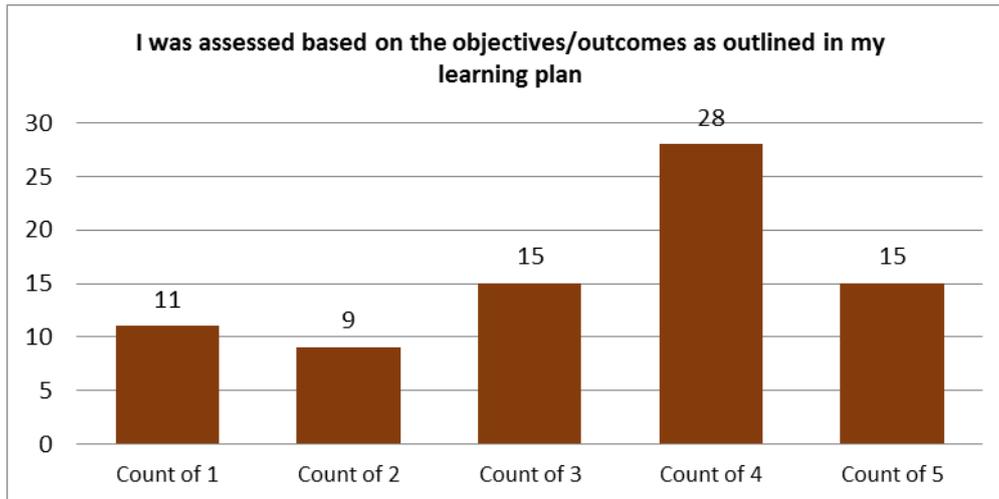
**Figure 19: Sample A – A proper, well-developed learning plan was in place for my development**

Most of the respondents (45 (57.7%)) indicated that a proper, well-developed learning plan was in place for their development as interns. However, 22 (28.2%) of the respondents indicated that no proper learning plans were in place for their development. Of the respondents, 11 (14.1%) were undecided as to whether or not proper learning plans were in place to assist with their development.

**Table 21: Sample A – I was assessed based on the objectives/outcomes outlined in my learning plan**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
I was assessed based on the objectives/outcomes as outlined in my learning plan.	11	9	15	28	15	3.3	4	4	25.6%	19.2%	55.1%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

**Figure 20: Sample A – I was assessed based on the objectives/outcomes outlined in my learning plan**

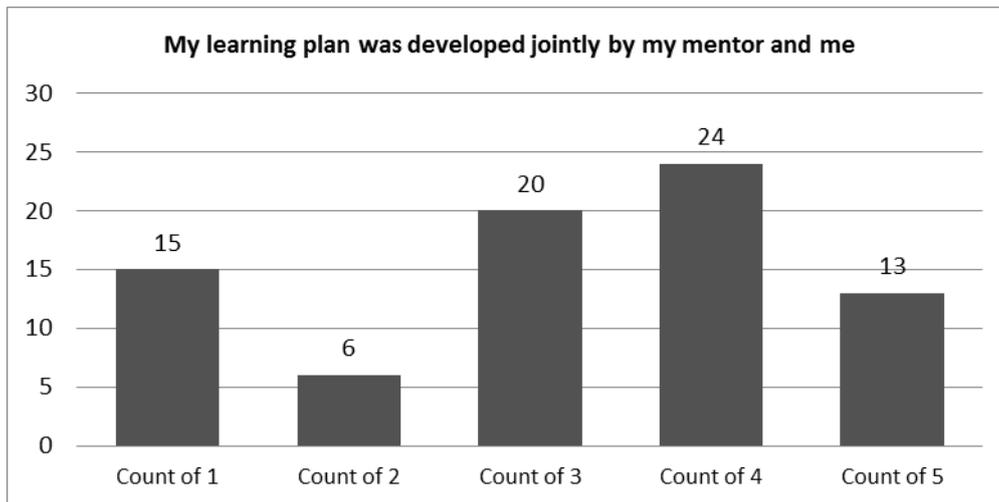
The majority of the respondents (43 (55.1%)) were of the view that their assessments were done based on the outcomes or objectives as outlined in their learning plans. However, 20 (25.6%) of the respondents indicated that their assessments did not take the objectives or outcomes as contained in their learning plans into account. Of the respondents, 15 (19.2%) were undecided as to whether or not their assessments were based on the objectives or outcomes as contained in their learning plans.

With the next question, I wanted to establish whether learning plans were developed jointly by the respondents and their mentors or whether this development was done by the mentor alone. The responses to this question are presented in Table 22 and Figure 21.

**Table 22: Sample A – My learning plan was developed jointly by my mentor and me**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
My learning plan was developed jointly by me and my mentor.	15	6	20	24	13	3.2	3	4	26.9%	25.6%	47.4%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

**Figure 21: Sample A – My learning plan was developed jointly by my mentor and me**

Most of the respondents (37 (47.4%)) indicated that their learning plans were jointly developed by themselves and their mentors. However, 21 (26.9%) of the respondents disagreed that they developed their learning plans together with their mentors. Of the respondents, 20 (25.6%) were undecided about whether or not they developed their learning plans together with their mentors.

As part of the ongoing development of interns, it is important that they are regularly assessed by their mentors against the specified outcomes in the learning plans. This is necessary to determine their progress and for them to receive feedback on their performance (see discussion in Chapter 2 of this study). I wanted to obtain the views of respondents in sample A of how they experienced the assessment process. The following two statements were put to respondents to indicate whether they agreed or disagreed:

- 1) Areas for development were pointed out to me during my assessment.

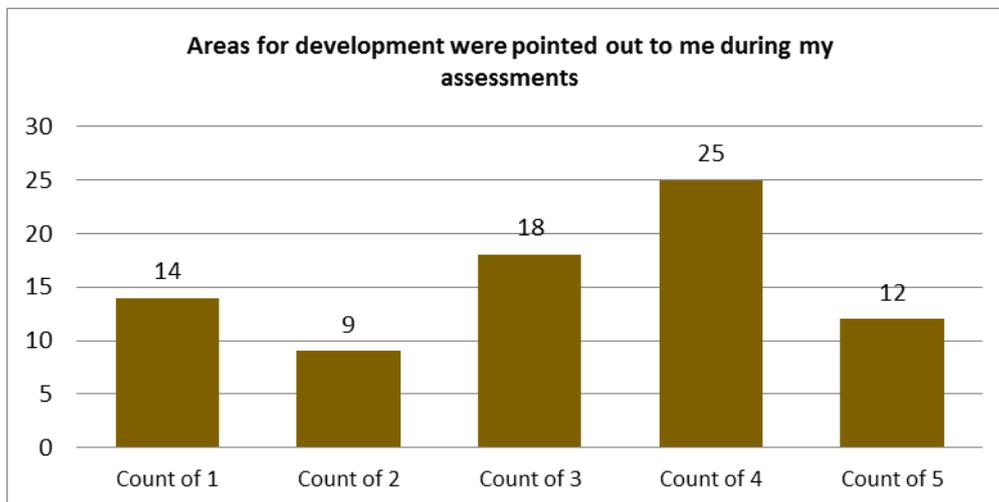
2) Steps were taken by my mentor to improve my performance in areas where my skills were lacking.

The responses of respondents to these questions are presented in tables 23 to 24 and figures 22 to 23.

**Table 23: Sample A – Areas for development pointed out during assessments**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
Areas for development were pointed out to me during my assessments.	14	9	18	25	12	3.2	3	4	29.5%	23.1%	47.4%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

**Figure 22: Sample A – Areas for development pointed out during assessments**

Although the majority of respondents (37 (47.4%)) agreed that areas for development were pointed out to them by their mentors/coaches during assessments, a large number of respondents (23 (29.5%)) indicated that this did not happen and an almost equal number of respondents (18 (23.1%)) neither agreed nor disagreed that this happened.

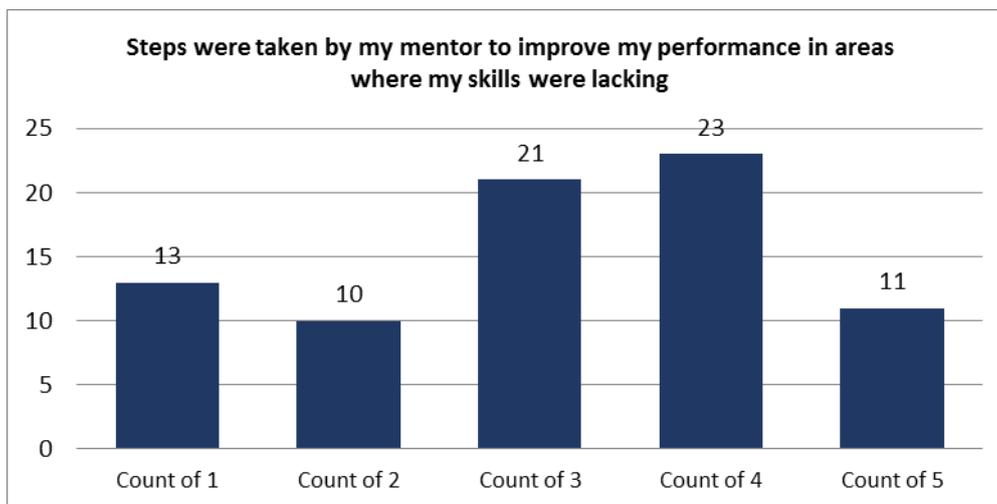
In the last question regarding assessments, respondents were requested to indicate whether their mentors/coaches took active steps to improve their performance in areas

where their skills were lacking. Their responses to this question are presented in Table 24 and Figure 23.

**Table 24: Sample A – Steps taken by my mentor to improve performance**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
Steps were taken by my mentor to improve my performance in areas where my skills were lacking.	13	10	21	23	11	3.1	3	4	29.5%	26.9%	43.6%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

**Figure 23: Sample A – Steps taken by my mentor to improve performance**

Of the respondents, 33 (43.6%) agreed that their mentors/coaches took active steps to improve their performance based on the assessments that were conducted. However, 23 (29.5%) of the respondents disagreed with the statement that their mentors/coaches took active steps to improve their performance based on the assessments that were conducted. An alarming 21 (26.9%) of the respondents neither agreed nor disagreed with the statement that their mentors/coaches took active steps to improve their performance based on the assessments that were conducted.

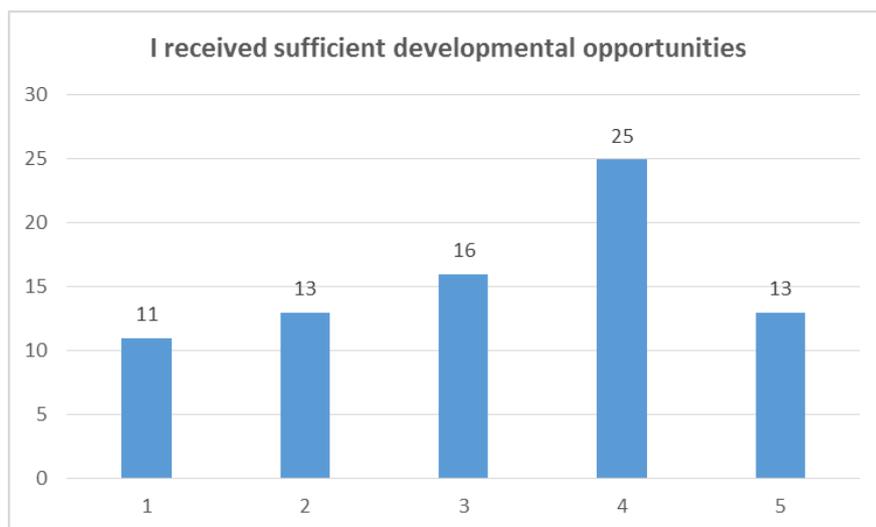
#### 4.2.4 Training and developmental opportunities received

I wanted to determine the extent to which respondents believed that the training/developmental opportunities that they were exposed to in the workplace were relevant and in support of their informal learning. Accordingly, four questions were posed to respondents in sample A of the research study. Firstly, respondents had to indicate whether they received sufficient developmental opportunities as interns in the organisation. Secondly, respondents had to indicate whether they thought that the training that was on offer in the organisation was designed to complement their formal learning. With the third question I wanted to determine whether the training that interns were exposed to during their internship was relevant for developing their statistical skills. The purpose of the last question was to obtain the views of the respondents on the relevance of soft-skills training in preparing them to function as employees in the organisation. The responses to these four questions are indicated in tables 25 to 28 and figures 24 to 27 below.

**Table 25: Sample A – Developmental opportunities received**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
As an intern, I was given ample developmental opportunities.	11	13	16	25	13	3.2	3	4	30.8%	20.5%	48.7%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

**Figure 24: Sample A – Developmental opportunities received**

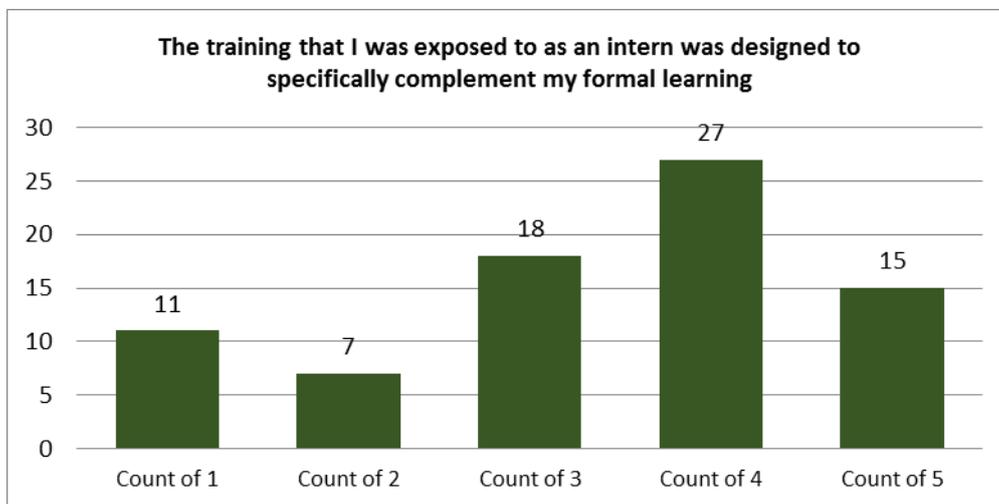
The majority of the respondents (38 (48.7%)) agreed that they received sufficient developmental opportunities as interns. Of the respondents, 23 (30.8%) disagreed that they received sufficient developmental opportunities. Out of all the respondents, 16 (20.5%) neither agreed nor disagreed that they received sufficient developmental opportunities.

In answering the next question, respondents had to indicate whether they agreed or disagreed that the training they received during their internship was designed to complement their formal learning. Their responses are presented in Table 26 and Figure 25 below.

**Table 26: Sample A – In-house training complementing formal learning**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
The training that I was exposed to as an intern was designed to specifically complement my formal learning.	11	7	18	27	15	3.4	4	4	23.1%	23.1%	53.8%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

**Figure 25: Sample A – In-house training complementing formal learning**

In response to this question, the majority of respondents (42 (53.8%)) indicated that the in-house training or short courses that they were exposed to complemented their formal learning. However, 18 (23.1%) of the respondents disagreed that the in-house

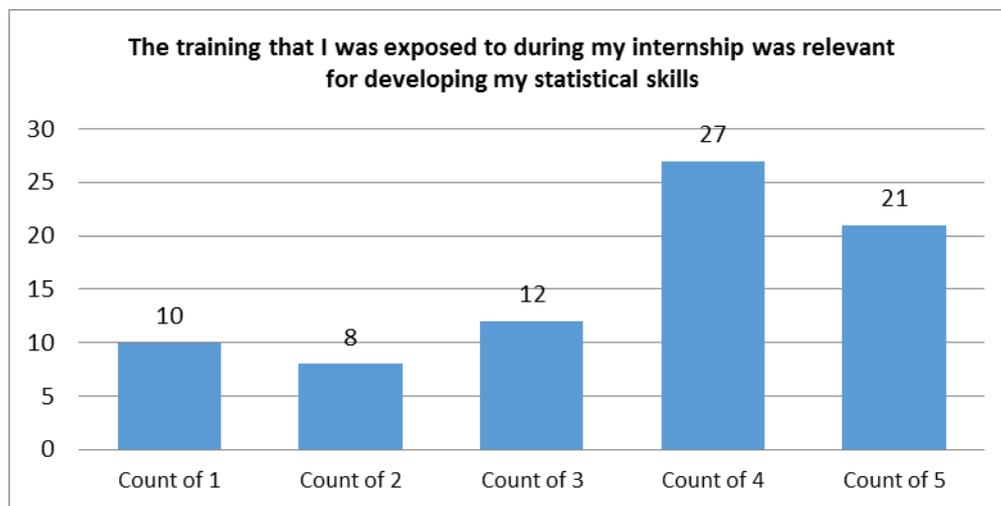
training was designed to complement their formal learning. An equal number of respondents (18 (23.1%)) neither agreed nor disagreed that the in-house training complemented their formal learning.

The next question elicited the respondents' views on whether they perceived the in-house training or short courses that they were exposed to as relevant in respect of the development of their statistical skills. Their responses to this question are presented in Table 27 and Figure 26 below.

**Table 27: Sample A – In-house training contributing to development of statistical skills**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
The training that I was exposed to during my internship was relevant for developing my statistical skills.	10	8	12	27	21	3.5	4	4	23.1%	15.4%	61.5%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

**Figure 26: Sample A – In-house training contributing to development of statistical skills**

The overwhelming majority of respondents (48 (61.5%)) agreed that the in-house training or short courses that they were exposed to were relevant to developing their statistical skills. However, 18 (23.1%) of the respondents disagreed that the training

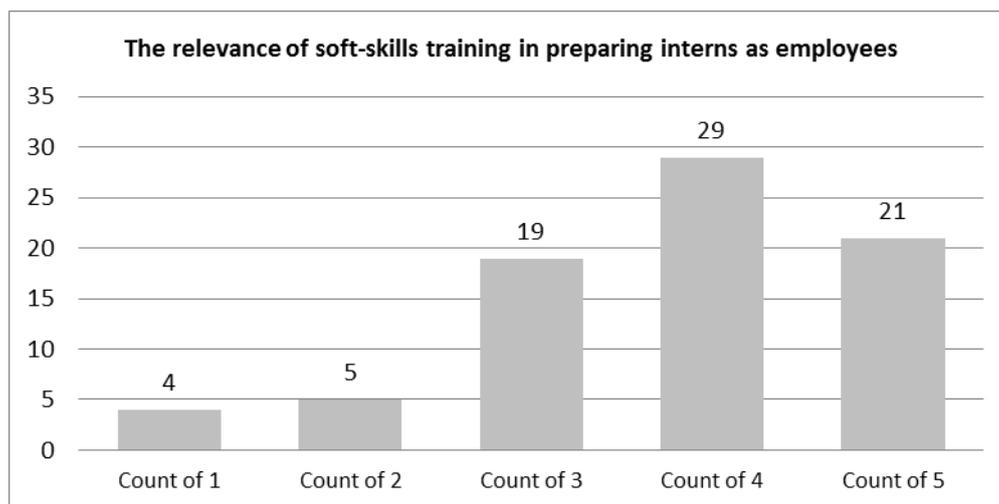
contributed to the development of their statistical skills. Of the respondents, 12 (15.4%) neither agreed nor disagreed with this statement.

The last question was posed in order to determine respondents' views on the relevance of the soft-skills training that they were exposed to as interns. Their responses are presented in Table 28 and Figure 27 below.

**Table 28: Sample A – Relevance of soft-skills training**

Questions	Frequencies					Descriptives						
	Count of 1	Count of 2	Count of 3	Count of 4	Count of 5	Mean	Median	Mode	%Negative response (options 1-2)	%Undecided (option 3)	%Positive responses (options 4-5)	Total
The soft-skills that I was exposed to in the workplace adequately prepared me to function as an employee in the organisation.	4	5	19	29	21	3.7	4	4	11.5%	24.4%	64.1%	100%

1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree



1 = strongly disagree; 2 = disagree; 3 = undecided, 4 = agree; 5 = strongly agree

**Figure 27: Sample A – Relevance of soft-skills training**

The majority of respondents (50 (64.1%)) in sample A of the research study confirmed that the soft skills that Stats SA exposed them to adequately prepared them for the demands of the working environment. Only 9 (11.5%) of the respondents disagreed that the soft-skills training prepared them for the demands of the working environment. Of the respondents, 19 (24.4%) neither agreed nor disagreed that the soft-skills training prepared them for the world of work.

#### 4.2.5 Open-ended question

The following open-ended question was also posed to respondents: “Do you have any other comments to make on the knowledge or skills that would have helped you most in transitioning from formal studies to being effective at work?”

Although this open-ended question yielded qualitative data, the inclusion of and responses/findings to the open-ended question are discussed under this section as the question formed part of the online survey. To protect the privacy of respondents, their names are not used in presenting their responses to this open-ended question. Although 78 respondents participated in the online survey, not all of them responded to this open-ended question. The following codes as depicted in Table 29 were used to refer to the respondents:

**Table 29: Participant codes**

<b>Respondents Statisticians (Interns)</b>	<b>Participants Statisticians (Mentors)</b>	<b>Documents</b>
<b>Online survey</b>	<b>Semi-structured interviews</b>	<b>Internship documents</b>
<b>A</b>	<b>B</b>	<b>C</b>
IS/1 IS/2 IS/3 IS/4 IS/5 IS/6 IS/7 IS/8 IS/9 IS/10 IS/11 IS/12 IS/13 IS/14 IS/15 IS/16 IS/17 IS/18 IS/19 IS/20 IS/21 IS/22 IS/23 IS/24 IS/25 IS/26 IS/27 IS/28 IS/29 IS/30 IS/31 IS/32 IS/33 IS/34 IS/35 IS/36 IS/37 IS/38 IS/39 IS/40 IS/41 IS/42 IS/43 IS/44 IS/45 IS/46 IS/47 IS/48 IS/49 IS/50 IS/51 IS/52 IS/53 IS/54 IS/55 IS/56 IS/57 IS/58 IS/59 IS/60 IS/61 IS/62 IS/63 IS/64 IS/65 IS/66 IS/67 IS/68 IS/69 IS/70 IS/71 IS/72 IS/73 IS/74 IS/75 IS/76 IS/77 IS/78	SM/1 SM/2 SM/3 SM/4 SM/5 SM/6 SM/7 SM/8	ID/1 ID/2 ID/3 ID/4 ID/5
<b>TOTAL NUMBER OF RESPONDENTS</b>	<b>TOTAL NUMBER OF PARTICIPANTS</b>	<b>TOTAL NUMBER OF DOCUMENTS</b>
<b>78</b>	<b>8</b>	<b>5</b>

The purpose of the open-ended question was to probe respondents for suggestions on how institutions of higher learning and Stats SA could work together to ensure integration between the formal learning and workplace learning of statisticians. The following three themes were identified from the responses received from intern statisticians: technical skills, a practical component to the formal learning and the utilisation of skills.

Each of these three themes are discussed next by analysing the relevant data. The responses of the intern statisticians, which served to support the findings of the current research, are quoted verbatim.

#### **4.2.5.1 Technical skills**

Respondents mostly expressed a need for training in technical skills to assist them with an easier transition from their formal educational environment to a working environment. These technical skills, which do not necessarily form part of statisticians' formal learning, are required by Stats SA in order for them to fulfil their duties. As alluded to by the respondents, these skills included the following:

Standard developer/development is one skill that is required in the workplace but it is not taught in the tertiary institutions (IS/1).

I am enhancing my skills as well as learning things that we did not focus on to them at varsity. I also learn new software packages, e.g. SAS and SuperCross (IS/2).

Some respondents also felt that Stats SA needed to invest more in the technical training of interns, as pointed out by the following respondents:

More training especially on SAS. To be able to analyse data. I feel like I am in wrong division sometimes where I don't learn anything about statistics (IS/4).

SAS software is a powerful, efficient tool that is needed by statisticians. I think the organisation should prioritise to train all relevant staff on SAS base (programming) as it was not provided at tertiary (IS/7).

Yes, my most concern is data analysis skills which are ignored at provincial levels; they are only implemented at the National Office (Pretoria). We call ourselves statisticians whom don't have necessary skills to analyse data effectively such as SAS, etc. (IS/9).

I, in person, would like to know how data was processed immediately after collection until it reaches the point of dissemination. (IS/13).

#### **4.2.5.2 Practical component to formal learning**

A crucial component of the conceptual framework of this study was the practical component, which is supposed to form part of the formal learning of statisticians. Respondents also expressed a need for the inclusion of a practical component in their formal learning to assist with the integration between their formal learning and their workplace learning. Support for the inclusion of a practical component in formal learning was expressed by respondents as follows:

More practical work would have helped with the transitioning from formal studies to being effective at work; my formal studies were more theoretical than practical, which made it a bit difficult to put the theory into practice (IS/3).

Formal institutions need to focus more on applying theories in practice than just trying to pass on theoretical knowledge (IS/6).

#### 4.2.5.3 Utilisation of skills

Utilisation of skills was another important element of the conceptual framework of this study. Intern statisticians need to be granted an opportunity to utilise their skills by being placed in the correct division and doing work at a level that is commensurate with their formal qualifications. It is also important that intern statisticians are treated not as employees but as interns who need to acquire the necessary knowledge and skills through the guidance of their mentors. Some of the respondents clearly felt that they were wrongly placed, that their qualifications and the divisions in which they were placed did not match, and that they were treated as employees rather than as interns. The following responses from intern statisticians supported this finding:

At Stats SA I was treated like an employee rather than an intern. I was placed in a division which had nothing to do with what I studied in school. Most interns face the same problems, and it seems like we have no say in it because we are “interns”! This is discouraging, discouraging to a point where one is considering a change in profession (IS/5).

I feel that the knowledge that I have gained from my studies are now at waste; the magnitude of knowledge I have received is not used the way I would have wanted it to be used. I am currently working just like someone who never obtained a tertiary qualification. I am as good as someone who just have matric as their highest level of education (IS/8).

My experience of the internship programme for me is not really focusing on my development. I am actually treated more as an employee than an intern as I was merely doing the same thing over and over again (IS/9).

I really do feel they [the organisation] should re-assess their method of recruiting interns, in terms of the areas in which interns are interested in gaining experience from in the organisation, because

the current method really makes us (the interns) have negative attitudes towards any of the work being assigned to us because we have no interest in it (IS/15).

The following statements from respondents IS/11 and IS/17 were indicative of the fact that not all interns received the support and guidance of a mentor, which could result in intern statisticians not being able to utilise their skills.

I rotated as an intern from one section to another due to the fact that my initial coach did not coach me. I always had to ask other colleagues to assist me. When I rotated to the other division, my coach was very helpful and I used my tertiary skills as well as the training that I attended to complete my tasks (IS/11).

Greater involvement from coaches and mentors on what is expected from interns by when (IS/17).

#### **Additional themes that emerged from the responses to the open-ended question**

Besides the three themes discussed above, the following additional themes were identified from the responses of intern statisticians to this question:

##### **4.2.5.4 Exposure**

Respondents expressed a need for greater exposure besides exposure to knowledge and skills to assist them in their transition from the formal learning environment to the workplace environment. This exposure should include the attendance of divisional meetings. The following responses from IS/5 and IS/18 were in support of this finding:

Being able to participate in divisional meetings (IS/5).

Greater involvement with regard to taking interns along to meetings (even if they don't participate at least exposure is given) (IS/18).

#### **4.2.5.5 Managing expectations**

While engaged in their formal studies, intern statisticians have certain expectations regarding the type of work that they will be involved in once they complete their formal studies and join the internship programme of Stats SA. It is important that these expectations are managed to avoid intern statisticians' disappointment and disillusionment. Respondents IS/12 and IS/16 expressed their disappointment regarding their expectations, especially regarding the type of work they were involved in while on the internship programme:

I feel that Stats SA has failed me tremendously. I had high hopes thinking that the course I'll be doing is an engineering course in statistics as the advertisement stated (bachelor degree) only to find out that it's just a certificate after my completion, which today, rumours say, it's a national diploma (IS/12).

Stats should present to us while at university so that we know what to expect when coming to the workplace (IS/16).

To summarise the responses to the open-ended question posed in the research study, it can be said that respondents felt that being equipped with more technical skills, which were fully utilised in the workplace, would facilitate smoother transitioning from their formal learning to their workplace learning. Respondents also felt that the addition of a practical component to their formal learning would certainly facilitate the integration between their formal learning and workplace learning. In addition, respondents felt that once in the workplace, they needed greater exposure to the real operations of the organisation and, to avoid disappointment upon joining the organisation, they needed to know exactly what to expect from the workplace.

### **4.3 QUALITATIVE FINDINGS (SEMI-STRUCTURED INTERVIEWS WITH MENTORS)**

Participants in the qualitative phase of this study were statisticians and managers (B) who were involved with interns in a mentoring capacity. The participants in this phase

will, therefore, be referred to as mentors. The conceptual framework introduced in Chapter 2 contained the following concepts that guided the data analysis process: work readiness, utilisation of skills, support for informal learning, and developmental practices. Data were arranged according to these concepts. Tesch's method of open coding was used to analyse transcriptions (Creswell 2009).

#### **4.3.1 Work readiness**

Question 1 (See Annexure D) sought to gauge the perception of mentors regarding the work readiness of statisticians upon joining the organisation as interns. The majority of mentors were of the view that intern statisticians were not ready for the world of work upon joining the organisation. Mentors felt that "There is a big gap in terms of what we require and the skills they have" (SM/1).

Intern statisticians might have the formal qualifications "but they do not know how to do the work" (SM/3). This finding was further supported by SM/7 who stated that "You do not get your degree and you say now I can go and work for Stats SA" (SM/7). SM/4 also stated that "When our statisticians come from universities, they are not prepared to work as statisticians in official statistics" (SM/4).

The fact that technical skills and techniques are not necessarily a focus during the formal learning of statisticians could be one of the reasons why mentors perceived that "They [intern statisticians] are not properly prepared to join the workplace" (SM/8). This finding was further supported by the following statement by SM/6:

Because some of the techniques ... you see there is that kind of gap and most of the things at university level is kind of generalised (SM/6).

The practical exposure of intern statisticians as part of their formal learning could greatly assist in preparing intern statisticians for the workplace. Mentors SM/3 and SM/7 alluded to this missing practical component as part of the formal learning of statisticians as follows:

They don't have that practical background to do the things that are needed (SM/3).

There's no practical experience ... Interns who join our organisation don't have any work experience (SM/7).

#### **4.3.2 The role of institutions of higher learning in preparing statisticians for the workplace**

As discussed in Chapter 2 of this study, institutions of higher learning play a crucial role in preparing intern statisticians for the workplace by providing them with the necessary statistical knowledge and skills. With question 2 in this qualitative phase (see annexure D), I wanted to obtain participants' views and experiences of the role that institutions of higher learning played in preparing statisticians for the workplace by providing them with statistical knowledge and skills. Mentors reported their views of these two concepts (statistical knowledge and skills) as follows:

##### **4.3.2.1 Statistical knowledge**

Theoretical knowledge forms a crucial part of the formal learning of statisticians. In general, mentors agreed that "They [interns] have some theoretical background" (SM/1) and that some universities made a significant contribution by teaching students theoretical knowledge so as to prepare them for the workplace. This finding was supported by the following statements made by some of the mentors:

The theory they know (SM/5).

Everything is theoretical. Theory is quite well, but that's where it stops (SM/7).

I think a lot of them come with the theoretical background in statistics (SM/8).

#### **4.3.2.2 Statistical skills**

Mentors were of the opinion that although institutions of higher learning were doing well in terms of providing the theoretical knowledge that statisticians needed, they were lacking in terms of providing statisticians with the necessary statistical skills because “they don’t have that practical background to do the things that are needed” (SM/3). Practical skills can only be obtained through experience and exposure to the workplace as part of their formal learning. This finding was supported by the following statements made by SM/1, SM/4 and SM/5:

There’s no practical experience. Interns don’t have any work experience (SM/1).

I think practical training would be good (SM/4).

You learn from doing: not just from reading a book (SM/5).

These statements clearly supported the view that a practical component should form part of the formal learning of statisticians.

#### **4.3.3 Suggestions: Cooperation between Stats SA and institutions of higher learning to integrate formal learning of statisticians with their workplace learning**

Participants were requested to offer suggestions as to how institutions of higher learning in South Africa could play a greater role in the integration between the formal learning and workplace learning of statisticians. The following themes emerged from their responses and are presented below:

##### **Key skills needed for a career in statistics and to be learnt formally**

Mentors mentioned that the following skills (presented in Table 31) should form part of the formal learning of statisticians:

**Table 30: Sample B – Key skills**

<b>Key skills needed for a career in statistics</b>
<b>Sample B</b>
ArcGIS (2)
Communication (7)
Computer skills (8)
Data analysis (8)
Data collection, practical (7)
Data interpretation (6)
Data processing, practical (5)
Data quality (5)
Forecasting (6)
Interviewing skills (3)
Listing (5)
Mathematical skills (6)
Presentation skills (6)
Product marketing & publicity (2)
Questionnaire design (6)
Report writing (5)
Research ability (6)
Sampling (7)
SAS (8)
SASQAF (2)
Small area statistics (3)
SPSS (4)
SuperCross (2)
Survey methodology (7)
Statistical standards (2)
Statistical value chain (7)
Teamwork (6)
Time series (5)
Writing skills (8)

Note: Numbers in brackets represent the number of participants mentioning the same skill. ArcGIS = A geographic information system for working with maps and geographic information; SAS = Statistical Analysis Software; SASQAF = South African Statistical Quality Assessment Framework; SPSS = Statistical Package for the Social

Sciences; SuperCross = A desktop cross tabulation analytics tool for analysing data from raw data to aggregated cross tabulations.

As indicated in Table 31, mentors were of the view that statisticians needed to be equipped with both technical and soft skills during their formal learning. The following statements were made in support of the provision of **technical skills**:

Several participants were of the view that it was crucial that intern statisticians should receive education on the entire South African Statistical Quality Assessment Framework (SVC). In terms of the SVC (Statistics South Africa 2010b), the statistical value chain comprises the following elements: need, design, build, collection, processing, analysis and dissemination. The following statements supported the finding that it was regarded as crucial that intern statisticians should receive education on the SVC:

Statistical value chain ... and that is what institutions should be looking at(SM/2).

There's another topic and that's the statistical value chain (SM/7).

A few other participants referred to parts of the SVC that intern statisticians needed to receive training in, such as dissemination:

For instance if you take a subject like dissemination. It is not taught at school [university] and it is not something that is covered in any curriculum. The whole range of issues is about transparency in your dissemination, your terms and conditions, the timeliness of your dissemination, the access of the data, you know, like, one of the issues around dissemination is around government intervention or interference around the data that is being released (SM/8).

We only do the part of statistics that relate to sampling, imputation, editing, and maybe sometimes series analysis (SM/4).

They don't spend a lot of time on things such as statistical standards or questionnaire design (SM/5).

Data quality and that's not covered by universities, and that's a whole topic by itself (SM/2).

In order for statisticians to be exposed to technical skills as part of their formal training, mentors also felt it necessary that they "do some assignments on what do they think about these kinds of analysis that we publish" (SM/1).

Finally, mentors also felt that "A graduate needs to have Statistics, Mathematics and Accounting and know all the other statistics, like, let's say, manufacturing and wholesale and retail trade" (SM/3) as well as "have a lot more interactive and intense training in the basics like SPSS, SAS, Excel, and SADC program should be part of such curriculum" (SM/7).

Soft skills are crucial to survive in any workplace, not just in Stats SA. Mentors therefore felt it necessary that **soft skills** should be provided by institutions of higher learning as part of the formal learning of statisticians "because students getting here, sometimes [they] don't have the writing skills" (SM/5). Another mentor was of the opinion that it did not matter "whether people studied statistics, accounting, economics; soft skills are sometimes lacking" (SM/8).

SM/7 was of the opinion that "if the modality of teaching could be changed to include much more specific areas such as group work, you'll be able to give a person exposure to leading a team, functioning in a team, making presentations; communication skills in general I think is quite lacking".

SM/5 felt that some intern statisticians joining the organisation lacked both technical and soft skills. The following statement supported this finding:

So then those guys don't necessarily have the technical skills as well as the other skills that we are looking for in a candidate that we want straight out of university, like, for example, attitude (SM/5).

## **Practical component as part of the formal learning**

Participants were also of the view that a practical component that would allow for the practical exposure of statisticians during their formal learning should form part of the formal learning of statisticians because “you learn by doing ... Not just from reading from a book” (SM/5). The addition of a practical component to the formal learning of statisticians would “ensure that they are able to apply the theory in the different situations” (SM/8). “Then they can come here and they just walk into a work situation and they are able to do it exactly because they are groomed in a situation that simulates a working environment” (SM/2).

Mentors believed that the relevant exposure to working environments in which intern statisticians might be employed would assist them greatly in getting a sense of what the work environment entailed, while at the same time capacitating them with relevant skills. This finding was supported by the following statements from participants:

Make it compulsory for the student to come and work and get practice for a year. Even something like they do at the technikons, that six-month practical component (SM/3).

Just get some exposure. But not general exposure. I would say that the students must be more exposed to what is actually happening practically out there (SM/5).

Exposure to the Treasury, Reserve Bank, to Stats SA, to the type of work that they'll actually be doing (SM/8).

## **Relevance**

Participants indicated that in order for institutions of higher learning to play a greater role in the facilitation of integrating the formal learning with the workplace learning of statisticians, it was necessary that they presented relevant content during the formal learning of statisticians. If statisticians were not equipped with content that was relevant, specifically relevant to the working environment, the result could be that

statisticians “can do the basics, they can draw a graph, but that is not what you require” (SM/6).

Another problem alluded to by one of the mentors was that “We have enough statisticians, but the real problem is, do they fit in the specific areas where we need them ... because our institutions do not offer training in official statistics” (SM/7).

Some of the mentors also felt that it was necessary for institutions of higher learning to determine “What is it that is relevant so that when they come up with a curriculum it should be relevant for the environment” (SM/5). Therefore, institutions of higher learning needed to “create the skills that are required for the workplace” (SM/3) because “Some of the things have become a little bit irrelevant because things are changing, but tertiary institutions are not changing as fast” (SM/2).

Another mentor stated that “You might find that not many graduates have a combination of what we want. Because at Stats SA we look at a unique combination of skills” (SM/1).

SM/3 expressed the need for relevant theoretical content as follows:

What I’ve seen is that in some instances the theory that they cover and what we require at Stats SA is sometimes quite far apart.

### **Contextualising the formal learning content**

Participants indicated that in order to integrate the formal learning of statisticians with their workplace learning, it was crucial that the formal learning content that statisticians were exposed to be contextualised. Using real data from Stats SA will assist statisticians to understand what is happening in the real world. Statements in support of contextualising the formal learning of statisticians and to allow easier integration with the workplace learning were as follows:

We always ask them to as far as possible use our data to demonstrate certain methodologies and techniques (SM/4).

They must be exposed more to why certain statistics are being published and why the statistics are important. You would want them to understand the reason for that practice (SM/6).

So, come to Stats SA, talk to us, and find out what we're doing, what we're publishing, how we publish it (SM/8).

## **Consultation**

Mentors expressed a need for institutions of higher learning to consult them about their needs in order to provide relevant content that would result in better integration between the formal learning and workplace learning of statisticians. Some of the mentors felt that "They [institutions of higher learning] have to go to the people in the workplace to find out, if you want to do this kind of work, what is it that these people need to know" (SM/1).

Other mentors were of the view that "They need to go to the workplaces and see what are expected of students when they done studying" (SM/5) and "Universities should find out the needs in the workplace" (SM/7).

SM/3 expressed the need for consultation as follows: "And for Stats SA then, if tertiary institutions want to produce people that are relevant, they should be looking at what does the workplace require". In addition, SM/6 was of the opinion that institutions of higher learning needed to "do much more to see what is required of people to do a certain job, and then go and see if their curricula are addressing that".

Some mentors were also of the view that in order for institutions to know what was needed in the workplace, it was important that they scanned the environment, not just locally but also internationally. The following statements supported this finding:

Most of this so-called previously advantaged, they would scan the environment (SM/6).

Firstly looking at what's happening within the country, but also looking at international standards (SM/2).

The following statement by SM3, which also confirmed the necessity of relevance, emphasised the fact that by scanning the environment, institutions of higher learning would be in a position to provide what was needed:

So if ever institutions were aware that we had a shortage of demographers, they would then start to continue to provide for these areas (SM/3).

## **Collaboration**

Mentors were of the view that collaboration between different stakeholders was important because, as one participant expressed it, "It's the schools, the universities and the employing organisations who are supposed to work together, and who are not working together" (SM/5).

More mentors alluded to the need for collaboration and for this collaboration to start at school level already. Statements in support of this finding were as follows:

So I mean we need to educate already from school level going forward as to the aspects we're looking for (SM/2).

We do not have enough statisticians, but maybe what we should do is starting at school level and get them interested (SM/3).

Judging from the views expressed by the participants as well as the experiences they had regarding the role that institutions of higher learning could play in the integration between the formal learning and workplace learning of statisticians, it can be said that participants viewed the inclusion of technical and soft skills as well as a practical component in the formal learning curriculum of statisticians as paramount to facilitate this integration. Participants were further of the view that the formal learning content had to be relevant and contextualised and had to take the data and examples provided

by Stats SA into account. Lastly, participants felt that more consultation between institutions of higher learning and more collaboration between various stakeholders needed to take place to facilitate integration between formal and informal workplace learning.

#### **4.3.4 Suggestions: How Stats SA can ensure integration between formal and informal workplace learning**

Mentors were also probed for suggestions as to how Stats SA could ensure that the formal learning of statisticians was integrated with their workplace learning. Themes that emerged from their responses were monitoring, development, recruitment, communication, compliance, management of expectations and rotation.

##### **Monitoring**

Participants were of the view that monitoring the progress of interns after placement was imperative to ensure that they were actively engaged in learning in order for their formal and informal workplace learning to be integrated. Submitting a monthly or quarterly report did not guarantee that an intern had learnt anything, and for the report to be a true reflection of an intern's learning in a relevant division, the statements in the report had to be followed up. Support for this view was expressed as follows:

The problem within Stats SA is that they'll place the interns somewhere, and then whoever is responsible for the interns, they'll basically forget about them (SM/7).

They'll expect the manager to send a monthly report or a quarterly report and that's it. They'll never then go and check whether the intern has actually learnt anything (SM/8).

If monitoring was not done as suggested, the result could be that "that intern is stuck there, not given any work, not given any training, not given any guidance, and eventually they leave Stats" (SM/2).

Another mentor's view about the lack of monitoring was as follows:

And now you have a vast amount of interns just sitting here (SM/4).

## **Development**

In the interviews conducted with mentors, the training of statisticians as part of their development also emerged as a theme. Mentors were of the view that Stats SA had to pay particular attention to the development of interns if it was to make a meaningful contribution to the integration between the formal and informal workplace learning of statisticians. Through development, one could "identify their shortfalls and address that as soon as they start working" (SM/6).

Development through training would fill the gaps in terms of interns' knowledge and skills, which did not form part of their formal development. The following statement supported this finding:

Other type of thing is those things that were missing at university like the standards, the interns should be taken through all these practical things (SM/3).

SM/2 was of the view that although it was important to develop interns, it was also important that "we need to look at employees within the organisation and what we can do for them and sort of expose people to different training as well".

## **Recruitment**

Another major theme relating to how Stats SA could ensure integration between formal and informal workplace learning and which emanated from the interviews was the recruitment process. Mentors indicated that in order for integration between learning to take place, it was necessary that the recruitment process be streamlined. The following statements supported this finding:

I think the recruitment process needs to be more rigorous. Currently they are taking anyone with anything (SM/1).

I think we cast the net too wide to say that if you've majored in any of these disciplines, please apply for the internship (SM/4).

It was indicated that although a competency test formed part of the recruitment process it would appear that "the competency test is a one-size-fits-all kind of competency test" (SM/5) and that "people do well in the competency tests which are way too generic and not specialised enough" (SM/7).

## **Communication**

Participants were of the opinion that if the formal learning of statisticians was to be integrated with their workplace learning it was important for the workplace to communicate its needs to the institutions of higher learning. The following suggestions were put forward by the mentors during the semi-structured interviews:

What we can do, I think, as a statistical agency, is, they can indicate to the institute the shortages of the specific skills or give specifications on what they want (SM/1).

We need methodologists who then say, ok, are our methods and techniques sound, so that our data is of the best quality. So, then again, you also need competent people in those areas. So, speak to institutions about your needs (SM/8).

## **Compliance**

Mentors felt that Stats SA should not compromise the quality of the internship for the sake of complying with requirements in terms of quantity. The following statements supported this finding:

I think the mistake that Stats has made is that they've sacrificed the quality of interns for quantity (SM/2).

When this programme started out, there were 15 or 16 ... Three years later there were 50 or 60 of them (SM/4).

### **Management of expectations**

Responding to the question about how Stats SA could ensure integration between the formal and informal workplace learning of statisticians, mentors said it was necessary for Stats SA to manage the expectations of interns even before they joined the internship programme, because “They tend to come out of varsity and tend to think that they’re going to make policy decisions, etc. They don’t realise that for the first couple of years you’re going to man a telephone and do basic tasks like data collection” (SM/5).

Another mentor also felt that “Interns need to understand that when they join the organisation you should be willing to learn. Nothing is too beneath them that they cannot learn about it. Me as a manager had to phone respondents” (SM/4).

Yet another mentor expressed the need to manage expectations as follows:

So, people join, and then they’re very disillusioned about the work that actually happens. We should be a little bit more open or descriptive in what is the actual day-to-day work that they will be doing or will be exposed to (SM/7).

### **Rotation**

Another theme that emerged in response to the question about the integration between formal and informal workplace learning was that of rotation. Participants felt that the rotation period was an important factor that could contribute to the integration between the formal and informal workplace learning of statisticians. If not handled correctly, or if the duration of the stay in a division was too short, rotation could become frustrating to both intern and mentor and it could affect the development of the intern. Statements in support of this finding were as follows:

They should revisit and maybe think about the current policy of rotation, and maybe keep an intern for a longer period in a division (SM/2).

So, if I have to get an intern every quarter, a brand-new one and start training a brand-new one from the start I don't really get anywhere (SM/4).

Rotating people too quickly, and then it takes away again from their development, because they are not long enough in their post to be able to really make a meaningful contribution (SM/5).

The views obtained from participants during the semi-structured interviews regarding the question as to how Stats SA could ensure that the formal learning of statisticians was integrated with their workplace learning could be summarised as follows:

The progress and development of interns should be monitored once they have been placed in certain divisions. Instead of being fixed, the rotation period of interns should be flexible and be determined taking the specific situation into account. Attention must be paid to the development, and specifically the training, of interns. The expectations of interns need to be managed before they join the internship programme and the recruitment process for the internship programme must be streamlined. If integration between the formal and informal workplace learning of statisticians is to take place, Stats SA needs to take accountability for communicating their needs to institutions of higher learning. In addition, the fact that Stats SA has to comply with legislative requirements does not mean that it should sacrifice the quality of the internship programme for quantity.

#### **4.3.5 Kinds of developmental opportunities available for interns**

One of the subquestions that I asked mentors during the interviews aimed to establish the kinds of developmental opportunities that intern statisticians were involved in as part of their informal workplace learning.

When asked about these developmental practices that existed in the organisation to assist interns in acquiring informal workplace learning, the mentors mentioned developmental assignments, relevant placements, training/in-house short courses, practical application, communities of practice and research.

### **Developmental assignments**

It emerged from the discussions with the mentors that interns were given developmental assignments, after completion of which they had to present these to their mentors and their peers. The following statements supported this finding:

So there is that type of thing where we're giving you the opportunity to learn as much as we can and then we tell you present it to us (SM/2).

We have done presentations internally just to build on their skills and particular aspects that they had to focus on (SM/5).

So it will be the learning part would be me giving them an assignment. They would be given a deadline, they would submit their assignment, we discuss it (SM/6).

Someone would've prepared a presentation, and every week someone else would get a turn to present on what he's doing, or on a specific topic that we all have in common and we would then discuss that (SM/7).

They'll be given the data, then we'll have a meeting where they will come and present their results and then I give them feedback (SM/8).

In order for interns' learning to be meaningful and relevant, assignments must be followed up. It was found that mentors realised the importance to development of follow-ups and feedback since some of them indicated that they in fact followed up assignments and provided interns with feedback on their work:

They would be given a deadline, they would submit their assignment, we discuss it (SM/3).

They will come and present their results and then I give them feedback (SM/4).

## **Relevant placement**

Mentors felt that interns needed to be placed in areas that would complement their qualifications if they were to benefit and learn anything from their placements. If interns were not placed in areas that complemented their qualifications, their skills could not be utilised. Mentors indicated the importance of the relevant placements of interns as follows:

It's important that you're placed in the relevant area. So if you're placed in the wrong division, you're not gonna perform at your best (SM/1).

Relevant placement in order for interns to utilise their skills is very important (SM/2).

We would be given IT people. Like for me, I really wouldn't want an IT person. I would rather have a statistician and you would see that this IT person is struggling to understand statistics (SM/5).

Relevant placement is very important. The internship programme should make sure that interns are placed in relevant areas for their qualifications (SM/6).

That's another thing because they have to be placed in the right area (SM/7).

I think a lot of that has to do with the appropriate placement of interns. ... And there is nothing as bad as being incorrectly placed (SM/8).

### **Training/in-house short courses**

Training/in-house short courses emerged as a subtheme from the interviews that were conducted with the mentors. Mentors indicated that they clearly understood the importance of exposing intern statisticians to training or in-house short courses to assist them with their development. The following statements of mentors were in support of this finding:

So you've got structured in-house short courses that you put them through (SM/2).

We do in-house short courses (SM/3).

We also have in-house short courses (SM/5).

In our short courses, I've said yes, if it's very relevant to his/her area of work then they could attend (SM/6).

Evidence also emerged from the interviews with mentors that job-specific training was provided to intern statisticians as part of their informal learning in Stats SA. One of the mentors stated: "We have a structured programme for our interns. We take our interns through the whole prices process" (SM/1).

Another mentor mentioned: "So you have training on price collection, capturing, quality control, auditing and then you come back to me" (SM/5).

The following statements supported the finding that mentors supported the exposure of intern statisticians to job-specific training:

I do believe that they should be trained. The human capacity one is very good, but what I have also introduced are these learning sessions (SM/2).

So while they were here they learnt the data analysis, the statistical cleaning process, the data production according to the value chain. So we tried to involve the intern from the beginning steps, right up to the advanced stages of the statistical value chain (SM/3).

From the discussion with mentors, it emerged that the job-specific training that interns were involved in included price-collection, capturing, quality control, auditing, data analysis and production, and training on the statistical value chain.

### **Practical application**

Mentors also indicated that they gave interns the opportunity to practically apply the skills obtained during their in-house training. The following statements were indicative of this finding:

So, they do that training, but they also work in that area for a week or two weeks (SM/2).

Apply the understanding that you got during the time that we went through the theory. Now give me your inputs on that (SM/4).

I will say, ok, you're going to apply this in this product, this is the metadata, it could be a general survey, a household survey (SM/5).

Mentors were also quite aware of the fact that if newly acquired knowledge and skills were not applied after training, that knowledge and skills would be lost. The following statements supported the fact that mentors were aware of the need for the application of newly acquired knowledge and skills:

But the people need to apply what they've learnt. And that is where the problem is because they don't go back and apply what they've learnt (SM/3).

And you can send someone on SAS training. They go back to their specific areas where they are working and they don't even have SAS installed on their computer. So they won't use it. So they lose the skills (SM/8).

### **Communities of practice**

It also emerged from the interviews with mentors that communities of practice were utilised as a developmental practice within certain areas of the organisation. One of the mentors expressed the following view:

Methodology and Evaluation have what we would call communities of practice. They would invite any methodologist whether it's in economics, statistics, mathematics (SM/3).

Another mentor indicated that "We used to have something like communities of practice in our division where all the statisticians in our division would maybe get together once a week for an informal meeting in our boardroom" (SM/5).

Yet another mentor felt that "there's definitely value in establishing cross-cutting groups. Where people from the same year of intern group can meet regularly and share that I've learnt this type of skill, I've experienced these kinds of challenges. A little bit of cross-pollination of ideas" (SM/7).

It was found that not all interns were involved in communities of practice. The following statements from some of the mentors supported this finding:

And on various occasions the interns are not invited along ... So they are just left behind, they are sitting at their desks while

everyone else is discussing things that they might actually be interested in and learn from (SM/2).

Communities of practice is an excellent developmental practice, but I don't think that is happening enough for all the interns (SM/6).

## **Research**

Mentors also indicated that interns received exposure to research as part of their development and were given opportunities to present their research at conferences. The following statements from mentors supported this finding:

What seems to be happening is around young statisticians who get involved in research. So they participate and then go and present at conferences (SM/1).

So she had to go and do desktop research and then you have a research task (SM/4).

They do a research project (SM/8).

### **4.3.6 Benefits of merging the formal learning of statisticians with their informal workplace learning**

During the interviews with mentors, it emerged that mentors were of the view that both statisticians as well as the workplace would benefit greatly if statisticians' formal and informal workplace learning could be integrated. The benefits mentioned were categorised as individual and organisational benefits.

#### **4.3.6.1 Individual benefits**

One of the mentors was of the opinion that statisticians should receive practical exposure during their formal studies because "I think it will better prepare them for the

workplace. It will give them more exposure to what is actually expected from them when they're getting to the actual working environment" (SM/2).

Practical exposure during formal studies would also better prepare statisticians for the workplace and allow them to adapt much quicker to the workplace. Some of the mentors alluded to this view as follows:

Well, some of the benefits, it's going to take a shorter time for the students to adapt into the workplace environment (SM/3).

I think it would be amazing. So, that would help people at least know the basics when they're entering the workplace (SM/4).

The learners will get the skills of how to write a paper, how to do analysis, and in the end it could be a win-win for everybody (SM/5).

More mentors alluded to the individual benefits of integrating formal learning with workplace learning. They made reference to the fact that if statisticians were exposed to the workplace earlier they would at least know what to expect from the working environment, which would assist them in establishing whether they had made the right career choice. The following statements supported these findings:

In fact I think that could work because they are exposed much earlier. Because sometimes when they get here they might not even be sure that this is what they wanted to do in the first place (SM/1).

You need to merge the two in order for people to know what to do in the workplace. ... I think it will be beneficial to combine the two if it's very relevant to what the intern is supposed to do back in the workplace (SM/3).

that can really benefit Stats SA and other organisations, including the learner, because you get many learners getting into a field that they're really not passionate about (SM/7).

So that could be a good way of giving people the practical exposure (SM/8).

#### **4.3.6.2 Organisational benefits**

Mentors were also of the view that an organisation such as Stats SA would benefit greatly if the formal learning of statisticians was integrated with their workplace learning because productivity time and training costs would be reduced. As an organisation, Stats SA could also prove its relevance if statisticians were exposed to their data sets and environment as early as during their formal studies. Statements in support of these organisational benefits were as follows:

Because the benefit is that Stats SA can demonstrate that we are relevant (SM/1).

The transition period of getting them to produce would be reduced (SM/3).

We wouldn't spend so much on training (SM/5).

So when they're coming from university they'll need only limited training to get them to produce (SM/6).

So in terms of production that might improve ... also costs related for companies and cost related to Stats SA (SM/7).

It adds a lot of value to the field of statistics. So, I think what happens if they are already work-ready when they start here, that probably saves us about three years which we could be using for more stuff (SM/8).

It was important for I to determine how the mentors perceive their role, as well as their involvement in the support provided for the informal workplace learning of intern statisticians. Their responses are presented below:

#### **4.3.7 Support for informal workplace learning**

I also wanted to establish the views of mentors as to how they perceived their role in terms of supporting interns assigned to them. From the interviews it emerged that mentors took their mentoring responsibilities seriously and even proposed mentorship to form part of their performance assessments. The following statements were in support of this finding:

I like being in the mentor kind of relationship (SM/1).

So, in terms of mentors, I think that is quite important because people have to find their way (SM/3).

So, I think that the internship should be a little more specialised and in doing that you can't just leave them to fend for themselves. So, the only way you can get mentors to take it more seriously is to make it part of their performance assessment (SM/4).

Mentors perceived that they had a role to play in guiding interns, a view that was indicated by the following statements:

Because the mentors are going to assist students to translate what they have into what they can do (SM/5).

So I tell people how to analyse, so I let them sit next to me, then I tell them step by step (SM/6).

An intern should be sitting with a mentor on a daily basis to see what he/she does (SM/8).

Mentors further took ownership of developing interns and exposing them to developmental opportunities, as evidenced by the following statements:

What I do now is to take people on lower levels and expose them to data analysis. So I'm busy developing them. So I see myself as a mentor (SM/5).

The main aim is to get the intern to perform at the required ability. And also equipping them with the necessary skills related to the division (SM/6).

One challenge that mentors pointed out was that due to the seniority of their positions it was not always possible for them to dedicate the necessary time and attention to interns:

Remember when I said to you, these mentors are mostly supervisors or managers. And they don't have time (SM/7).

#### **4.4 DOCUMENT ANALYSIS**

To triangulate the findings obtained from analysing the responses of respondents and participants in samples A and B in this study, I employed content analysis (Welman & Kruger 1999) to analyse the learning plans and assessment plans for intern statisticians used by Stats SA.

Among all the Stats SA documents I consulted and analysed (i.e., annual reports, strategic plans, job descriptions for statisticians (entry level), learning plans, assessment plans, database of intern/mentor pairing and training, internship policy and placement documents), the learning plans, assessment plans, job descriptions and the database containing placement and training information of interns were found to be the most relevant in terms of corroborating the findings obtained from analysing the responses of respondents and participants in samples A and B in this study. The said documents were analysed specifically to corroborate the findings relating to the utilisation of skills, relevant placement and the training and support received by interns.

The results of the document analysis are discussed as they relate to the learning plans, assessment plans, placement and developmental opportunities.

#### **4.4.1 Learning plans**

A content analysis of the learning plans revealed that these plans outlined the objectives, roles and responsibilities relating to interns. A requirement of a learning plan is preparing a specification about what the learning activities will entail, how they will be executed, what the performance indicators are and what percentage of time will be spent on each activity. The level of the tasks or activities was found to be in line with the entry-level job descriptions for statisticians. The outcomes of the plans were well formulated, which made assessments easy. An example of such an outcome is illustrated below:

To be able to assess the quality of data against a specified set of standards.

Additional elements that were contained in the learning plans were the work conditions of the post, where most of the work would be carried out and whether there would be any exceptional physical demands on the jobholder (these included travelling and working long hours). To show that both the intern and mentor agreed to the contents of the learning plan, both of them needed to sign off the plan.

#### **4.4.2 Assessment plans**

Upon investigation I found evidence that the use of assessment plans was a compulsory requirement of the internship programme in Stats SA. An assessment plan stipulated the following:

- The mentor/coach was required to provide a brief overview of the intern's performance for the quarter.
- The duties and responsibilities that were assigned to an intern needed to be outlined (but not scored/rated).

- The professional qualities of the intern, such as quality of work, initiative, communication skills and interpersonal relations, needed to be rated. I could find no evidence that these qualities had been outlined in the learning plans as criteria for the assessment of interns.
- The personal qualities of the intern, such as decision-making, adaptability, persistence and enthusiasm, had to be rated or scored. When analysing the learning plans of interns, I could find no evidence that interns would be assessed on these personal qualities.
- Lastly, as part of the assessment, mentors were required to comment on the following:
  - strengths of the intern;
  - areas of improvement; and
  - what the intern was thought to have gained from the relevant section.

#### **4.4.3 Placement**

In order to corroborate the finding that interns were placed in areas that were relevant to their qualifications, and therefore able to utilise their skills, I performed content analysis on the database containing information about the placement of interns. Evidence from this content analysis suggested that most interns were placed in areas where their qualifications would be suitable. It was also found that all interns had mentors assigned to them in the particular areas in which they were placed.

#### **4.4.4 Developmental opportunities**

I examined and analysed the documents pertaining to the training of intern statisticians at Stats SA and found evidence corroborating the findings that sufficient training opportunities were made available and that the training provided was relevant to developing the statistical skills of intern statisticians. It was also found that soft skills formed part of the training of intern statisticians. Table 32 below outlines evidence in this regard.

**Table 31: Development interventions**

Course	Statistics interns	Other interns
Applied analytics	✓	
Assertiveness	✓	✓
Basic sampling	✓	
Customer care & telephone skills	✓	✓
Map reading	✓	
MIP (massified induction program)	✓	✓
MS Word	✓	✓
MS Excel	✓	✓
MS PowerPoint	✓	✓
MS Access	✓	✓
Nat Stats Systems	✓	
SADC Phase I (survey methods)	✓	
SADC Phase 2 (sampling methods)	✓	
SAS Ent.	✓	
SAS JMP	✓	
SAS Prog I	✓	
SAS Prog II	✓	
Stats SA induction programme	✓	✓
SuperStar Cross	✓	
Survey quality	✓	
Time & stress management	✓	✓

#### 4.5 CONCLUSION

Chapter 4 outlined the findings of the online surveys, semi-structured interviews and document study. The data analysis revealed respondents' and participants' views and expectations regarding the integration between the formal and informal workplace learning of statisticians. Current best practices by Stats SA in terms of developmental opportunities provided to intern statisticians and the support provided for their informal learning in the workplace were revealed. Gaps relating to the integration between the formal and informal learning of statisticians were identified. Views about the role of

institutions of higher learning in integrating the formal learning of statisticians with their workplace learning, as well as the role of Stats SA in this process, were presented.

An integrated discussion of the findings in relation to answering the research questions follows in Chapter 5 of this study.

## **CHAPTER 5: DISCUSSION OF THE FINDINGS**

### **5.1 INTRODUCTION**

In Chapter 4 of this study, the analysis and the findings of both the quantitative and qualitative phases were reported on. In Chapter 5, I follows an integrated approach in interpreting the findings reached based on a study of the various data sources in order to provide a consolidated overview of the findings in relation to the main research question and the secondary research questions.

The themes that emanated from the data, and which were identified from the conceptual framework, were: (i) work readiness; (ii) utilisation of skills; (iii) support for informal learning; and (iv) developmental practices related to statisticians who had joined Stats SA. The discussion of the findings is presented under each theme and the correlation between reaching the findings and answering the main- and the secondary research questions are shown.

### **5.2 WORK READINESS**

There is a noticeable difference between intern statisticians' and mentors' views of interns' work readiness upon their entering the workplace. Interns clearly feel that they are ready to join the world of work whereas their mentors feel that they lack crucial skills upon joining the organisation and that they are not yet ready for the demands of work.

This difference in perception could be ascribed to the fact that people generally are optimistic about their abilities and do not want to underrate themselves, whereas mentors who have been exposed to the working environment for a while know exactly what is expected of new entrants. The fact that intern statisticians have not necessarily been exposed to the world of work prior to their joining the organisation plays a significant role in mentors' views of interns' work readiness. Comments in support of this view are as follows:

... but they do not know how to do the work.

They don't have that practical background to do the things that are needed.

There's no practical experience. ... Interns who join our organisation don't have any work experience.

Institutions of higher learning play a crucial role in providing the theoretical knowledge interns need to function as required in the workplace (Department of Higher Education and Training 2013; Slay 2010; Zieminski 2009). Intern statisticians and their managers taking part in this research study were all in agreement that the institutions of higher learning in South Africa sufficiently covered the theoretical statistical knowledge that was required of statisticians in the workplace. However, when asked whether statisticians were sufficiently equipped with the necessary skills to adequately perform their duties, both interns and their mentors were in agreement that they were not sufficiently equipped with the necessary skills to perform their duties.

Skills are normally obtained through practical experience, for example, through internships (Foley 1999; Hager & Halliday 2006; Knowles et al 2015; Kolb 2014; Marsick & Watkins 2015; Nonaka & Takeuchi 1995; Parks, Rich & Getch 2012). Since a practical component is not included in the statistics curricula at the institutions of higher learning in South Africa, it makes sense that statisticians feel that they did not obtain the necessary statistical skills through their formal studies. It is crucial to note that a practical component should be introduced to the statistics modules at institutions of higher learning in order to integrate the formal learning of statisticians with their workplace learning.

The experiences and views of statisticians about the key skills required to pursue a career in statistics depended on the division in which they were employed within the organisation. One can therefore conclude that the skills that statisticians need will differ depending on where they are employed in the organisation.

Besides the technical skills that participants listed as skills that statisticians needed to have but were not trained in, they also listed soft skills that were needed such as

communication, writing, teamwork and presentation skills. These soft skills were needed across the board and this need was not confined to a particular division. It can therefore be concluded that these soft skills are generic skills that are needed by all statisticians.

The first secondary research question, which related to the theme of work readiness, was **“What are the respondents and participants views and experiences about the role of institutions of higher learning in South Africa to the work readiness of statisticians?”** The main findings of the study that emerged from the responses obtained to this question are as follows:

- Institutions of higher learning do an excellent job in terms of supplying the theoretical knowledge that statisticians need.
- There is a need to capacitate students to **apply** the theory that they have learnt.
- Statisticians need to be **exposed** during their formal learning to the real world and environments they will be operating in once they have completed their studies. A practical component therefore needs to form part of the statistics curricula at institutions of higher learning in South Africa.
- Participants placed great emphasis on the need that the curriculum of statisticians should be **relevant** and that universities should teach and focus on what is required in the workplace.
- The content of statistics modules needs to be contextualised by using real data and examples from Stats SA.
- The majority of participants requested that much more **consultation** should take place between the workplace and institutions of higher learning in terms of the technical content of statistics modules.
- Key statistical skills that are needed to ensure the work readiness of statisticians upon entering the workplace should be included in the formal learning of statisticians. This view corresponds to findings in the literature that consultation needs to take place between workplaces and institutions of higher learning to ensure that graduates are equipped with the needed and necessary

skills (Barth et al 2007; Biesma et al 2007; Schomburg 2007; Strauss & Sawyer 1986).

- Participants also indicated that the statistics curriculum should be more **focused** and less generalised than the one currently being offered and that **soft skills** should also be included in the curriculum.
- A practical component, which would allow for practical exposure to the workplace, should be included as part of the formal learning of statisticians.
- Lastly, participants expressed a need for **collaboration** between the different stakeholders.

### **5.3 UTILISATION OF SKILLS**

Two crucial elements are involved in the optimal utilisation of skills, namely, relevant placement and the level of the tasks assigned to interns.

#### **5.3.1 Relevant placement**

The optimal utilisation of the skills of interns is crucial in order to ensure that the formal learning of statisticians is integrated with their workplace learning and that the workplace learning that interns are exposed to is relevant. For the achievement of both these aspects, it is important that interns be placed in areas in the workplace that complement their formal qualifications. The importance that the qualifications of interns match the roles in which they are placed is highlighted by Meyer, Trost and Vukovinsky (1998:205) as follows:

Anyone skilled enough to be a very good statistician may be less valuable to the company in a role that is less statistical; that is, the move is a net loss to the company over the short term ... This is especially true if the company has experienced difficulties in recruiting good statisticians.

Relevant placement also goes hand in hand with giving workplace assignments that stimulate employees' cognitive abilities, thereby enhancing their learning experience

and integrating formal learning with workplace learning (Ellström & Kock 2009; Lave & Wenger 1991; Misko 2008; Stenström 2006; Tynjälä 2008). The areas in which interns are placed and how their qualifications and these areas are matched therefore have a direct influence on whether or not their skills are utilised. This in turn influences whether learning takes place or not.

Findings (see Chapter 4) suggested that the mentors understood the importance of the relevant placement of interns according to their qualifications. Evidence was also found in the placement documents studied that interns were mostly placed in areas that were commensurate with their qualifications. When questioned, most of the interns indicated that they were placed in areas that were relevant according to their qualifications, and this finding corresponded with the findings reached after interviewing the mentors and studying the documents.

### 5.3.2 Level of tasks

As discussed in sections 5.3.1 and 5.3.2, in order for integration between formal and informal workplace learning to take place, it is necessary that interns are placed in areas that complement their qualifications and that the level of tasks assigned to them match their cognitive abilities so that they can apply their formally acquired knowledge and skills. The results obtained in the study from the responses to the questions regarding the placement of interns and the assignment of tasks of a certain level corroborated the findings from the literature. The second secondary research question that was investigated and that is relevant here is: **“What are the respondents and participants views and experiences regarding the integration between their formal and informal workplace learning?”** Based on the findings in respect of samples A and B of this study, the literature sources and the relevant documents, this aspect of the research question could be answered. The literature provided evidence that if interns were placed in areas that complemented their qualifications, tasks that matched their cognitive abilities could be assigned to them (Boud & Garrick 1999; Eisenberger et al 2002; Siemens 2007) and these tasks would give them an opportunity to practise their formally acquired knowledge and skills (Ellström & Kock 2009; Misko 2008; Tynjälä 2008). Most of the interns indicated that the tasks assigned to them were on a professional level (therefore matching their cognitive abilities) and

gave them an opportunity to practise their formally acquired knowledge and skills. Job descriptions and learning plans of interns showed that clear outcomes were formulated, which further corroborated the findings that their skills were utilised and that their tasks were on a professional level.

Therefore, the second secondary research question of this study that relates to the theme of the utilisation of skills can be answered as follows:

- Stats SA clearly recognises the need to **place interns in areas that are relevant for their qualifications**, thereby ensuring that interns' formal learning is integrated with their workplace learning.
- Due to the fact that the **qualifications** of interns **match** the **areas** in the organisation in which they are placed to do their internship, it is easier to **assign tasks that closely match their cognitive abilities** and that are on a professional level.
- Because of the close match between qualifications and tasks, **interns get the opportunity to practise** their formally obtained knowledge and skills.
- In general, interns are therefore very **optimistic about the integration** between their formal learning and informal workplace learning.

## **5.4 SUPPORT FOR INFORMAL LEARNING IN THE WORKPLACE**

Support for informal learning in the workplace can take several forms. In the case of this study, mentorship, feedback and developmental practices were identified as the major means to support informal workplace learning.

### **5.4.1 Mentorship**

A prerequisite for the integration between the formal learning and informal workplace learning of statisticians is that once interns enter the workplace they should receive support for their workplace learning in the form of a mentor being assigned to them (Ashton 2004; Eisenberger et al 2002; Folkestad 2006; Ramaswami & Dreher 2007;

Siemens 2007; Smith et al 2005; Steinmann 2006). A mentor could accelerate and enhance workplace learning (Billet 2001:136).

It is clear from the evidence that, as an organisation, Stats SA values the contribution that mentorship can make to the integration between the formal and the workplace learning of statisticians. Every intern joining the organisation is assigned a mentor. Evidence from the document analysis suggests that Stats SA invests in the training of their mentors because mentors are trained and certified to mentor intern statisticians. The in-house criteria relating to becoming a mentor, which are contained in the internship policy, stipulate that mentors need to occupy relatively senior positions (at managerial level), be experts in their areas and be permanent employees of the organisation for at least the past two years. The final criterion is that those appointed as mentors have to undergo mentorship training. The requirement that mentors have to be specialists in their areas is in line with the requirement recommended in the literature (Ramaswami & Dreher 2007; Steinmann 2006).

Evidence (see Chapter 4) suggests that mentors realise the importance of the roles they have to fulfil. The majority of mentors view their role as hands-on, total involvement in the development of interns. Most of the mentors participating in the study underwent the in-house mentorship training offered by Stats SA in order to prepare them for their roles. However, one challenge that mentors face is that they usually occupy positions on a managerial level, which makes it difficult for them to be involved as much as they should and to provide the kind of support required of them. Overall, participants were positive about their roles as mentors, and respondents were positive about the support they received from their mentors.

An overwhelming majority of respondents in sample A of this study indicated that their mentors assisted them to perform their duties adequately. This information correlates with the data obtained from the answers of mentors who indicated that their involvement with the interns was mostly hands-on. Respondents were asked to indicate whether or not they thought their mentors/coaches were experts in their area of speciality. As this question was posed to respondents, an objective evaluation could be obtained of existing subordinate/supervisor (intern/mentor) relationships. If the mentors had been asked whether they regarded themselves as experts in their field,

this would have resulted in more subjective opinions. From the overwhelming positive responses received it can be deduced that the mentor/intern relationship is generally positively experienced by interns at Stats SA. Interns are confident that their mentors are experts in their areas, and such confidence could contribute to enhancing interns' informal learning experiences (Rankhumise 2013).

#### **5.4.2 Feedback**

In order for the learning experience to be effective and for learners involved in any activity to know whether they are doing things right or whether there is a need for improvement, it is important that they receive feedback on their performance (Conn et al 2015; Wiggins 2012). Responses from the mentors indicated that they regarded feedback as a necessary and essential element of workplace learning. Most of the mentors indicated that they provided regular feedback to interns on the work they had performed and the assignments they had completed. Some mentors even created a safe environment for interns to receive feedback from and provide feedback to their peers. Interns' responses confirmed that they received regular feedback on their performance from their mentors. Furthermore, assessment plans of interns on which feedback was recorded, validated this finding.

#### **5.5 Developmental practices**

In order to ensure graduates' continued learning after completion of their formal studies as well as to ensure the integration between their formal learning and informal workplace learning, it is important that they be exposed to developmental practices informally in the working environment. This is especially necessary to complement their formal learning or fill a gap if they did not get the necessary exposure during their formal studies. There are various developmental practices that interns can be engaged in and that can contribute to the integration between their formal and informal workplace learning (see Chapter 2). These practices include, but are not limited to, developmental assignments, learning plans, assessment plans, training and development opportunities, communities of practice and research projects. Responses were elicited from both mentors and interns regarding the kinds of

developmental practices that interns were exposed to. Evidence was also collected from documents regarding the training of statisticians.

#### **5.4.3.1 Developmental assignments**

Based on the following statements made by mentors, it is clear that some of them recognise the need for developing interns through giving them assignments on the work that they are doing.

So there is that type of thing where we're giving you the opportunity to learn as much as [you] can and then we tell you present it to us.

We have done presentations internally just to build on their skills and particular aspects that they had to focus on.

So, it will be the learning part would be me giving them an assignment. They would be given a deadline, they would submit their assignment, we discuss it.

The assignments referred to above contribute to the informal learning of interns in that they are relevant and job-specific.

In order for learning to be meaningful and relevant, follow-ups after assignments are necessary. It was found that mentors realised the importance of follow-ups and feedback for developmental purposes since some of them indicated that they adopted this approach. Evidence to this effect was discussed under section 5.4.2.

#### **5.4.3.2 Learning plans**

A properly formulated and well-designed learning plan can serve as a contract between interns and their mentors, and it should ideally stipulate the outcomes to be achieved at the end of the learning period (Rankhumise 2013). Knowles (1984) affirms that the learning objectives/outcomes need to be clearly specified. Van der Berg (2012:16) uses the following example of a clearly specified outcome for intern

statisticians: *“to be able to properly analyze a statistical dataset using the SAS application”*. In contrast, an outcome that is not clearly specified is: *“to learn how the organisation works with statistical datasets”*. The former outcome will also be easier than the latter to evaluate at the end of the learning period. The clear specification of outcomes will also provide clarity as regards the tasks to be performed, which will enhance the effectiveness of the internship programme (Rothman 2007).

Findings from the content analysis of the learning plans revealed that the outcomes in the learning plans were clearly formulated and could therefore be easily assessed. It was also found that the level of the tasks contained in the learning plans was in line with the descriptions of statisticians’ entry-level jobs. This corroborated findings from respondents in sample A of the study that the tasks assigned to them were on a professional level.

#### **5.4.3.3 Assessment plans**

According to the internship policy of Stats SA, one of the aims of its internship programme is to build a pool of competent statisticians from which the organisation can recruit candidates to fill the skills gaps in the critical areas where shortages are experienced. In order to do this, it is important that intern statisticians are regularly assessed based on their performance to ascertain whether they successfully acquired the necessary skills and are competent enough to fill the skills gaps in the organisation.

It is important that interns are assessed against pre-determined outcomes/objectives (Young & Baker 2004), which should preferably have been specified in the learning plans/contracts of intern statisticians. It would be unfair to assess interns based on personal observation and judgement instead of on prior specified outcomes/objectives as personal assessments could be subjective and biased. Van der Berg (2012:17) advises that “the learning plan and assessment plan be developed together since these two documents are supposed to be mutually dependent on each other”. The author further suggests that assessment be accompanied by developmental feedback from the mentor. The purpose of this developmental feedback is to discuss plans for remedial action in areas where interns need further development.

Evidence suggests that the use of assessment plans is a compulsory requirement of the internship programme in Stats SA (Statistics South Africa 2010b). Current documentation requires a mentor to give an overview of an intern's performance and an outline of the duties and tasks the intern is involved in. The professional qualities of the intern, which include aspects such as meeting deadlines, communication skills and initiative, are also scored. The findings of the study indicated that these aspects were not mentioned in the learning plans. Therefore, interns did not work towards achieving these outcomes throughout their tenure in the division since these were not contained in their learning plans. However, these findings did not correspond with the responses received from interns who mostly indicated that they thought they were assessed based on the outcomes as specified in their learning plans. It is, however, important to note that there is only a 10% difference between interns who agreed that they were assessed based on the outcomes in their learning plans and those who disagreed or who were undecided regarding the link between their assessments and their learning plans. The validity of the assessments to determine interns' skills and abilities for employment within the organisation is therefore questionable.

Mentors indicated that they also commented on the strengths of interns, the areas in which they needed to improve and their opinion about what interns had gained from their section. This evidence was corroborated by findings from the responses of interns indicating that areas for improvement were pointed out to them.

An equal number of respondents both agreed and disagreed that their mentors took active steps to improve their performance based on the assessments that were conducted. This finding suggests that although areas for improvement are pointed out in interns' assessments, there is no evidence suggesting that active steps are taken to develop interns if areas for improvement have been identified. This is of concern if the goal is to establish a pool of competent statisticians from which candidates can be recruited to fill the skills gaps in the organisation.

#### **5.4.3.4 Training/in-house short courses**

One way of supporting informal learning in the workplace is through in-house training or short courses. This kind of training should be designed specifically to address gaps

in the development of interns or to supplement the skills they did not acquire formally through their studies. The practical application of newly acquired knowledge or skills always leads to better retention, and thus the informal learning experience can be enhanced. Kolb (1984:38) supports this notion and points out that knowledge is created through the transformation of experience during the learning process. Meyer et al (1998:204–205) reiterate that statistician interns need to be provided with opportunities for relevant and appropriate work experience and training in order to contextualise their academic training. This training could include, but is not limited to, technical or job-specific training and the acquisition of soft skills, and participants should ideally be able to practically apply the skills gained from these courses.

Mentors fully supported interns' exposure to training, either in the form of in-house courses or the attendance of conferences, and they also provided opportunities for interns to practically apply newly acquired knowledge and skills. This finding was corroborated by interns who mostly agreed that they were provided with sufficient development or training opportunities that were related to and supplemented their formal qualifications and that the training they had attended was specifically aimed at enhancing their statistical knowledge and skills. Evidence found in the training documents of the internship programme further corroborated these findings, which indicates that the training of interns is suited to the development of their statistical knowledge and skills and complements their formal qualifications.

It is clear that a lot of time and resources are invested in statistician interns in terms of in-house training, short courses and job-specific training. Documentary evidence of the training that interns are exposed to suggests that interns who are recruited and who did not major in Statistics or Economics are not exposed to the same amount of training as statistician interns who majored in these subjects. Besides being exposed to statistical training, interns are also exposed to soft-skills training, enabling them to function better within the workplace. The majority of participants in sample A of the study confirmed that the soft skills that Stats SA exposed them to adequately prepared them for the social demands of the working environment. Evidence therefore suggests that by providing a mix of both technical and soft-skills resources, Stats SA aims to equip statistician interns to function optimally within the organisation.

#### 5.4.3.5 Communities of practice

Communities of practice are effective in providing interns with opportunities to learn from their peers and other experts in the field (see section 2.4) (Lave 1996; Wenger 1998, 2000; Wenger et al. 2002). However, judging from some of the responses received from participants in sample B of the study, communities of practice are not implemented in all the divisions at Stats SA, indicating that not all interns are necessarily involved in communities of practice.

#### 5.4.3.6 Research

An additional finding that emerged from the data was that interns were exposed to research as a developmental practice. They are also afforded the opportunity to do presentations at conferences.

In conclusion, reference is made to Chapter 2 of this study in which the various means of support for intern statisticians were discussed. These include support through training, developmental assignments (Eisenberger et al 2002), communities of practice (Lave 1996; Wenger 1998, 2000; Wenger et al 2002), feedback and mentorship (Ramaswami & Dreher 2007; Smith et al 2005). Findings from the responses of respondents and participants in samples A and B of this study and the study of literary sources and documents (training of interns, learning plans, assessment plans and Stats SA's internship policy) served to answer the third secondary research question of this study, namely, **“How is the informal learning of statisticians supported in the workplace?”** This question, which relates to the theme of support for informal learning in the workplace as well as to the theme of developmental practices, can be answered as follows:

Every intern statistician joining the organisation is assigned a mentor to guide them in terms of their development.

- Mentors are subjected to stringent selection criteria in order to ensure that intern statisticians receive the best possible guidance.

- Mentors are trained to fulfil their roles in supporting interns.
- Mentors view their roles as important and are closely involved with the interns.
- Interns perceive their mentors as experts in their areas of speciality, which instils confidence in the interns that they are receiving the best support possible.
- Feedback between mentors and interns seems to be an ongoing and regular process.
- Feedback amongst peers is encouraged.
- Developmental assignments that are job-specific are utilised as an important means of development for intern statisticians.
- Learning plans contain clear, easy-to-assess objectives. Assessment plans should be linked to learning plans and interns should be assessed based on outcomes contained in learning plans. Learning plans are important in structuring and guiding informal workplace learning.
- Ample training and developmental opportunities that are designed to complement formal learning and improve statistical knowledge and skills are made available to interns.
- Research opportunities are provided and communities of practice are implemented, although to a lesser extent than training opportunities.

In respect of the fourth and last secondary research question, namely, **“What suggestions can be made to Stats SA to ensure more effective integration between the formal and informal workplace learning of statisticians?”**, the findings that emerged from the responses provided to the question related to the following: monitoring of the internship programme, development of the interns, compliance issues, the ability of Stats SA to communicate its needs to higher education institutions, management of expectations, and the rotational issues of the internship programme. These findings are discussed next.

Regarding the **monitoring of the progress of interns**, findings from the responses of participants in sample B of the study indicate that Stats SA regards it as important to monitor what is happening to interns once they are placed in particular sections. According to one of the respondents interviewed, if this monitoring is not done “the

intern is stuck there, not given any work, not given any training, not given any guidance, and eventually they leave Stats”. It is also crucial that interns are monitored during their **development** and training. The training of interns needs to be relevant and lead to the enhancement of their knowledge and skills, otherwise it will be a wasteful and fruitless expenditure and Stats SA will receive no return on its investment. This fact is demonstrated by the following statement from one of the participants:

When I attend courses, I see so many interns that are on those courses, and it's not even really their field. So it's not really what interns have to focus on or what they're ever going to use. Or they might not even be interested in that.

With regard to **compliance issues**, it was found that participants were of the opinion that Stats SA should pay attention to the fact that “they are sacrificing the quality of interns whom they recruit to be on the programme for quantity” in order to comply with government regulations and legislation.

In respect of the **ability of Stats SA to communicate its needs** to higher education institutions, the finding was that participants in sample B of the study felt it necessary that Stats SA should clearly articulate its needs and communicate these to higher education institutions. The statement in support of this view is quoted below:

What we can do, I think, as a statistical agency, is they can indicate to the institute the shortages of the specific skills, or give specifications on what they want.

Respondents/Participants in both samples A and B of this study indicated the need that Stats SA should **manage the expectations** of prospective employees in order to avoid disappointment when they eventually join the organisation. Findings from both these samples highlighted the need that statistics students should get practical exposure to the workplace during their studies, which will ensure that they have a good idea of what to expect from the profession that they chose. Should they get practical exposure well in advance, they have the option of deciding whether to continue with

the qualification or not. Statements indicative of the need to manage the expectations of prospective employees are quoted below:

They tend to come out of varsity and tend to think that they're going to make policy decisions, etc. They don't realise that for the first couple of years you're going to man a telephone and do basic tasks like data collection.

So people join, and then they're very disillusioned about the work that actually happens. We should be a little more open or descriptive in what is the actual day-to-day work that they will be doing or will be exposed to.

Interns need to understand that when they join the organisation you should be willing to learn. Nothing is too beneath them that they cannot learn about it.

During an internship, interns are expected to **rotate** so as to be exposed to the various areas of their chosen field in order to maximise their learning (Campion et al 1994; Noe & Ford 1992). However, an intern needs to be placed in one area long enough to gain meaningful knowledge and skills in that particular area. Findings from the responses received from participants in sample B of this study indicate that since Stats SA is a project-driven organisation, it is imperative that interns at least see a project through from start to finish before being rotated. It should therefore not be compulsory to rotate at a pre-determined time (in this instance every quarter). The rotation should be determined by the duration of the project. The statements below support this notion:

Maybe keep an intern for a longer period in a division.

So if I have to get an intern every quarter, a brand-new one, and start training a brand-new one from the start, I don't really get anywhere.

Rotating people too quickly ... And then it takes away again from their development, because they are not long enough in their post to be able to really make a meaningful contribution.

The findings on the benefits of integrating the formal learning with the workplace learning of statisticians are discussed in 5.5 below:

## **5.6 BENEFITS OF INTEGRATING THE FORMAL LEARNING OF STATISTICIANS WITH THEIR INFORMAL WORKPLACE LEARNING**

Participants indicated that if the integration between formal and informal workplace learning could be achieved, it would benefit both the individuals (interns) involved and the organisation (Stats SA). In terms of individual benefits, participants highlighted that individuals would be better prepared for the working environment since they would get practical exposure during their studies and would know what to expect upon entering the workplace. It would take them a shorter time to adapt to the working environment since they would have obtained the necessary statistical knowledge and skills earlier (before joining the organisation). In terms of organisational benefits, participants indicated that the period to get statisticians to be productive in the workplace would be reduced, which would result in time and cost savings for the company.

These findings confirm the findings in the literature relating to the benefits of integrating the formal learning of statisticians with their workplace learning (Bulaliya, Regien & Marendera 2012; Maertz et al 2014) as well as the findings based on respondents' responses in sample B of the study to the open-ended question. The majority of respondents indicated a need to be practically exposed to the workplace during their formal studies in order for them to know what to expect from the workplace before entering the world of work.

Findings from the literature (Colley et al 2002; Eraut 2010; Marsick & Watkins 1990) suggest that formal learning and informal workplace learning still exist as two polar opposites (see Chapter 2). It was therefore important for I to get statisticians involved in making suggestions about the improved integration between the formal learning and

informal workplace learning of statisticians. One of the main findings that emerged from the request for suggestions related to Stats SA's recruitment process of interns was that it would be easy for Stats SA to recruit the right interns for the right positions if the recruitment process was refined. A refined recruitment process would ensure that the areas in which interns were placed were relevant in terms of their qualifications, which in turn would lead to enhanced informal learning experiences. It can be concluded that the recruitment process is crucial to ensure that the formal learning of statisticians is integrated with their informal workplace learning.

To conclude, the findings obtained from the responses of both samples A and B of this study as well as the findings from the literature study (Bulaliya et al 2012; Maertz et al 2014) indicate numerous individual as well as organisational benefits if the formal learning of statisticians is integrated with their workplace learning. Stats SA will clearly benefit from the integration between the formal learning and workplace learning of statisticians.

Based on the preceding discussion, the fourth and last secondary research question, namely, **“What suggestions can be made to Stats SA to ensure more effective integration between the formal and informal workplace learning of statisticians?”** can be answered by making the following suggestions:

- The recruitment process for interns needs to be refined. Recruitment should be linked to specific areas where shortages of skills are experienced.
- Stats SA should inform institutions of higher learning about its needs in regard to the technical skills they require interns to be trained in during their formal learning.
- Closer monitoring and follow-up should be done after interns have been placed in different divisions. Management should not rely solely on the learning and assessment plans.
- Although it is a legislative requirement for Stats SA to train interns, the organisation should not compromise the quality of the programme for quantity.
- Expectations of interns need to be managed even before they join the organisation.

- In order to ensure that interns gain maximum benefit from the internship programme, the rotation period should not be predetermined but each rotation period should be determined based on project completion.

## **5.7 CONCLUSION**

In Chapter 5 the findings from both the quantitative and qualitative approaches as presented in Chapter 4 were integrated and discussed according to the themes that had emerged from the data obtained in order to provide answers to all four aspects of the main research question posed in Chapter 1 of this study. The findings in terms of the work readiness of interns, the support that interns receive in the workplace, developmental practices available to them and the perceived role of higher education institutions in South Africa regarding the integration between the formal learning and workplace learning of statisticians were discussed. Suggestions to Stats SA as to how to integrate the formal learning of statisticians with their workplace learning and the benefits of this integration were also made.

In Chapter 6, the evaluation of the research by the critical reference group, the achievement of the study's objectives, the findings, the conclusions reached in the study, as well as the limitations of the study are presented and recommendations for future research are made.

## **CHAPTER 6: EVALUATION OF RESEARCH, CONCLUSION, LIMITATIONS AND RECOMMENDATIONS**

### **6.1 INTRODUCTION**

This chapter concludes the research by discussing the evaluation of the research by the critical reference group, achievement of the study's objectives, findings, conclusion, limitations and recommendations.

### **6.2 EVALUATION OF THE RESEARCH**

Mentors who are considered experts in the field of statistics and who occupy relatively senior positions in Stats SA were requested to evaluate the proposed framework (see section 2.8) to integrate the formal learning of statisticians with their informal workplace learning.

The following feedback was received:

Regarding your framework, and model, I must say, that the framework and the implementation steps look really good.

I do believe that all government organisations, not only Stats SA, can benefit greatly from your framework and steps. I am in constant contact with a few of the 2013 interns and I am quite saddened at how the internship programme is deteriorating. The phrase on page 141 of your document, "it is important that the organisation focus on the quality and not on the quantity of intern statisticians" speaks volumes, as I perceive the current focus is on quantity rather than quality. Your framework provides brilliant solutions to the current shortcomings of the internship training programme as well as forward-looking plans, i.e. integration between formal learning and informal learning and building relationships with higher education institutions.

Over and above your framework and implementation steps, there are a few points that I would like to commend you on:

- The needs analysis, as I feel this is not being pursued as intensively as it should be. The programme sponsors make little effort to drive home the importance of the programme. There is no real analysis, apart from mere enquiries, and in most cases, the onus falls on the component manager or executive managers to approach the sponsors.
- The importance of proper placement, as I believe that the current lack of planning results in poor placement of interns, and I am glad you have given this focus. The surefire way to stifle an intern is to place them in a situation that is not conducive to their learning and career growth.
- The focus on soft skills, as you have noted under point 6.3, as I think that is very often overlooked, even with non-interns.
- The feedback and follow-up functions, which are non-existent in the current programme. An important part of the learning process is affirmation, and feedback between the various role players (intern, coach, and sponsor) ensures a healthy programme.

I have noted the above as I feel that these are significant contributors to the declining retention rate of interns within Stats SA. A framework such as yours would go a long way to correcting the shortcomings that are currently evident in the Stats SA internship programme.”

and

I find the model very exciting and can see the actual value it can bring to our current processes.

Simplicity – the model flows easily and has a simplified understanding from the input through to the outcome.

Practicality – each phase is described in detail making the understanding of each requirement easy to follow. Each phase is clear and precise.

Detailed – as mentioned, there is enough detail available to break each phase down into steps that will provide a strong foundation for implementation.

Sustainability – considering the importance of the internship training programme towards the development of specific skills sets, the model provides a foundation of sustainability to overcome specific skill gaps but also allow for the development of individuals that will make them more employable.

In summary, your framework for the integration between formal and informal learning will take our current internship training programme into the next generation of skill sets that will allow an organisation to move to a higher level of evolution.”

and

Thank you for the opportunity to comment on a portion of your research. I have found it to be well argued and clear.

Linking the formal training with informal workplace training is difficult. The last bullet on page 183 is important and in my view should be expanded on in the paper. For me this is the crux of the solution. These practical courses can be extremely valuable especially if they are linked to specific topics that the higher education institutions are offering during that year of study.

But this will not be successful if implemented in the form of learnerships as the six-week period makes it difficult for Stats SA to impart knowledge as part of its normal operations. It rather calls for practical training in the field of official statistics, similar to courses offered previously in Stats SA (the SADC training and even before that the STAC (statistics in action) courses). Similar courses from Statistics Canada have also proven beneficial although their courses are substantially longer and offer to new appointees to bridge the gap with official studies.

If this approach is followed, a student will typically do three of these practical sessions over the course of completing a degree with this education institute but with some

support from Stats SA. It is important that successful students be invited again in subsequent years and linked to the same Stats SA staff for continuity and mentorship.

Item 6.10 should be more clear/strong to emphasise that internship is not only about preparing future appointees but also training society in general for appointment. The principle of fair competition for posts is therefore very important. I wouldn't give us much prominence to 'absorption'.

### **6.3 CONCLUSION OF THE RESEARCH**

Identifying a gap in terms of a framework to integrate the formal learning of statisticians with their informal workplace learning was what prompted me to conduct this research study. There is much debate about the formal learning and informal learning of graduates but in practice these two are still two polar opposites. No evidence could be found of an existing framework for formal learning that includes a practical component in the form of an internship that is coupled with an internship upon the completion of formal learning to integrate these two kinds of learning.

#### **6.3.1 Research aims and findings**

The main aim of this study was to suggest a framework for integrating the formal learning of statisticians with their future informal workplace learning in order to address the statistical skills shortages in Statistics South Africa. Furthermore, the study also aimed at reaching an understanding of this particular case (Statistics South Africa).

Key stakeholders in the area of statistics contributed valuable insights into aspects of formal learning that institutions of higher learning should focus on in order to produce work-ready statisticians. They also made suggestions as to how organisations that employ statisticians could integrate the formal learning of statisticians with the informal workplace learning that they are supposed to gain in practice. This approach formed the basis for developing the conceptual framework, which culminated in the framework aimed at integrating the formal learning of statisticians with their informal workplace learning. The framework was evaluated by the relevant stakeholders and limitations as well as recommendations were pointed out.

In order to address the aim of this research study, the research objectives were divided into four categories, namely, to:

- understand respondents' and participant's views and experiences about the role of institutions of higher learning in South Africa in the work readiness of statisticians;
- understand respondents' views and experiences regarding the integration between their formal and informal workplace learning;
- understand how the informal learning of statisticians is supported in the workplace; and
- obtain inputs and suggestions from statisticians to ensure better integration between the formal and informal workplace learning of statisticians.

I am convinced that the aim of the research was accomplished. The framework addressed most, if not all, of the problems stated in Chapter 1 of the research. The input, process, output and outcome to give effect to this framework were stated explicitly. The framework offered grounding in theoretical principles in the fields of people skills and adult learning and provided depth in terms of the key aspects of the integration of the formal learning of statisticians with their informal workplace learning. In addition, this framework addressed the unique factors that influenced its implementation within the context of a developmental state such as South Africa.

The mixed-method analysis yielded the following key findings:

- An overwhelming majority of respondents indicated that statistical knowledge (the theoretical component of formal learning) was covered sufficiently during their formal learning at institutions of higher learning in South Africa but that these institutions' formal statistics curricula did not include practical components. A practical component was indicated to be a crucial link in terms of the integration between the formal learning and the workplace learning of statisticians. This study confirmed Dewey's theory that formal learning will make much more sense if learners can practically apply their knowledge while they are engaged in the formal learning process. The practical application of

knowledge during formal learning will lead to a gradual build-up of skills, which will be of great benefit to the intern statistician. By the time interns join the world of work they will not need training to become productive in the workplace.

- Consultation in terms of the relevance of statistics modules offered at institutions of higher learning was indicated as another crucial component in ensuring the effective integration between formal and informal workplace learning. According to the findings, no consultation takes place between Stats SA and institutions of higher learning in South Africa in terms of the relevance of the formal learning content offered at these institutions.
- The industry (Stats SA) requires specific statistical skills from interns joining the organisation. It was found that certain statistical skills that are needed in the industry are not covered during the formal learning of statisticians. These skills are practical in nature, which points to the fact and corresponds with the finding that current formal learning does not include a practical component.
- Soft skills were also identified as necessary in preparing interns for the workplace. Stats SA invests in the soft-skills training of interns and as these skills are generic in nature they are useful for all interns. It was found that soft-skills training did not form part of the formal learning of statisticians. It remains a bone of contention whether such training is the responsibility of institutions of higher learning or of the organisations that employ statisticians.
- Stats SA follows a rigorous recruitment process to select and train intern statisticians. However, evidence suggests that recruiting intern statisticians for certain areas in the organisation is not specific enough, resulting in instances of mismatch, in other words, intern statisticians are placed in positions for which their qualifications/skills are not necessarily suitable. Such improper placements create situations where interns' prior acquired skills cannot be properly utilised and where they are inevitably perceived to be incompetent, with the result that little learning takes place. Nevertheless, this situation is not true for the majority of interns, since the study found that the placements and qualifications of interns were mostly well matched, resulting in the achievement of some integration between the formal and informal workplace learning of statisticians.

- Two crucial elements are involved in the optimal utilisation of skills, namely, relevant placement and the level of the tasks assigned to interns. Since most of the interns were placed in areas that matched their qualifications, it was found that they were assigned tasks that matched their intellectual capacity, which contributed to the integration between their formal and informal workplace learning.
- The informal workplace learning of statisticians is supported in that trained mentors train and guide intern statisticians and these mentors' involvement is hand-on. Interns perceive their mentors to be experts in their areas of speciality, which instils confidence in the interns as they feel they are receiving the best support possible. Mentors also provide regular feedback to their interns, which is invaluable as interns can determine their own progress in terms of set objectives.
- Developmental practices that interns are involved in include developmental assignments, which are job-specific, as well as learning plans and assessment plans. Training and development opportunities are also provided for intern statisticians. Learning and assessment plans provide structure to the informal learning of statisticians. Although learning and assessment plans for intern statisticians are in place, it was found that these two documents did not necessarily have any connection. For instance, it was found that interns were not necessarily assessed based on what was contained in the learning plans. The assessment plans lend themselves to bias and subjectivity due to the fact that intern statisticians are not assessed based on what is outlined in their learning plans.
- Overall, it was found that a few of the fundamental processes that are required for successfully integrating the formal learning with the informal workplace learning of statisticians and for addressing the statistical skills shortages in Stats SA are already part of this organisation's informal learning programme.

### **6.3.2 Recommendations**

Based on the findings of this research, the following recommendations are proposed:

#### **6.3.2.1 The role of institutions of higher learning in South Africa in the work readiness of statisticians**

It is recommended that:

- Institutions of higher learning should consider including a practical component as part of the formal learning of statisticians. This should consist of practical training in the field of official statistics such as the SADC training or STAC (Statistics in Action) courses, which will assist in integrating the formal learning of statisticians with their informal workplace learning. With the involvement and support of Stats SA staff, a student will then typically do three of these practical sessions over the course of completing a formal degree.
- Extensive consultation on the relevance of the content of formal learning should take place between institutions of higher learning and organisations (especially Stats SA) and this should be reviewed on an ongoing basis.
- There should be closer collaboration between schools, institutions of higher learning and workplaces in order to ensure work-ready graduates. Learners should be exposed to statistics at school level already. Current practices by Stats SA to capacitate school teachers to be effective in teaching statistics should continue. However, it is recommended that due to large numbers, universities should get involved in the training of these teachers.
- The content that statisticians are taught at secondary and tertiary levels needs to be contextualised. Contextualisation can be achieved by using South African examples at both levels and by using Stats SA's data sets for assignment purposes. Assignment topics should be confirmed with Stats SA to ensure that students investigate and solve real-life problems experienced at Stats SA.
- Soft-skills training related to customer care, emotional intelligence, team-work and conflict management should be offered as part of formal learning at

institutions of higher learning. If a curriculum cannot accommodate such training, it can be offered to students in the form of assignments or portfolios.

### **6.3.2.2 Participants' views and experiences regarding integration between their formal and informal workplace learning**

It is recommended that:

- Statisticians should be exposed very early on in their studies to their chosen field so that they can make certain that this is what they want to study. To accomplish this, partnerships can be formed with organisations to pair students with employees for a short period of time so that they can get exposure to their chosen field and see what it entails.
- The recruitment process of an organisation that employs graduate statisticians should be refined to be quite specific. The specific division recruited for and the specific skills required for the position should be clearly stated in the advertisement. The competency assessment, which should precede the interviews, should also not be generic but should be position-specific so that candidates can be assessed on the specific qualifications and skills that are required to perform the duties of the relevant position successfully.
- Intern statisticians should only be recruited for those divisions that indicate they can accommodate interns. Only interns with the specific skills required should be recruited and placed in the areas in which they are needed. This will ensure that proper placements are made and mismatches between intern qualifications and position requirements are avoided.
- Learning and assessment plans should be merged to form one single document. This will ensure that intern statisticians are assessed on the criteria contained in the learning plans.
- Intern statisticians should mainly be exposed to short courses that will assist them in performing their duties. Before intern statisticians attend training, a plan should be put in place describing how they will utilise the knowledge and skills they gained by undergoing the training. This will give the organisation a return on its investment.

### **6.3.2.3 How is the informal learning of statisticians supported in the workplace?**

and

### **6.3.2.4 Suggestions to Stats SA to ensure integration between the formal and workplace learning of statisticians**

It is recommended that:

- Stats SA should continue building on and expanding the current processes that are in place to successfully integrate the formal learning of statisticians with their informal workplace learning through the support that they provide to interns in respect of their informal learning.
- Mentorship should be a voluntary and not a forced arrangement. Personality tests to match mentors and mentees are recommended.
- Mentors should be aware of their shortcomings and continually strive to improve their relationships with the interns assigned to them.
- The identification of areas in which skills shortages are experienced should be reviewed on an ongoing basis. Intern statisticians should only be recruited and developed for these specific areas.
- In order to ensure that interns gain maximum benefit from the internship programme, the rotation period should not be predetermined (for instance, every quarter) but each rotation period should be determined based on the completion of a project/assignment. Rotation times should be mutually agreed between a mentor and an intern statistician.
- Even though intern statisticians are being groomed to fill the statistical skills gaps where these exist, it is important that they still compete for permanent positions in the organisation and that positions are not handed to them on a silver platter. This will ensure that they always deliver their best and do not become complacent and that competition will be fair.
- Closer monitoring and follow-up should be done after interns have been placed in the different divisions. Management should not rely solely on the learning and assessment plans.

- Although it is a legislative requirement for Stats SA to train interns, the organisation should not compromise the quality of the programme for quantity.
- Expectations of interns need to be managed even before they join the organisation.

#### **6.4 FRAMEWORK TO INTEGRATE THE FORMAL LEARNING OF STATISTICIANS WITH THEIR INFORMAL WORKPLACE LEARNING**

It is recommended that the framework to integrate the formal learning of statisticians with their informal workplace learning be implemented and reviewed on an ongoing basis. It is of paramount importance that the relevant stakeholders who reviewed this framework be involved in its implementation and continued review to ensure that the changing needs of both the industry and higher education institutions are met.

#### **6.5 LIMITATIONS OF THE RESEARCH**

The framework to integrate the formal learning of statisticians with their informal workplace learning proposed in this study was informed by key stakeholders in the field of statistics. The practical implementation of this model will be easier for Stats SA than it would be for institutions of higher learning in South Africa. Dedicated resources would be required in order for extensive consultation to take place on the formal learning component of statisticians. The implementation of this framework will also need to be constantly monitored, an aspect that poses a challenge as dedicated resources will be required for this purpose.

The standardisation of formal learning across the various institutions of higher learning would require much consultation and collaboration. This could be a time-consuming process and could probably take a few years to complete.

## **6.6 UNIQUE CONTRIBUTION OF THE RESEARCH**

This research study addressed the existing empirical void, in respect of both theory and practice, relating to the training of statisticians in South Africa. By making use of mixed-method data collection techniques, I was able to identify a gap in the literature and aimed to make a contribution to the existing body of knowledge (Noaks & Wincup 2004) by eliciting meaningful responses from respondents and participants that would enable the creation of a framework to successfully integrate the formal learning of statisticians with their informal workplace learning.

I anticipate that this research study will contribute to the field of official statistics by assisting higher education institutions in South Africa and Stats SA to offer learning content that is relevant for the training of staff working for Stats SA (the largest institution responsible for the production and dissemination of official statistics in South Africa) as well as for those statisticians employed in the broader national statistics system.

Another unique aspect of the integrated framework proposed in this study is its focus on both the demand side (statistical organisations) and the supply side (institutions of higher learning) of the statistics industry. In addition, practical guidelines for the implementation of this framework are provided.

## **6.7 AREAS FOR FUTURE RESEARCH**

Areas for future research could include the following:

- Examining the influence of the relationship between the mentor and the intern statistician in respect of the construction and the transfer of knowledge in the workplace
- Doing a longitudinal study to determine the effectiveness of the suggested framework if implemented and used in the training of statisticians
- Examining the views of permanent staff of the targeted development that interns are exposed to

- Determining whether interns get more developmental opportunities than permanent staff

## **6.8 CONCLUSION**

Chapter 6 brought to a close this research and included the evaluation of the research by the critical reference group. This evaluation of the research was done to establish whether the aims and research questions of this study had been addressed. The research findings and recommendations in respect of integrating the formal learning of statisticians with their informal workplace learning based on responses provided to each of the secondary research questions were addressed. The chapter concluded with discussions of the limitations and the unique contribution of the research study as well as suggestions for future research.

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# **ANNEXURE A: ETHICAL CLEARANCE CERTIFICATE**

## **Ethical Clearance Certificate**

# **ANNEXURE B: PARTICIPANT INFORMATION AND CONSENT LETTER**

## **College of Education**

### **Participant information and consent letter**

**Title of the study: A framework to integrate the formal learning with the informal workplace learning of statisticians in a developmental state**

Research conducted by:

*Ms G van der Berg (35642726)*

*Cell: 082 808 9482*

Dear Respondent

You are invited to participate in an academic research study conducted by Ms Gwendoline Hilary van der Berg, doctoral student of the *College of Education* at the University of South Africa.

The purpose of the study is "To create a framework to integrate the formal and future informal workplace learning of statisticians in order to address statistical skills shortages in Statistics South Africa. Furthermore, the study aims to reach an understanding of this particular case (Statistics South Africa)."

#### **The objectives of the study**

The primary objective of this study is to create a framework to integrate the formal learning and informal workplace learning of statisticians.

The secondary objectives of the research are:

- to understand the views and experiences of respondents and participants regarding the role of institutions of higher learning in South Africa in the work readiness of intern statisticians;
- to obtain respondents' views regarding the integration of their formal learning and informal workplace learning;
- to understand how the informal learning of intern statisticians is supported in the workplace; and
- to obtain inputs and suggestions from respondents and participants as to how institutions of higher learning and Stats SA can work together to ensure the integration of the formal learning and informal workplace learning of statisticians.

Please note the following:

- This study involves a survey ( $\pm$  10 minutes) as well as interviews ( $\pm$  30 minutes). You are not requested to provide your name on the questionnaire. If you wish to do so it will be strictly voluntary and the answers you give will be treated as strictly confidential. You cannot be identified in person based on the answers you give.
- Your participation in this study is very important to us. You may, however, choose not to participate and you may also stop participating at any time without any negative consequences.
- The results of the study will be used for academic purposes only. We will provide you with a summary of our findings on request.

Please contact my study leader, Professor R. Joubert at [hendrikajoubert@gmail.com](mailto:hendrikajoubert@gmail.com) if you have any questions or comments regarding the study.

Should you choose to participate, you are kindly requested to sign the consent form included below to indicate your willingness to voluntarily participate in the study.

Kind regards,

Gwendoline van der Berg

---

**GH van der Berg**

---

**Date**

---

### INFORMED CONSENT

Please sign the form to indicate that:

- you have read and understood the information provided above; and
- you give your consent to participate in the study on a voluntary basis.

I agree  do not agree  to participate in this study

---

**Respondent's signature**

---

**Date**

## **ANNEXURE C: REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT STATISTICS SOUTH AFRICA**

The Statistician-General: Statistics South Africa

**SUBJECT: Permission to conduct research studies in your organisation**

Dear Mr Lehohla,

Permission is hereby sought to conduct research for my doctoral studies offered by the University of South Africa. The title of my thesis is **“A framework to integrate the formal learning with the informal workplace learning of statisticians in a developmental state”**.

The purpose of the study is “To create a framework to integrate the formal and future informal workplace learning of statisticians in order to address statistical skills shortages in Statistics South Africa. Furthermore, the study also aims at an understanding of this particular case (Statistics South Africa).”

The intention of this study is to understand the views and experiences of respondents and participants regarding the role of institutions of higher learning in South Africa in the work readiness of intern statisticians as well as to obtain respondents’ views and experiences regarding integration between their formal and informal workplace learning. Further to this, I intends to understand how the informal learning of intern statisticians is supported in the workplace, as well as to obtain inputs and suggestions from respondents and participants as to how institutions of higher learning and Stats SA can work together to ensure integration between the formal and informal workplace learning of statisticians.

The final thesis in the form of a report with recommendations will then be formulated and communicated to the senior management of Statistics South Africa to hopefully assist the organisation to form a beneficial partnership with the institutions of higher

learning in South Africa in an attempt to address the statistical skills shortages within your organisation.

The following participants will be requested to participate in the research: The Executive Manager for Human Capacity Development, 95 statisticians (former interns) and 10 managers who act(ed) as mentors and who will be selected through non-probability sampling by a purposive method.

The participants will be requested to complete an online survey and to avail themselves for an interview at a date and time that will suit them, so as not to impact negatively on the normal operations of the organisation.

I undertake to adhere to the ethics codes pertaining to these types of research and assure the Statistician-General that all information will be treated with the strictest confidentiality. All participants will be informed of:

- the aims, objectives and methods of the research; and
- the maintenance of confidentiality and anonymity by eliminating any kind of materials or information that could lead others to identify the subject or subjects involved.

It is also further requested that the Executive Manager provide I with the necessary documentation pertaining to the internship, as well as any other relevant information that may enhance the study.

A full proposal is available upon request from I.

Kind regards,  
Gwendoline van der Berg

.....  
Ms G. van der Berg (Student No. 35642726)

.....  
Date



Permission granted Yes

No

.....

Statistician-General

Mr P. Lehohla

.....

Date

## **ANNEXURE D: INTERVIEW GUIDE – MENTORS**

### **A framework to integrate the formal and informal workplace learning of statisticians in a developmental state**

**Interviewer:** Ms GH van der Berg

**Supervisor:** Prof R Joubert

1. Please elaborate on why you would agree/not agree that interns who join your organisation are/are not properly prepared for the world of work?
2. What, in your opinion, should the role of institutions of higher learning be in terms of the work readiness of intern statisticians?
3. What, in your opinion, are the institutions of higher learning currently doing well in preparing statisticians for the workplace, and what can they do differently?
4. What role do you play in ensuring that interns are supported in their quest to acquire learning informally in the workplace with specific reference to the items mentioned below?
  - a) Mentoring
  - b) In-house training or short courses
  - c) Relevant placement to utilise skills
  - d) Feedback
  - e) Communities of practice
5. How, in your opinion, can Stats SA and institutions of higher learning ensure that the formal and informal workplace learning of intern statisticians are integrated?
6. What do you think the benefits could be of merging formal and informal workplace learning for statisticians?

## **ANNEXURE D1: ONLINE QUESTIONNAIRE FOR INTERN STATISTICIANS**

### **A framework to integrate the formal and informal workplace learning of statisticians in a developmental state**

Dear participant,

As explained in the consent letter which you have signed, I am conducting a study to create a framework through which the formal and informal workplace learning of statisticians can be integrated in order to address statistical skills shortages in Statistics South Africa.

I am kindly requesting you to complete this questionnaire by following the link provided below. You may also choose to copy and paste this link into your web browser. I need your help and would highly appreciate it if you would agree to form part of this research. Your participation in this study is very important to us. You may, however, choose not to participate and you may also stop participating at any time without any negative consequences.

This questionnaire should not take more than 7 minutes of your time. Your response is confidential and highly appreciated. Feel free to contact me at any time for more clarity or information regarding this study. My contact details are included in my signature below:

Kind regards,

Gwen



0828089482



vdberg1@unisa.ac.za

# QUESTIONNAIRE

## BIOGRAPHIC INFORMATION

Please complete the following section by placing a tick in the appropriate box to select the relevant option.

\*Required

### **GENDER\***

Please select only one option.

- Male
- Female

### **POPULATION GROUP \***

Please select only one option.

- African
- White
- Coloured
- Indian
- Asian

### **AGE\***

Please choose only one option.

- 19 and under
- 20-24
- 25-34
- 35-44
- 45-54

**LEVEL OF EDUCATION\***

Please select only your highest qualification.

- National Diploma
- Degree
- BTech
- Honours
- Masters
- Doctorate

**CLUSTER \***

Please indicate the cluster in which you are currently employed. Select only one option.

- Economic Statistics
- Population and Social Statistics
- Survey Operations
- Methodology and Standards
- Corporate Relations
- National Statistics Standards

**DIVISION \***

Please indicate the division in which you are employed.

**OCCUPATIONAL LEVEL \***

Please indicate your post level. Select only one option.

- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14

**IN WHICH YEAR WERE YOU AN INTERN IN STATISTICS SOUTH AFRICA?\***

Select only one option.

- 2005
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012
- 2013

**WORK READINESS**

1) Upon joining Stats SA I felt ready and prepared to take on the challenges of the world of work.\*

Please select only one option.

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
----------	----------	----------	----------	----------

Strongly Disagree Strongly Agree

2) The statistics curriculum at the institution at which I studied sufficiently covered the knowledge which was needed from me in the workplace.\*

Please select only one option.

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
----------	----------	----------	----------	----------

Strongly Disagree Strongly Agree

- 3) The statistics curriculum at the institution at which I studied sufficiently covered the skills which were needed from me in the workplace.\*

Please select only one option.

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
----------	----------	----------	----------	----------

Strongly Disagree

Strongly Agree

- 4) What, in your opinion, are the skills which are required to successfully continue a career in Stats SA?\*

Please list the skills.

- 5) Were you taught on these skills during your formal studies?\*

Please select only one option.

Yes	No
-----	----

## UTILISATION OF SKILLS

### Relevant placement

- 6) My qualifications were relevant for the area in which I was placed.\*  
Please select only one option.

①	②	③	④	⑤
---	---	---	---	---

Strongly Disagree

Strongly Agree

- 7) My statistical skills were fully utilised in the area in which I was placed.\*  
Please select only one option.

①	②	③	④	⑤
---	---	---	---	---

Strongly Disagree

Strongly Agree

- 8) The tasks that were assigned to me as an intern were on a professional level.\*  
Please select only one option.

①	②	③	④	⑤
---	---	---	---	---

Strongly Disagree

Strongly Agree

- 9) The tasks that were assigned to me gave me an opportunity to fully utilise my statistical skills which I have acquired during my studies.\*  
Please select only one option.

①	②	③	④	⑤
---	---	---	---	---

Strongly Disagree

Strongly Agree

## SUPPORT IN THE WORKPLACE

- 10) When you joined the organisation as an intern, were you assigned a mentor?\*
- Please select only one option. If no, skip and go straight to question 17.

Yes	No
-----	----

- 11) My mentor assisted me to perform my duties adequately.\*
- Please select only one option.

1	2	3	4	5
---	---	---	---	---

Strongly Disagree

Strongly Agree

- 12) My mentor was an expert in his/her area of speciality.\*
- Please select only one option.

1	2	3	4	5
---	---	---	---	---

Strongly Disagree

Strongly Agree

- 13) My mentor provided me with regular and constant feedback on my performance.\* Please select one option.

1	2	3	4	5
---	---	---	---	---

Strongly Disagree

Strongly Agree

- 14) A proper, well-developed learning plan was in place for my development.\*
- Please select only one option.

1	2	3	4	5
---	---	---	---	---

Strongly Disagree

Strongly Agree

- 15) My learning plan was developed jointly by me and my mentor.\*
- Please select only one option.

1	2	3	4	5
---	---	---	---	---

Strongly Disagree

Strongly Agree

- 16) Steps were taken by my mentor to improve my performance in areas where my skills were lacking.\*  
Please select only one option.

1	2	3	4	5
---	---	---	---	---

Strongly Disagree

Strongly Agree

- 17) I was regularly assessed based on the objectives or outcomes as outlined in my learning plan.\*

Please select only one option.

1	2	3	4	5
---	---	---	---	---

Strongly Disagree

Strongly Agree

- 18) Areas for development were pointed out to me during my assessments.\*  
Please select only one option.

1	2	3	4	5
---	---	---	---	---

Strongly Disagree

Strongly Agree

### TRAINING AND DEVELOPMENT OPPORTUNITIES RECEIVED

- 19) The training that I was exposed to during my internship was relevant for developing my statistical skills.\*

Please select only one option.

1	2	3	4	5
---	---	---	---	---

Strongly Disagree

Strongly Agree

- 20) The training that I was exposed to as an intern was targeted and designed to specifically enhance my statistical skills.\*

Please select only one option.

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
----------	----------	----------	----------	----------

Strongly Disagree

Strongly Agree

21) The short courses (e.g. customer care, emotional intelligence, time and stress management) that I was exposed to adequately prepared me to function as an employee in the organisation.\*

Please select only one option.

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
----------	----------	----------	----------	----------

Strongly Disagree

Strongly Agree

22) As an intern I was given ample developmental opportunities though formal courses.\*

Please select only one option.

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
----------	----------	----------	----------	----------

Strongly Disagree

Strongly Agree