NELSON MANDELA UNIVERSITY

# FACTORS INFLUENCING FIRST-YEAR STUDENTS' CAREER DECISIONS TO PURSUE AN IT CAREER

M TWANI

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Submitted in fulfilment of the requirements for the Master's Degree in Computer Science and Information Systems in the Faculty of Science at the Nelson Mandela University

Supervisor: Prof Andre Calitz

December 2021

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# Abstract

The process of deciding on a career is a daunting and life-changing decision, which all scholars have had to make. Various factors influence a first-year student's career choice decision and selected field of study. Career decision-making, as a field of study, has been extensively researched, globally. The research studies focusing on IT career choices of students have indicated that scholars choosing careers in Information Technology (IT) are influenced by factors such as salaries, knowledge of career opportunities, the reputation of IT-related fields in society and by parents, teachers and role models. Recent research indicates that exposure to new technologies and programming concepts at the school level can influence a scholar's IT career choice.

Theories relating to career choice have focused on the characteristics of individuals and their environment. Career choice models have identified factors that influenced a student's career choice. In South Africa however, there have been limited studies investigating the factors influencing students' career decisions in choosing careers in Computer Science (CS), Information Systems (IS) and Information Technology (IT) using mixed-methods. This study aims to investigate the factors that influence first-year students' decisions in choosing an IT career at the Nelson Mandela University.

The research study pursued a pragmatistic approach, using a mixed-methods approach. In investigating theories and factors that influence students' decisions in choosing IT careers, the study used systematic literature reviews. The decision-making theories and factors in the literature review facilitated the creation of the conceptual framework for IT career decision making.

A questionnaire was developed and distributed amongst IT and Non-IT first-year students in 2021. Four hundred and eight participants completed the survey. The data obtained from the survey were statistically analysed, including descriptive analysis and Exploratory Factor Analysis (EFA). Additionally, inferential statistics were used namely; Correlations, t-test, Confirmatory Factor Analysis (CFA) and Structural Equation Modelling (SEM). The study results were interpreted and compared with other relevant studies. Recommendations were made to address the factors that influence first-year students' IT career decisions.

The study highlighted that high academic confidence and personal attributes amongst students, who were involved at an early age in programming and using computers, chose IT as a career. The study showed significant statistical differences between IT and Non-IT groups in perceptions about the IT industry and identifying job title descriptions. Additionally, a significant statistical difference between languages and genders was identified in understanding careers.

The study proposed and evaluated an IT career choice model, based on existing theories, literature and the results from the EFA. The EFA and statistical results indicated that four factors namely; career awareness, personal attributes, academic confidence and perceptions about the IT industry influenced the first-year student's IT career choice. However, the CFA and SEM results indicated three factors that directly influence students' chosen career decisions namely; Career Awareness, Personal Attributes and Perceptions about IT Industry. The recommendations made in the study include the importance of a child's early learning experiences of using computers to increase enrolments in IT careers. Career Choice Influencers were identified as key influencers in a child's career decision and an effort must be made to inform teachers and families about IT careers. A comprehensive plan is proposed, detailing the strategies that can be used with key activities that stakeholders can use to increase the number of first-year students choosing IT careers at Higher Education Institutions in South Africa.

**Keywords**: Career decision-making, Career choice theories, IT career choice model.

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## List of Abbreviations

4IR – Fourth Industrial Revolution

4IRSA - Fourth Industrial Revolution South Africa

AU – African Union

COVID-19 – Corona Virus Disease

CS – Computer Science

DHET – Department of Higher Education and Training

HE – Higher Education

HEMIS – Higher Education Management Information Systems

ICT – Information and Communications Technology

IS – Information Systems

IT – Information Technology

IT Group – Bachelor in CS, Bachelor in Science CS&IS, B.Com IS, Bachelor IT, National Diploma: IT, and National Higher Certificate: IT

NDP - National Development Plan

Non-IT Group - Bachelors in Commerce, Economics, Finance and Accounting

PSET - Post-School Education and Training

SCCT – Social Cognitive Career Theory

SDG – Sustainable Development Goals

UN – United Nations

USAf - Universities South Africa

# Chapter 1: Background

## 1.1 Introduction

The world embraces the technologies of the Fourth Industrial Revolution (4IR or Industry 4.0) as Africa is riding the wave of digitisation, with South Africa as the leading voice (John & Clinton, 2020). Schofield and Dwolatzky (2019) further note that the government focuses on 4IR as the potential catalyst for productivity improvements and as the driver of innovation and enterprise development. While there is an emphasis on 4IR, sustainable education cannot be ignored as skills needed for 4IR are digital skills, such as software developers, database administrators and user-interface designers. These skills are tightly linked with education (Heleta & Bagus, 2021; John & Clinton, 2020; United Nations, 2020).

Heleta and Bagus (2021) further state that education can contribute to sustainable development and the implementation of the Sustainable Development Goals (SDG) through knowledge production and skills development. However, for the past decade the biggest challenge globally and for the South African (SA) government has been the skills shortage, specifically in the field of Information Technology (IT) (Schofield & Dwolatzky, 2019). The 4IR is reshaping the way of doing business, which marks the survival of businesses (BusinessTech, 2021a). Although 4IR is the driver of digital skills growth, sustainable development is focusing on enhancing education and IT skills in South Africa but there is still a shortage of IT skills.

An ongoing shortage of educated workers to fill jobs requiring IT skills has become elevated more seriously globally (Lyon et al., 2021). In February 2021, BusinessTech (2021a) noted that despite a decline in the trend of hiring software developers, a high demand remains for IT skills in South Africa. Furthermore, when IT jobs supply and demand of skills were compared, summarised in Figure 1-1, it showed IT listed high in demand, while there is a low supply of skilled professionals (BusinessTech, 2021b). Additionally, the ICT skills demand remains unprecedented and climbs as the industry struggles to source skilled professionals to drive the demand of the transition into the digital economy of the 4IR (BusinessTech, 2021a).

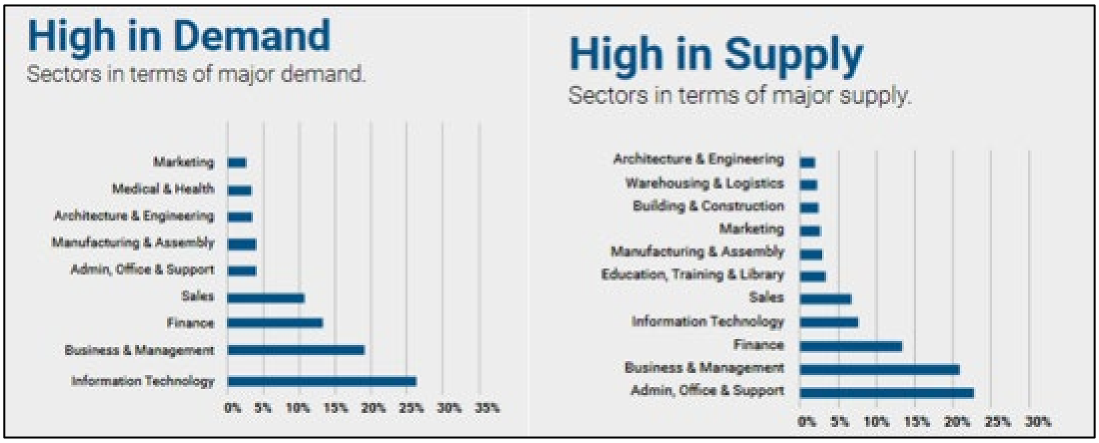


Figure 1-1: Demand versus Supply based on Sectors (BusinessTech, 2021b)

The Career Junction (2020) concurred with the demand, as it showed Software Development skills was the most sought after skill in 2019. Schofield and Dwolatzky (2019), in describing the demand for skills, used words, such as *lack of relevant* experience and *lack of qualifications* in describing the scarcity of IT skills. Furthermore, Kirlidog and Coetzee (2018) note that there is an acute shortage of skilled workforce in Information Technology in South Africa. This fact has been acknowledged by the South African Government.

The report by Vandeweyer (2017) further drives the point as it shows that Information Communication and Technology (ICT) skills in South Africa have been identified as part of the top three scarce skills depicted in Figure 1-2. Additionally, the literature in the past has noted that the shortage of computing skills was a global problem, particularly in the fields of ICT, which include Information Technology (IT), Information Systems (IS), and Computing Science (CS) (Schofield, 2014; Govender & Naidoo, 2013).

In South Africa, Kirlidog and Coetzee (2018) state that the IT skills shortage has resulted in the Department of Higher Education and Training's (DHET) interest in increasing enrolments in the fields leading to ICT careers. Additionally, ICT has been identified by the South African Government cabinet as the key focus for skills development and they aim to increase ICT enrolments nationally (Kirlidog et al., 2018). The shortage of IT skills and graduates has been caused by the decline in enrolments at the tertiary level (Govender & Naidoo, 2013; Mashaw, 2009). Furthermore, it has been noted that while graduates are fewer, the demand for capable ICT graduates remains high (BCS, 2011).

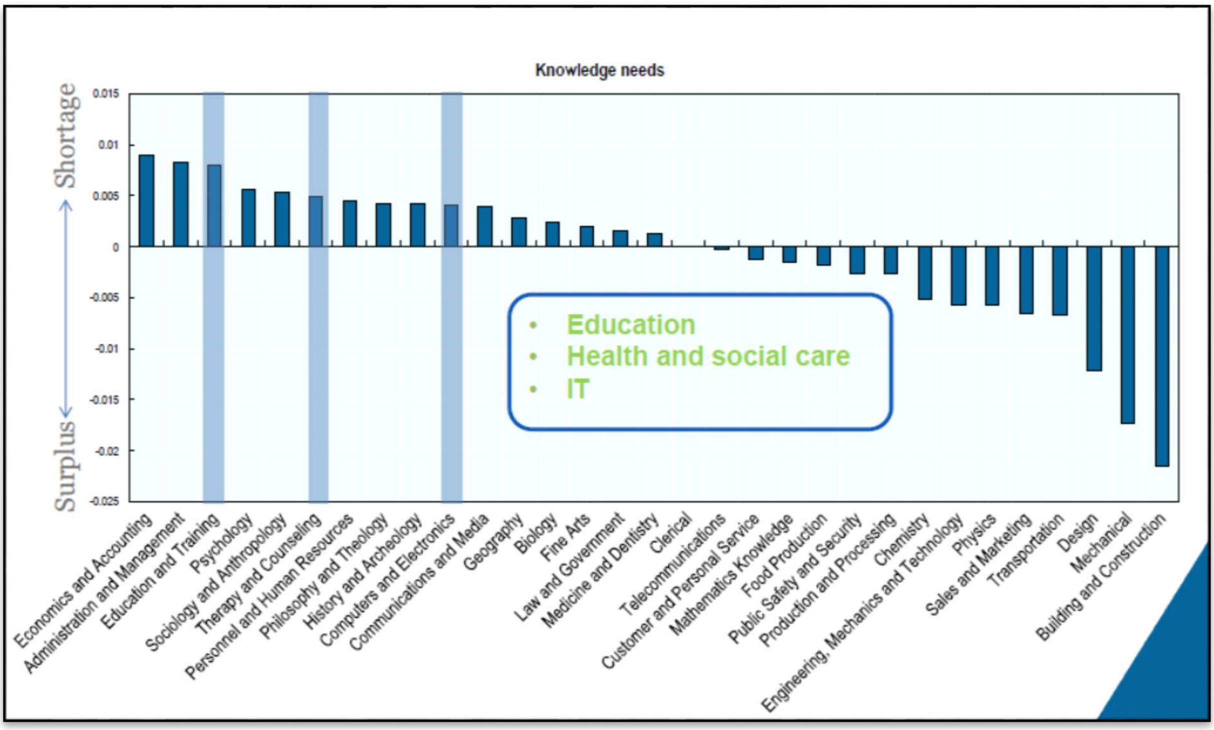


Figure 1-2: Critical Skills in South Africa (Vandeweyer, 2017)

Schofield and Dwolatzky (2019) showed that employers emphasise a graduate degree, post-graduate qualification and internationally recognised standards when seeking new employees. Hence, it is believed that education and technology can bridge the enormous demand versus supply gap and that there is no other way to generate urgently demanded skills and capacities needed to realise and set a sustainable growth plan (Froehlich et al., 2021).

Lyon et al. (2021) further add that emphasis on increasing the number of graduates can address the ongoing IT skills shortage. While Kirlidog and Coetzee (2018) note that IT education and enrolments in South Africa must be monitored and analysed to help to keep track of the supply of graduates and further aid in understanding the influences on students' decisions to pursue ICT careers. Additionally, it is vital to check the status of the current availability of IT skills and compare it against the industry demands, so that any discrepancies can be remedied in time (Dubey et al., 2021). Therefore, IT skills must be balanced with demands in the industry, hence monitoring enables maintenance and balance.

With industry demands as a priority, universities globally have begun to investigate factors such as interest and participation in IT careers. There has been an increase in the United States of America enrolments in Computing courses which have increased IT student numbers (Aivaloglou & Hermans, 2019). Calitz (2010) noted that several factors affecting IT career choices have been extensively researched in the South African environment. Kirlidog and Coetzee (2018) further state that there is a growing body of research on IT education issues in South Africa. Some studies show factors influencing students' career decisions. Perceptions of Computer Science vary, based on gender, culture and factors, such as experience working with computers. Furthermore, other studies highlighted dominant influential factors, such as future expected earnings, preference for work and the ability to do the work (Arcidiacono et al., 2012; Becerra-fernandez et al., 2010; Carrico et al., 2019). More factors are influencing IT students' career decisions and a further detailed discussion is presented in Section 3.5.

The Department of Computing Sciences at the Nelson Mandela University offers degree programmes in the Science Faculty, namely a BSc in Computer Science and B.Com in Information Systems programmes in the Commerce Faculty. The School of IT offers certificates, diplomas and advanced diplomas in IT. Additionally, the School of IT offers a bachelors degree in IT. When the study refers to IT qualifications, this study refers to the BSc CS, BSc CS & IS, B. Com IS, BIT, NDip: IT, and NH Cert qualifications in the context of Nelson Mandela University.

The subjects, Accounting and Economics are part of the serious skills shortage in South Africa, as shown in Figure 1-2. On the contrary, compared to the IT field, the supply for the Business field is high, as shown in Figure 1-1. Accounting and Economics are included in degree courses, such as the Bachelor in Commerce degree (B.Com), which has several majors, including Accounting, Economics, Finance or Management (Govender & Naidoo, 2013).

A study at the University of KwaZulu-Natal, which examined factors influencing females choosing B.Com IS as a career, identified that an interest in the field, perceptions of computers and self-efficacy were the determining factors for those female students (Govender & Khumalo, 2014). There have been several studies investigating the factors that influence students' decisions to choose B.Com IS studies (Govender & Khumalo, 2014; Matthew et al., 2018). Therefore, the B.Com IS first-year students will also be part of this study, as data will also be collected from the B.Com IS first-year degree group at NMU. The Non-IT group, of students, includes the subjects Accounting, Accounting Sciences, Economics, Finance, Management, and other B.Com degree courses at Nelson Mandela University. Finally, the results from the Non-IT group (Accounting, Accounting Sciences, Economics, Finance, Management) will be compared with the first-year student in the IT group (BSc CS, BSc CS&IS, B. Com IS, NDip: IT, BIT, and NHert Cert: IT) and the results will be used to make recommendations on addressing the factors influencing IT first-year students and Non-IT first-year students.

This study explores the factors influencing first-year students' career decisions to pursue IT careers. The study aims to identify the factors influencing first-year student decisions in choosing an IT career. The factors are established by using career decision-making theories and a theoretical model is developed to conceptualise the factors that influence a career choice. The model will be developed and empirically evaluated. A comparison of the factors influencing the first-year students enrolled for Non-IT (Accounting, Accounting Sciences, Finance, Management, Economics) courses versus students enrolled for IT courses (BSc CS, BSc CS&IS, BIT, NDip IT, and NH Cert: IT), will be made. Finally, recommendations will be made to the Department of Computing Sciences and the School of IT at NMU to create awareness of the factors influencing scholars' IT career choices. Figure 1-3 depicts the layout of the contents of this chapter.

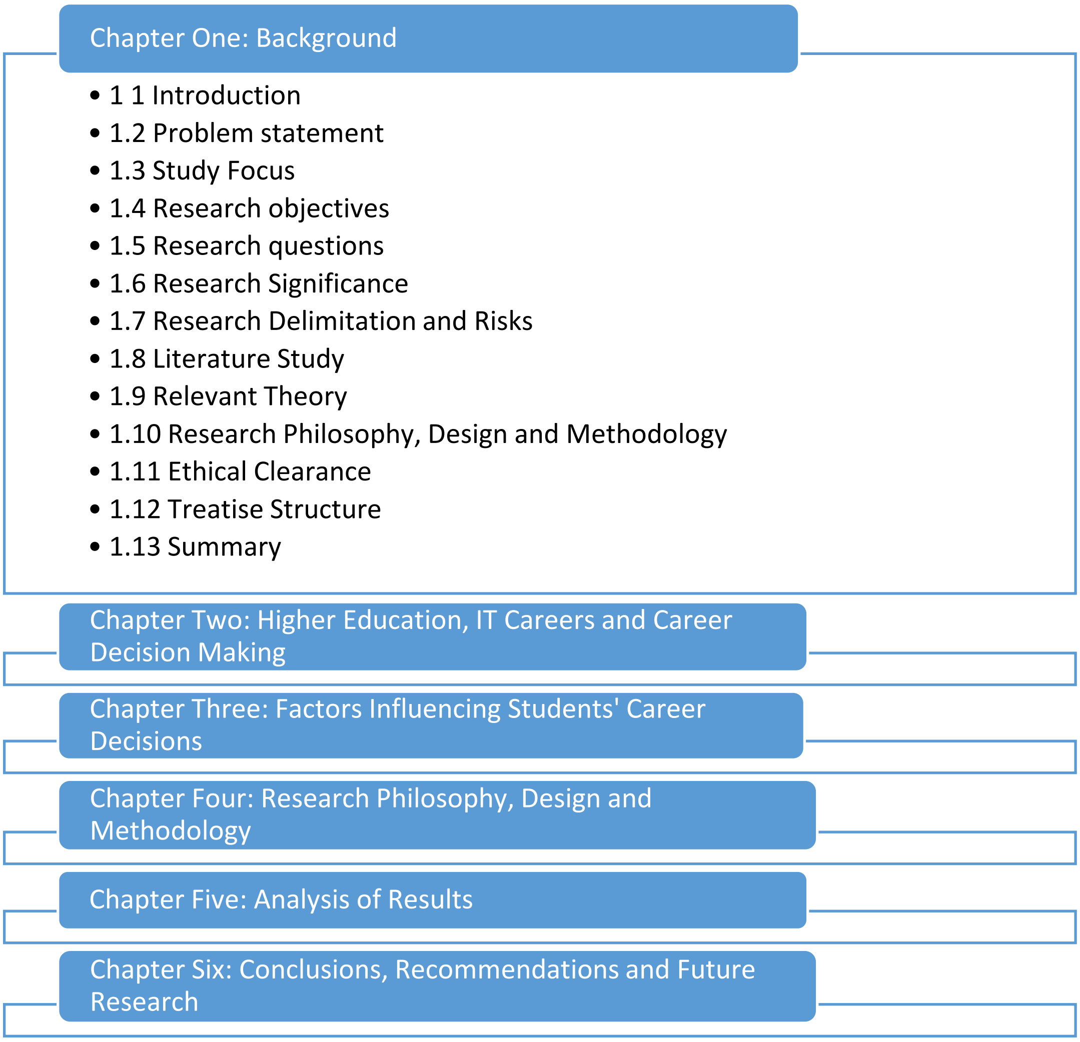


Figure 1-3: Chapter One Layout

## 1.2 Problem statement

Universities across the world have been viewed as training centres that can contribute to a country's intellectual development (John & Clinton, 2020). Developing the required skills requires many years and with the influence of the Fourth Industrial Revolution (4IR), it is important to address the skills needed by businesses at present and also in the future (Schofield & Dwolatzky, 2019). While there is a drive for the 4IR, there are challenges faced in developing countries, such as high unemployment rates and a lack of IT skills (Mayer & Oosthuizen, 2020).

John and Clinton (2020) add that with the advent of the 4IR, HEIs will be under pressure to produce students who are digitally savvy and multi-skilled to handle the

4IR challenges. However, they state that the decline in the number of IT professionals entering the industry, will have serious implications, such as the impact on the human capital potential (Breytenbach & De Villiers, 2015). Cloete, Maasen and Pillay (2017) support this view as they state that there is a remarkable association between countries that have a high rate of participation in Higher Education and the country's economy. Their study showed high levels of returns in innovation, economics and competitiveness for countries with high participation at the tertiary level when compared to the return for countries with a low rate of participation at the tertiary level.

Higher Education Institutions (HEIs) interventions have focused on the recruitment of students at HE particularly in the IT field (Kirlidog et al., 2018; Lyon et al., 2021). Dubey, Paul and Tewari (2021) add that increasing the supply of a skilled workforce in the IT field through HE will provide increased competitiveness. Therefore, the declining number of IT graduates must be addressed, as the decline and the shortage of IT professionals will impact a country economically and competitively.

HEIs play a central role in producing highly qualified graduates that can be employed in the industry. In improving the production of knowledge at HEIs, it is therefore important to understand the challenges and factors confronting a scholar's career decisions (Cloete et al., 2017). A study that investigated factors influencing the career decision of scholars at high school to choose to study at an HEI, indicated that parents, teachers, self-efficacy and academic experience attribute to success (Chinyamurindi et al., 2021). Furthermore, Chinyamurindi et al. (2021) recommended that exploring more factors that affect career planning and decision making will give further insight into understanding the influences.

Lyon et al. (2021) argue that factors, such as self-efficacy, interest, and outcome expectations should be investigated as these would aid in understanding the career decisions by scholars. Therefore, this study aims to understand the factors influencing first-year students' career decisions in choosing an IT career.

In order to understand the factors, this study uses theory to underpin the investigation to identify and understand the reasons and the factors that influenced students to choose to study IT courses. Nugent et al. (2015) assert that in building and refining theory, it is important to test the principles in different instructional contexts with a variety of populations, settings, academic disciplines and different age ranges. Therefore, this study will investigate several theories in the career decision-making field and apply them in the context of IT career choices to understand the factors influencing students' decisions to pursue IT careers.

Alshahrani, Ross and Wood (2018) state that by understanding the reasons and influences of scholars' career decisions, it may be possible to influence the decisions of scholars to choose IT careers. Therefore, this study while investigating influences amongst IT students and Non-IT students, will compare the factors that influence their career decisions. Babin, Grant and Sawal (2010) state that is also important to understand why students decide not to choose an IT career as this broadens the understanding of the factors that influenced their career decisions. A theoretical model will be developed underpinned by theories based on several general decision-making theories.

The theoretical model will formulate a systematic way of identifying the factors that influence scholar career decisions. Finally, recommendations will be proposed on how to address the factors, which influence students to decide to choose IT careers. Cloete et al. (2017) emphasise that it is important to identify ways of handling the challenges in HE, as it impacts the economy and skill shortages in the future. Therefore, the outcome of this study will be to recommend guidelines and strategies to the stakeholders such as the Computing Science Department, the School of IT, Schools, Parents, Scholars and the IT industry to address the challenges.

The main research problem addressed in this study is as follows: *Several factors influence first-year students' decisions to pursue IT careers at NMU; however, the Department of Computing Sciences and the School of IT do not know which factors influence first-year students decision to choose an IT career***.**

## 1.3 Study Focus

The research study was conducted at the Nelson Mandela University (NMU) in Port Elizabeth. Two stakeholders within the university are the Department of Computing Sciences and the School of IT. The other stakeholders include the faculties of Science, Commerce, students and lecturers in the mentioned faculties. The university has over 27000 students, with 8000 enrolling as first-year students every year.

NMU has the Department of Computing Sciences, offering mainly BSc and B.Com CS & IS programmes, and the School of IT that caters for students pursuing careers in mainly, diploma and BIT degree qualifications. However, the study was not limited to the IT first-year students, as Non-IT students also enrolled in some IT services courses. The intended numbers of students that will be surveyed in total were 2700 students, making the study target sample 337 participants, at a 95% confidence level.

The study aims to compare students who chose a career in IT with students who registered for other qualifications at NMU. The study will provide recommendations on how CS and IS departments of HEI's can influence scholars' decisions regarding careers in the IT industry.

## 1.4 Research Objectives

The Main Research Objective ($RO_M$) of this study is *"Identify the factors influencing first-year students, career decision to pursue an IT career."*

The following secondary research objectives have been identified:

- $RO_1$: Investigate Higher Education in South Africa and current IT Careers.
- $RO_2$: Develop a conceptual model of the factors influencing career decisions of first-year students.
- $RO_3$: Develop a data collection instrument that can be used to evaluate the conceptual model of the factors influencing career decisions of first-year students.

- $RO_4$: Empirically evaluate the conceptual model of the factors influencing first-year students' career decisions.
- $RO_5$: Identify strategies that can be used to address the factors influencing first-year students' career decisions.

## 1.5 Research Questions

The Main Research Question ($RQ_M$) for the study is "*What factors influence first-year students, career decision to pursue an IT career?"*

To analyse the main research question effectively, some sub-questions will support the main research question, which are based on secondary research objectives that need to be addressed:

- $RQ_{1.1}$: What is the environment of Higher Education in South Africa?
- $RQ_{1.2}$: What IT Curricula are available at Higher Education Institutions?
- $RQ_{1.3}$: What IT Careers are available in Industry?
- $RQ_{2.1}$: What theories are used to understand the factors influencing career decision-making?
- $RQ_{2.2}$: What factors influence students' career choices?
- $RQ_{2.3}$: Which factors must be included in a conceptual model to understand the career decisions of first-year students?
- $RQ_{3.1}$: What research design can be used for the study?
- $RQ_{3.2}$: What research instruments can be used for data collection?
- $RQ_{4.1}$: What factors did the empirical study highlight as influencing students, IT career decisions?
- $RQ_{4.2}$: What factors influence the career decisions of the IT students, compared to Non-IT students?
- $RQ_{4.3}$: What factors influence first-year students' IT career choice?
- $RQ_{5.1}$: How can the IT Career Choice Model be used to inform strategies to create IT Career awareness?
- $RQ_{5.2}$: What strategies can be used to address the factors influencing the decision of students to pursue IT careers?

The research for the study is organised through a research alignment plan which is illustrated in Table 1-1. This research alignment plan consolidates how the research questions and objectives fit into the overall research process, including the dissertation chapters.

Table 1-1: RQ's and RO's Integration (Author's Construct)

| Problem Statement: Understanding the factors that influence a student to pursue a career in IT. | | |
|---|---|---|
| **Main Research Question $RQ_{M:}$ What factors influence first-year students to decide to pursue a career in IT?** | | |
| **Main Research Objective $RO_{M:}$ Identify the factors influencing first-year students career decision to pursue an IT career.** | | |
| **Chapter** | **Research Question** | **Research Objectives** |
| **Chapter 2:**<br><br>**Literature Review: Career Decision Making** | $RQ_{1.1:}$ What is the environment of Higher Education in South Africa?<br><br>$RQ_{1.2:}$ What IT Curricula are available at Higher Education Institutions?<br><br>$RQ_{1.3}$: What IT Careers are available in Industry? | $RO_{1:}$ Investigate Higher Education in South Africa and current IT Careers. |
| **Chapter 3:**<br><br>**Literature Review: Factors Influencing Career Decision Making** | $RQ_{2.1:}$ What theories are used to understand the factors influencing career decision-making?<br><br>$RQ_{2.2:}$ What factors influence students' career choices?<br><br>$RQ_{2.3:}$ Which factors must be included in a conceptual model to understand the career decisions of first-year students? | RO2: Develop a conceptual model of the factors influencing career decisions of first-year students. |

| | | |
|---|---|---|
| **Chapter 4:**<br><br>**Research Design and Methodology** | $RQ_{3.1:}$ What research design can be used for the study?<br><br>$RQ_{3.2:}$ What research instruments can be used for data collection? | RO3: Develop a data collection instrument that can be used to evaluate the conceptual model of the factors influencing career decisions of first-year students. |
| **Chapter 5:**<br><br>**Research Results and Analysis** | $RQ_{4.1:}$ What factors did the empirical study highlight as influencing students, IT career decisions?<br><br>$RQ_{4.2:}$ What factors influence the career decisions of the IT students, compared to Non-IT students?<br><br>$RQ_{4.3:}$ What factors influence first-year students' IT career choice? | $RO_{4:}$ Empirically evaluate the conceptual model of the factors influencing first-year students' career decisions. |
| **Chapter 6:**<br><br>**Conclusions, Recommendations and Future Research** | $RQ_{5.1:}$ How can the IT Career Choice Model be used to inform strategies to create IT Career awareness?<br><br>$RQ_{5.2}$: What strategies can be used to address the factors influencing the decision of students to pursue IT careers? | $RO_{5:}$ Identify strategies that can be used to address the factors influencing first-year students' career decisions. |

## 1.6 Research Significance

Research can be classified into two main categories, namely, applied research and basic research. A study that is designed to solve an existing and specific problem is described as applied research, whereas a study designed to provide theoretical understanding and general knowledge is classified as basic research (Collis & Hussey, 2014). The research study is applied research as the study consists of identifying factors that influence a student's decision to choose IT as a career.

Furthermore, the study results can be used to address the existing problem of the decline in the number of professionals in the IT field. Identifying the factors is necessary as the first step in understanding the decline of the number of graduates in the IT field (Finzel & Deininger, 2018). The study will aim to create a new understanding of existing factors that influence first-year students to choose IT as a career and this knowledge will help in advising future scholars and students on the choices of IT as a career.

Considerable research has been undertaken globally over the years on career choices and the results have been the development of models, frameworks and theories (Aivaloglou & Hermans, 2019). The research findings are often undertaken in high student enrolment fields, such as business sciences and at large academic institutions (Brown, 2002). The models and frameworks however are not generalisable to smaller universities, due to differences including location, ethnic demographics and cultural dynamics. Given the range of personal and cultural factors that affect a student's career choice, it is critical to study career choice in context (Lent & Brown, 2006). Therefore, the study will uncover contextual factors that are experienced by the students in the Eastern Cape at the Nelson Mandela University.

Moreover, identifying the factors that influence a student's decision to choose a career in the IT field will be grounded on various decision-making theories. The theory allows a study to follow a systematic way of investigating a problem. The study will be based on the contribution of existing theories and the work of other researchers will thus be extended by expanding existing theories. Furthermore, a conceptual model will be developed to help understand the factors that influence a student's career decision. The new knowledge can be added to understanding the theories. Therefore, this study could contribute to a deeper understanding of theory through the evaluations of the conceptual model to be used in the field of decision-making.

While this research study focuses on factors influencing the decisions in choosing IT careers, the study simultaneously investigates factors that influence first-year students' decisions in Non-IT fields. This study compares the IT first-year students with Non-IT students and the results are used to make recommendations to improve the recruitment of IT students. Furthermore, the conceptual model will be evaluated using Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). To the author’s knowledge, there has never been a similar study undertaken at NMU and there is limited knowledge on this topic in South Africa.

Finally, research studies on the factors influencing students’ decisions and decision making are unknown at NMU and only limited research on the factors influencing first-year students’ in their choice of careers and decision making has been undertaken in South Africa. It is hoped that this research study will contribute to the creation of new knowledge in these areas.

### 1.7 Research Delimitation and Risks

This research is conducted in the Higher Education sector. Presently, there are twenty-six public universities in South Africa. This study focuses on Nelson Mandela University. The reasons for choosing this public university were:

- There are no studies, to the researcher's knowledge that investigate the factors influencing the decision of first-year students to choose IT careers at Nelson Mandela University; and
- There are not many recent studies that report on the factors influencing first-year enrolments in the IT field in South Africa.

This research will aim to investigate the factors that influence first-year students’ decision to pursue IT careers, at the Nelson Mandela University. The study will develop a proposed conceptual model that highlights the factors that influence first-year career choices. The research will be limited to NMU first-year students who are enrolled for Non-IT courses such as Bachelors in Commerce, Economics and Accounting, and compared with students enrolled for IT courses, such as Bachelors of Science in Computer Science, Bachelor degree in Commerce in Computer Science and Information Systems, Bachelor in Information Technology, National Diploma in Information Technology and National Certificate in Information Technology.

In order to participate in the study, the participants had to be functionally literate in English, to complete the questionnaire. Additionally, the participants had to be enrolled for first-year studies and be eighteen years or older.

Possible risks associated with this research are linked to the context of the study:

- As the study was conducted in 2021 and courses offered online, requesting students to participate in the study could be problematic; and
- Another possible risk could be limited participants for the study, as the targetted participants are first-year students many will be new to the university environment and may lack familiarity with the online environment. The identified risks could influence the results and the analysis phase of the study.

To mitigate the two risks identified, email reminders have been sent to the students, thanking those who have completed the questionnaire and requesting that the participants who have not responded in the study to do so.

### 1.8 Literature Study

A literature review was undertaken to define Higher Education, ACM Curricula of IT, IS and CS courses. The literature review was undertaken to get a better understanding of Higher Education in South Africa concerning IT courses and programme offerings. Additional to the literature review, a Systematic Literature Review (SLR) was conducted, to investigate the factors influencing the students' decision to pursue careers, the theories used in decision making and the methods applied in the research studies. The information for both the literature review and the SLR was gathered from various sources, such as academic journals, books, research publications and reports to address the research questions and objectives of this study. Furthermore, a conceptual model was developed based on existing decision-making theories and an instrument was developed for testing the model. The questionnaire was operationalised from the literature reviews. A comprehensive literature reference list is included for review at the end of this document.

### 1.9 Relevant Theory

The study is underpinned by career decision-making theories, in particular, the Social Career Cognitive Theory (SCCT). The SCCT has been developed from Bandura's (1986) general social cognitive theory and aims to understand the processes and outcomes, whereby individuals develop interest and make decisions about their educational and occupational pursuits. Furthermore, the application of SCCT in social sciences has become a common practice. In this study, a conceptual model was developed to guide the study on the factors influencing students' career decisions and was underpinned by SCCT and with other theories on career decision-making. The Conceptual Model allowed for the factors influencing first-year students’ decision to pursue IT careers to be observed and statistically analysed in a systematic approach.

### 1.10 Research Methodology and Design

The following sub-sections focus on the research philosophy, methodology, design and the research procedures for this study.

#### 1.10.1 Research Philosophy

Given (2008) states that positivism has historically been the dominant paradigm on how research is conducted, defined and communicated. Positivism is the view of social science based on universal truths, with the role of research being to uncover the truths (Yin, 2011). Therefore, positivism is a philosophical stance that entails working with observable social reality to produce law-like generalisation (Saunders et al., 2019). Therefore, for this study, the philosophy of positivism is applied, the researcher is objective and the research will aim to influence decision-makers and changes agents.

#### 1.10.2 Research Approach

There are two contrasting approaches deductive and inductive and the research approach applied in this research study is deductive (Saunders, Lewis & Thornhill, 2009). The inductive approach starts with evidence, particulars and builds theories and the explanation and interpretations represent those particulars (Given, 2008). Yin (2011) purports that inductive approaches let data lead the emergence of concepts, therefore, this research study follows the deductive approach, as the study uses the phenomena through a conceptual model underpinned by existing theories to arrive at conclusions. Additionally, the understanding of the themes will be through the lens of the conceptual model as that allows data collection and the analysis of results within specified fields.

### 1.10.3 Research Strategy

Research strategies can be used for exploratory, descriptive and explanatory research and the research strategies can be applied to either deductive or inductive approaches (Saunders et al., 2019). Creswell (2011) lists: Experimental, Correlational, Survey, Grounded Theory, Ethnography, Narrative, Mixed and Action research as research strategies that can be applied in a research study. For this research study, a survey strategy was used as surveys can be administered to a sample to describe attitudes, options and behaviours or characteristics of a population (Creswell, 2011).

### 1.10.4 Research Choices

Saunders et al. (2019) state that research choices can combine quantitative and qualitative techniques and procedures. Furthermore, studies can be mono-method or multiple-method studies. Multiple-methods studies can be divided into multi-method and mixed-methods studies (Saunders et al., 2019). This research study uses mixed methods as it combines quantitative and qualitative data collection techniques. The research methodology of the study is mixed-methods, with the more dominant method being the quantitative method. Triangulation/Convergence design is the most commonly used for mixing methods and its purpose is to obtain different complementary data on the same topic (Creswell et al., 2006; Morse, 1991). The convergence design involves the concurrent collection of data, a separate analysis of quantitative and qualitative data so that the researcher can detect the research problem (Creswell et al., 2006). Therefore, method convergence design was applied in the collection and analysis of the results in this study.

### 1.10.5 Time Horizon

There are two types of time horizons that are used in research, cross-sectional and longitudinal, which are both determined by the time data are collected (Creswell, 2011). The time horizon is identified as cross-sectional as the research data are collected in a specific period and over a short period (Creswell, 2011; Saunders, Lewis & Thornhill, 2009).

#### 1.10.6 Techniques and Procedures

This section focuses on the techniques and procedures that were used for data collection, sampling processes and data analysis.

##### 1.10.6.1 Data Collection

This research study consists of both primary and secondary data to validate the findings. The secondary data were used in a literature review discussed in Chapter Three, and an instrument was developed in Chapter Four that was used to collect the data based on secondary data obtained from the literature. The data obtained from the survey was the primary data. The questionnaire was developed to gather data from respondents. The questionnaire gathered information from NMU students enrolled in their first year of studies. The students have to be enrolled for IT and Non-IT courses as defined in the background.

The questionnaire was used for both quantitative and qualitative data collection. The quantitative part used closed-ended statements, which used different metrics to collect data from participants such as Multiple-choice, Dichotomous items, Lists and Likert scales. The qualitative part contained open-ended questions. Open-ended questions are widely used in in-depth questionnaires as they allow participants to voice their unconstrained experience and opinions (Saunders et al., 2009).

##### 1.10.6.2 Sampling Process

This study was limited to first-year students from Nelson Mandela University, which provided the unit of analysis for the study. Creswell et al. (2006) state that if an entire school is selected, the researcher needs to consider what individuals will be part of the study as this is the target population. Therefore, the target population for this study was first-year students. The target sample is the subgroup that will be used for generalising from the target population and this study’s target sample is first-year students enrolled for Non-IT courses, such as B.Com Business, Economics and Accounting and IT courses, such as BSc CS/IS, B.Com IS, NDip Information Technology and NH Cert in Information Technology.

A stratified sampling procedure was used as the researcher divided the population on the characteristics of the first-year student's enrolment and by using random sampling to obtain a sample from the first-year group (Creswell, 2011). Stratified sampling brings balance to the analysis of results, especially when there are few respondents for a specific group, stratified sampling will rectify such imbalance.

The target first-year student population was 2730 students. The sample size for the study is 337, considering a confidence level of 95% with a 5% margin of error. Therefore, selecting a large sample size allows for a smaller margin of error as there will be fewer differences between the sample and true population. Furthermore, non-sampling issues were addressed, such as observations biases, communication biases and induced biases. Lastly, validity and reliability were addressed.

#### 1.10.6.3 Data Analysis

After the data have been collected, the computer software was used to help clean the data of any errors in preparation for statistical analysis. Microsoft Excel, Statistica and Amos were used to perform statistical analysis on the collected data. As the study is a mixed-method study, both quantitative and qualitative analyses were undertaken. The quantitative data were statistically analysed by using both descriptive and inferential statistical analysis. Furthermore, the results of the IT group and the Non-IT group were compared and the results were used when making recommendations to the stakeholders. Thematic analysis was applied to the qualitative data obtained. The qualitative data was quantified and compared with the quantitative results by applying a convergent design.

## 1.11 Ethical clearance

Creswell (2011) states that a need for attention to ethical issues arose out of the inhumane treatment of participants in past years, as a result, organisations issued reports governing good ethical practices. Hence, Collis and Hussey (2014) state that when research involves human or animal subjects, it is a generally accepted practice to obtain ethical clearance. Creswell (2011) adds that it is good for researchers to anticipate ethical issues throughout the research process. Therefore, for this study, an Ethical Clearance has been approved by the NMU Ethics Committee under the ethics number: H20-SCI-CSS-008.

### 1.12 Treatise Structure

The treatise layout represented in Figure 1-4 depicts the chapter layout and links each chapter's research questions and research objectives, which seek to address the main research problem.

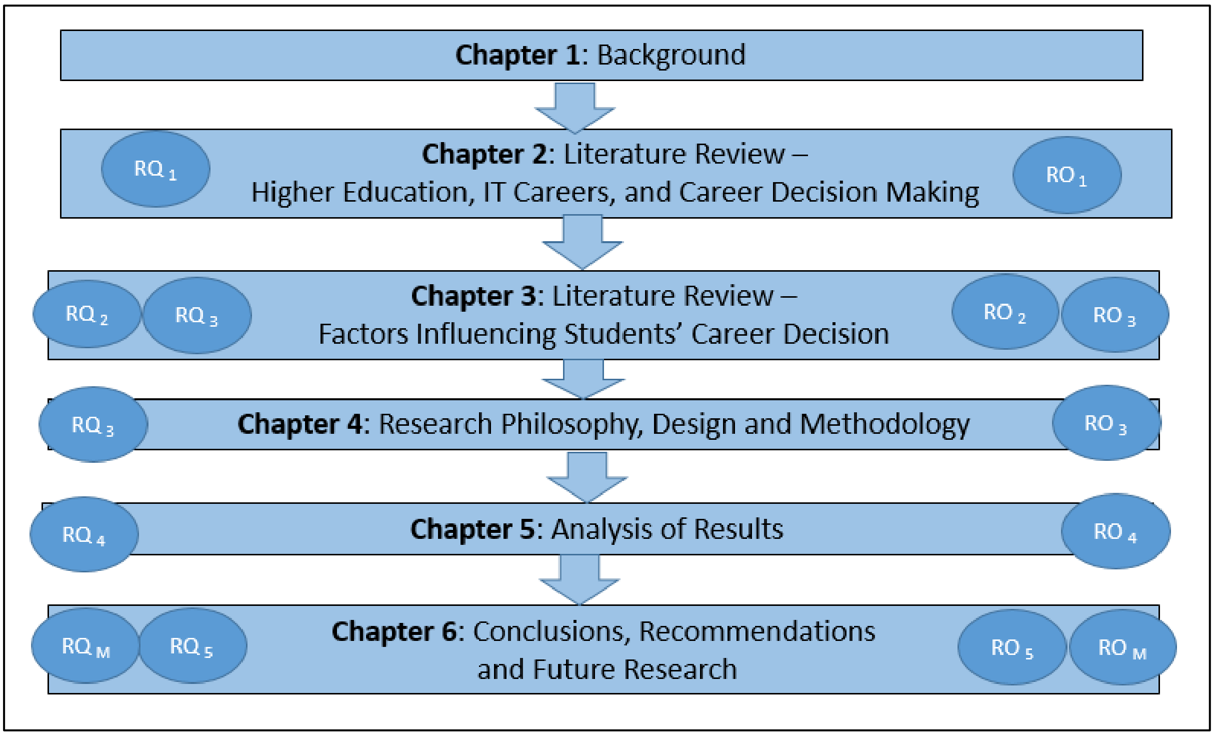

Figure 1-4: Chapter Layout (Author's Construct)

#### 1.12.1 Chapter One: Introduction

The chapter provides an overview of the proposed study, focusing on the background, to the research problem, which is investigating factors that influence the decision of first-year students to pursue IT careers. Furthermore, the chapter focuses on the research question and objectives that will be addressed in the study. The chapter gives a synopsis of the purpose of the study, the limitations and the research significance. Finally, an overview of the methodology followed in the study was discussed.

### 1.12.2 Chapter Two: Higher Education, Careers and Decision Making

Chapter Two outlines the research background by discussing the research setting and context. The chapter continues by defining the Higher Education environment globally and in South Africa. The chapter then focuses on where the research takes place with a focus on IT careers, students and ACM curricula. Finally, the chapter considers careers linked with IT curricula and decision-making.

### 1.12.3 Chapter Three: Factors influencing students' career decision

Chapter Three initially uses the Systematic Literature Review (SLR) to continually review the literature on career decision-making. The SLR undertakes an in-depth investigation of the factors, theories and methods applied in the field of decision making. The chapter uses the SLR to synthesise the theories used in literature as the basis for discussing the theories that will be applied in this study. Secondly, the chapter focuses on the factors influencing students' career decisions and discusses them in order to build a conceptual model. Finally, the chapter proposes a conceptual model that is developed from theories of the decision-making field.

### 1.12.4 Chapter Four: Research Design and Methodology

Chapter Four focuses on the development of the research instrument for the study, which will be used to empirically test the conceptual model proposed in Chapter Three and the data collection procedures. The chapter initially discusses research, the definition and philosophies of research and how they are applied in the study. Additionally, the chapter scrutinises the mixing of methods and applies the methods to the research study. A discussion of the survey tool development is undertaken to focus on both the qualitative and quantitative instruments and the analysis of results. Finally, the chapter focuses on piloting the instrument and how issues from the pilot were addressed and adopted in the instrument with ethical considerations.

### 1.12.5 Chapter Five: Analysis of Results

The chapter presents the analysis of the results, first using quantitative analysis, followed by qualitative analysis. Quantitative statistics focus on descriptive statistics, such as demographics and the profile of respondents, followed by inferential statistics such as t-test, Relationships between factors and Correlations. The qualitative analysis follows using thematic analysis by developing different themes of the open-ended questions. Finally, the chapter triangulates quantitative and qualitative results and synthesises the findings with other literature findings.

### 1.12.6 Chapter Six: Conclusions, Recommendations and Future Research

Chapter Six focuses on the conclusions and recommendations of the study, based on the statistical results presented in the preceding chapter. The chapter outlines recommendations to the relevant stakeholders to create IT Career awareness. The limitations of the study are presented and possible future research are discussed.

## 1.13 Summary

The main aim of the study is to investigate factors that influence the decision of first-year students to choose IT careers. Chapter One introduces the research study, problem and the research questions and associated research objectives that are addressed in the dissertation. Additionally, Chapter One outlines the significance of the study and details the process and methods of data collection that will be used for data analysis. Finally, the chapter outlines the research alignment plan, which illustrates and connects all chapters to specific research questions and objectives.

Chapter Two will address $RO_{1:}$ Investigate Higher Education in South Africa and current IT Careers by discussing higher education, IT curricula in South Africa, IT Careers and finally discussing the career decision-making process.

# Chapter 2: Higher Education, IT Careers and Career Decision Making

## 2.1 Introduction

Chapter One provided the background of this research study, focusing on the problem statement, research questions and objectives. Chapter Two focuses on the research setting and the context of the study by addressing $RO_{1:}$ Investigate Higher Education in South Africa and current IT Careers.

Therefore the chapter discusses the Higher Education environment, the ACM Computing Curricula and IT Career as outlined in Figure 2-1. By examining the Higher Education environment, the study focuses on universities globally and then focuses on South Africa, with an in-depth discussion of the Nelson Mandela University. Thereafter, the chapter discusses the challenges faced in Higher Education globally and specifically in South Africa. The chapter further discusses the research setting that is Nelson Mandela University (NMU), focusing on NMU history and student profiles. The author compares NMU with other Higher Education Institutions in South Africa, using student enrolment figures and research publication outputs as comparison variables. This addresses $RQ_{1.1:}$ What is the environment of Higher Education in South Africa?

The chapter answers $RQ_{1.2:}$ What IT Curricula are available at Higher Education Institutions? The chapter discusses ACM Computing Curricula for Information Technology, Information Systems and Computer Science and highlights their applications at NMU as shown in Figure 2-1. Further, the chapter highlights differences and overlaps of the ACM IT curricula.

Finally, the chapter addresses $RQ_{1.3}$: What IT Careers are available in Industry? Discussing IT careers based on the ACM curricula and focuses on the impact of 4IR on IT careers, and students' decision to choose an IT career. In addition, the chapter examines the career decision-making process that students have to make.

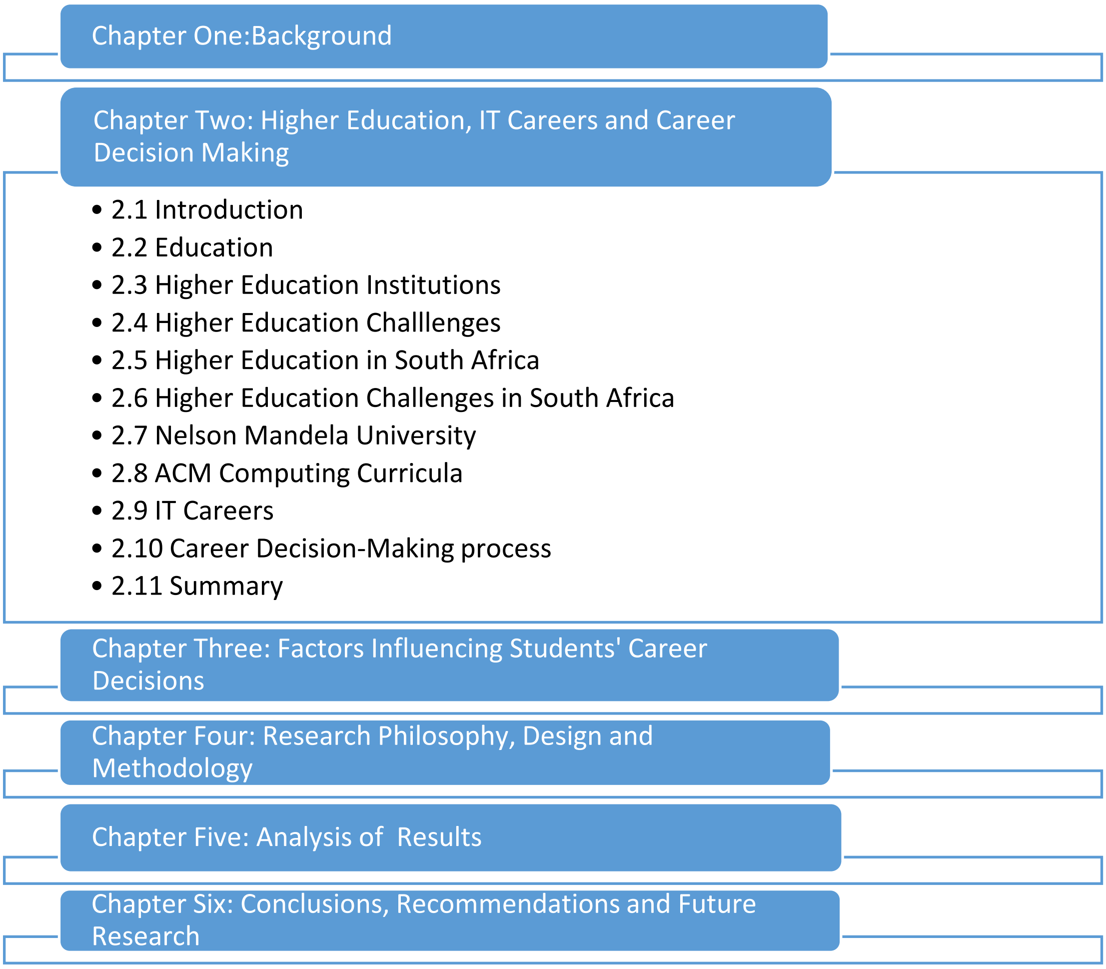


Figure 2-1: Chapter Two Layout

## 2.2 Education

Education has been considered a critical factor in Sustainable Development since the time of the 1972 Stockholm Conference, which encapsulated principles of the United Nations on the human environment (Froehlich et al., 2021). Recently, education has been highlighted as one of the Sustainable Development Goals (SDG4), which targets an inclusive and equitable quality education and promotes lifelong learning opportunities for all (United Nations, 2020).

The United Nations (2020) reports that despite progress, the world is not on track to meet its 2030 education targets. Recently, education systems worldwide have been hit by the Corona Virus Disease (COVID-19) pandemic, and the disruptions have adversely affected the education and learning environments (United Nations, 2020). While the SDG4 focuses on education, Heleta and Bagus (2021) argue that the goal does not focus on Higher Education (HE) as low-income countries are left behind in the world when it comes to education especially Higher Education.

## 2.3 Higher Education Institutions (HEIs)

Higher education traces its roots back to ancient times, where it evolved from the cathedral and monastic schools of medieval Europe. Additionally, new places of study grew to provide training in law, medicine and theology (Arbo & Benneworth, 2007). Arbo and Benneworth (2007) further add that many students flocked from all over Europe to obtain qualifications from newly established Higher Education Institutions (HEIs). Subsequently, the first two HEIs, which are acknowledged are the University of Bologna and the University of Paris, the two institutions that were the pioneers of HEIs. Zeleza (2016) highlights how HEIs mulitplied from the original two HEIs to 170 global universities in the 1970’s and a further growth of plus 1639 HEIs by the year 2015.

Arbo and Benneworth (2007) describe HEIs as the various forms of post-secondary education institutes of technology and universities that award professional or academic diplomas or degrees. Zeleza (2016) further argues that HEIs offer unprecedented opportunities for higher education and social mobility for previously marginalised social groups of low income or racial and ethnic backgrounds in developing countries (Arbo & Benneworth, 2007). Hence, Othman and Mohamad (2019) state that higher education is very important in shaping future generations and contributing to regional development.

HEIs are well placed in communities, regions and countries (United Nations, 2016). Hence the United Nations (2016) argues that HEIs can contribute to sustainable development and implementation of the Sustainable Development Goals (SDGs) through research, skills development and engagement. Subsequently, the African Union Agenda 2063 (2015) highlights the critical role that is played by HEIs in supporting economic development directly, by generating knowledge and adapting knowledge for local use. Additionally, the goal of the African Union (2015) is to focus on well-educated citizens and a skills revolution underpinned by science, technology and innovation in Africa.

### 2.4 Higher Education Challenges

Froehlich et al. (2021) note that access to HE is important in making education sustainable and that is one of the African Union 2063 goals. However, problems have been encountered in more goal-advanced countries, such as South Africa, with large racial disparities. Furthermore, Figure 2-2 shows access to HE in 54 states in Africa, indicating that in 41 states in Africa, Higher Education is accessible only to an elite group of people, while in only 2 countries in Africa HE is accessible to all.

Cloete et al. (2017) supporting Figure 2-2 illustrate that Higher Education in Africa is still an elite system. While HE is for the elite in Africa, Muthwa (2018) states that in South Africa there are projects that have brought about affordability, institutional culture, and the decolonisation of knowledge and curricula. Hence, nationally, affordability is being addressed and next will be institutional culture and decolonisation (Muthwa, 2018). Therefore, Africa has to do a lot of work to ensure that Higher Education is accessible amongst the masses and ensuring that Higher Education is universal.

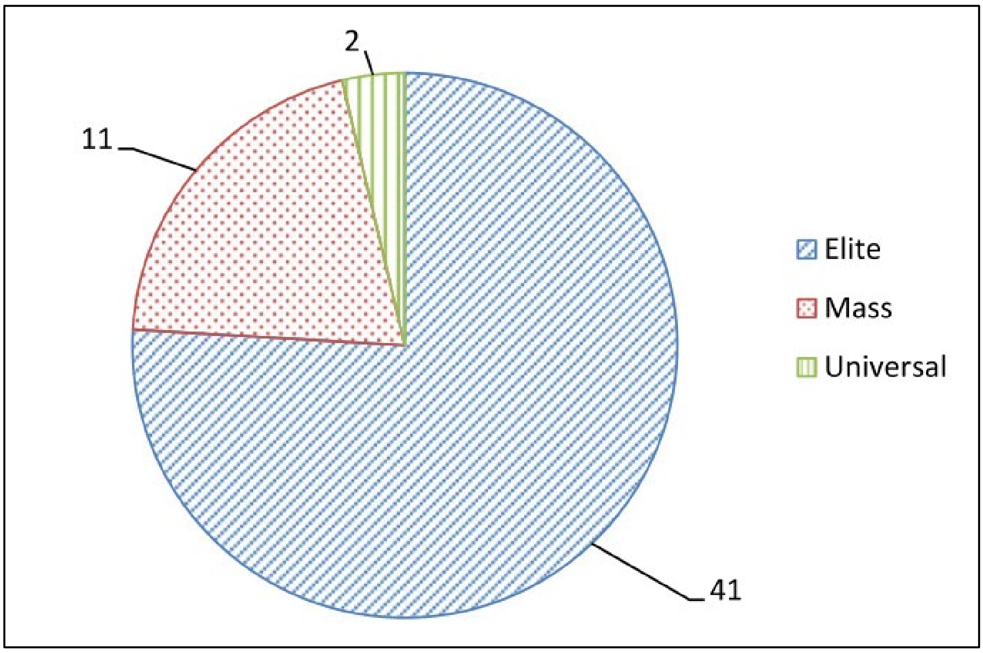


Figure 2-2: Proportion of African HEIs (Froehlich et al., 2021)

While the emphasis is on access to Higher Education, with reason, as it is crucial for capacity building for development, and socio-economic sustainability everywhere in the world and Africa (Froehlich et al., 2021). Heleta and Bagus (2021) state that on the African continent many universities have struggled with challenges of mismanagement and corruption and neglect of Higher Education by the Governments, which has weakened the HEIs in the continent. Additionally, Heleta and Bagus (2021) purport that political instability has hurt the development of higher education, which has led to the destruction of infrastructures and the exodus of academics from many African countries.

Froehlich et al. (2021) add that underfunding and poor social-economic conditions as a result of poverty have led to a decline of HEIs in Africa. Furthermore, these inequalities have been exacerbated by COVID-19 and the inequalities are drastic for low-income countries (United Nations, 2020). Figure 2-3 shows that in low-income countries only 34% of children will complete education (lower-education), that number is much smaller for the completion of higher education.

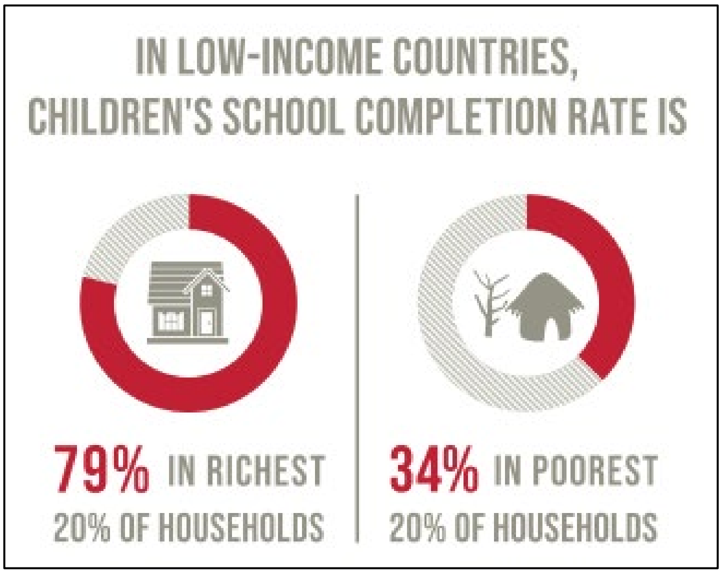


Figure 2-3: COVID-19 impact on Low-Income Countries Education (United Nations, 2020)

Furthermore, Froehlich et al. (2021) summarise the major challenges that affect HEIs in Africa as the following: underfunding, low replacement on faculty positions, poor management, lack of relevance of the curriculum, and a mismatch between education and the job market. The United Nations (2020) further adds that students and teachers around the world do not enjoy a safe learning environment due to the COVID-19 pandemic, which led to the temporary closure of schools as shown in Figure 2-4, 90% of schools, including universities, were closed due to the pandemic.  Many challenges are experienced in HE especially with COVID-19, so alternative accommodation must be used as universities had temporary closures.


Figure 2-4: COVID-19 Impact on education (United Nations, 2020)

Froehlich et al. (2021) state that globally and in Africa, there has been a push for remote learning or the online learning environment. Programs, such as Pan-African Virtual and e-University (PAVEU), Pan-African University Space Science (PAUSS) across Africa have been implemented to ensure remote/online learning. However, challenges like Internet access and connectivity remain a major barrier to Remote/Online learning.

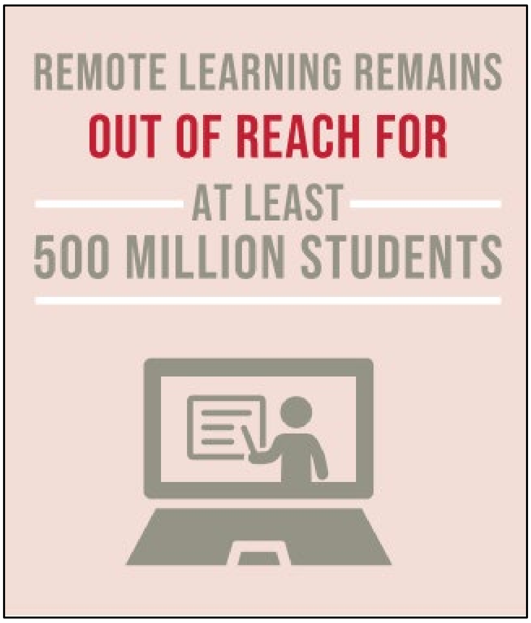


Figure 2-5: COVID-19 Impact on Remote Learning (United Nations, 2020)

The Internet access and connectivity in education or remote learning globally have been affected negatively by the Covid-19 pandemic as shown in Figure 2-5, remote learning remains a challenge as at least 500 million students remain out of reach (United Nations, 2020). They highlight the high numbers in Africa of people with limited Internet access even though many have devices to connect.

**2.5 Higher Education in South Africa**

South Africa offers a wide range of Post-School Education and Training (PSET) programs undertaken in private and public institutions. The PSET in SA has 123 private and 26 public HE institutions (DHET, 2016). The Universities South Africa (USAf) (2021) support the number of universities as 26 public institutions distributed across the 9 provinces in South Africa, with the new addition of three institutions (Mpumalanga, Sol Plaatjie, and Sefako Makgatho Health Sciences Universities) from 23 to 26 universities at the end of the year 2015. While the public PSET consists of several universities, the universities are differentiated into eleven general academic universities, nine comprehensive universities, and six universities of technology (DHET, 2016). The South African public universities operate under the supervision of the Department of Higher Education (DHET) through Higher Education Management Information Systems (HEMIS) (DHET, 2016; Van Schalkwyk et al., 2021).

The DHET ensures that HEIs perform their intended functions as outlined by the National Development Plan (NDP) which are: 1) to equip people with high-level skills to meet the employment needs, 2) produce new knowledge, assess and find a new application for existing knowledge, and 3) provide opportunities for social mobility, while strengthening equity, social justice, and democracy to deal with injustices brought about by the apartheid system (DHET, 2016). With the functions of HEIs in mind, John and Clinton (2020) state that the HEIs are positioning themselves to leverage the wave of 4IR by fostering collaborations with the industry.

The aim is to equip people with high-level skills, create new knowledge and make opportunities to deal with equity and social injustices, an example of such is the Fourth Industrial Revolution South Africa (4IRSA) (John & Clinton, 2020). Fourth Industrial Revolution South Africa (4IRSA) is a platform that brings together key stakeholders, such as businesses and universities and defines the principles of 4IR that will shape the future of South Africa (4IRSA, 2021).

John and Clinton (2020) argue that 4IRSA is designed to stimulate a national dialogue to leverage the opportunities provided by the 4IR for the benefit of the nation. Therefore, transformation in HEIs highlights the focus of universities organisationally and is becoming more efficient to serve students, staff and communities better (Muthwa, 2018). Additionally, while the recent focus has been 4IR, the Vice-Chancellor of NMU, Prof Muthwa (2018) states that in South Africa, universities have been closely aligned with the transformation of Higher Education since the period of 2015-2016. While the focus is on embracing the 4IR at HEIs, transformation is a key function as it aligned with efficiently serving the communities better.

### 2.6 Higher Education Challenges in South Africa

Muthwa (2018) notes that the biggest challenge in SA HEIs has been the student protests, which have become a key part of society, which are due to the intolerance of socio-economic inequality, hardships and sufferings of the poor. Tjonneland (2017) concurs that the student protest is a major manifestation of the shortcomings and failures of the transformation of the South African Higher Education system. The shortfalls are further noted by Tjonneland (2017) as extreme inequalities, poverty and huge youth unemployment. The inequalities have given rise to South African student societies to start campaigns, such as #RhodesMustFall, #FeesMustFall and “free education”.

The movements have pushed transformation across South African society because of the inequalities (Muthwa, 2018; Tjonneland, 2017). Commenting on the inequalities, Tjonneland (2017) adds financing as another challenge, as students have to pay expensive tuition fees. Tjonneland (2017) further notes that in contrast to Europe and America, the fees may be relatively low however they are relatively high in South Africa as the majority of households are below average South African income. Furthermore, Tjonneland (2017) states that although social protest has been part of South African politics, student protest was the first major national wave of protest. While social inequalities and high fees are challenges, social protests are ongoing and new challenges are increasing.

In addition to the above challenges, a new global issue has arisen, such as the Corona Virus Disease (COVID-19), which is noted by the United Nations (2020) and which brought new challenges, such as access to remote learning and online learning. Tjonneland (2017) states that the biggest challenge in South African HEIs is limited access to HE and infrastructure such as Internet access. Therefore, South African HEIs faces more challenges that need to be addressed like internet access to all students as that will enable the HE to achieve the goals set by African Union, SDG4 and 4IR needs.

John and Clinton (2020) acknowledge that while the world is gearing towards the 4IR, South Africa has sought to develop a competent future workforce and therefore has become one of the leading forces in Africa. South Africa has an increased participation rate in Higher Education when compared to the rest of Africa, it is still lagging behind the rest of the world (Cloete et al., 2017). Muthwa (2018) argues that the role of HE needs to engage with the above challenges and must generate HEIs that will contribute to a just and the renewal of curriculum and academy in ensuring HEIs are successful.

## 2.7 Nelson Mandela University

The Nelson Mandela University (NMU) was opened on the 1st of January 2015 and was formerly known as Nelson Mandela Metropolitan University (NMMU). The university was a result of a merger of PE Technikon, the University of Port Elizabeth (UPE) and the Port Elizabeth campus of Vista University (Vista PE) (NMU, 2021). As the result of the government restructuring of higher education, the NMU (2021) states that the merger was intended at delivering more equitable and efficient systems to meet the needs of South Africa. The NMU (2021) states that on 20 July 2017, the university was rebranded to position itself on the African continent and globally by being the only HEI in the world to carry the name of the great statesman, Nelson Mandela. As a result, Nelson Mandela University is today a sought-after educational destination and the most diverse university in South Africa (NMU, 2021).

The NMU is not a traditional university as it is recognised as a comprehensive university (Gibbon, 2004). Comprehensive universities were established to increase access to students and improve the delivery of career-oriented programmes, and increase research capacity, as a result of a greater combined knowledge capacity (Gibbon, 2004). Therefore, NMU has to cater for diverse students and be responsive and flexible to the increase in large numbers of student enrolments in the Eastern Cape.

NMU is one of the four HEIs located in the Eastern Cape (USAf, 2021). The NMU (2021) states that Nelson Mandela University is located in South Africa, Eastern Cape, in Nelson Mandela Bay, Gqeberha (formally Port Elizabeth) as depicted in Figure 2-6. Additionally, NMU spans seven campuses located in Gqeberha and George (Western Cape) (NMU, 2021).


Figure 2-6: NMU location

Muthwa (2018) states that the mission of Nelson Mandela University is to generate an institutional culture within which all can contribute to the renewal of curriculum and academy. Therefore, NMU aims to expand human understanding, pushing forward the frontiers of knowledge in all sciences, cultivating humanity and contributing to the well-being of its city, province, nation, continent and the world (NMU, 2018). Furthermore, the vision of the university is to be a dynamic African university, recognised for its leadership in generating cutting-edge knowledge for a sustainable future. NMU has the mission to offer a diverse range of life-changing educational experiences for a better world (NMU, 2021). While the university focuses on its vision and mission it is steeped in deep values of respect for Diversity, Excellence, Ubuntu, Social Justice and Equality, Integrity and Environmental Stewardship (NMU, 2021).

### 2.7.1 Students Enrolment

Student enrolments have increased in the HEIs in South Africa and cause concern over the increasing population size. Tjonneland (2017), however, states that the numbers are far too low compared to middle-income developing countries. Therefore, the SA government plans to increase university enrolment to 1.5 million by 2030 (Tjonneland, 2017). Tjonneland (2017) further asserts that there is a sharp increase in student enrolments, which indicates a major improvement in access to Higher

Education. The increase can be seen at NMU as Figure 2-7 shows a sharp increase at 28 342 student enrolments in 2020, compared to 27 627 student enrolments in 2017.

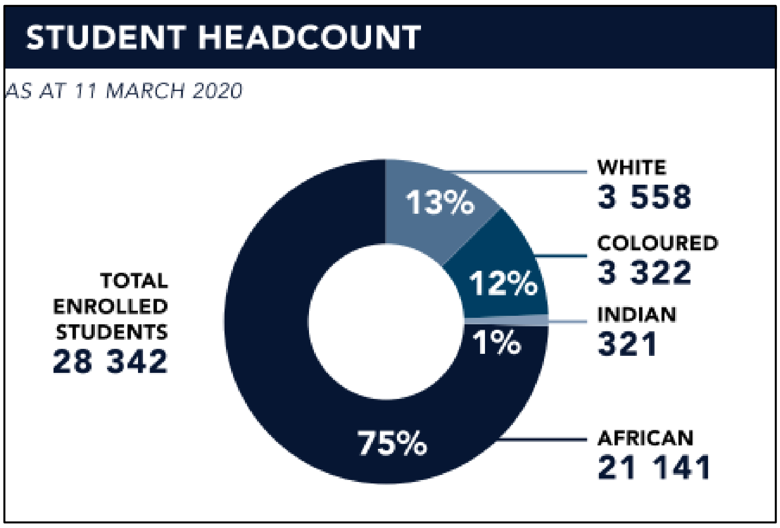


Figure 2-7: Student Headcount by race (NMU, 2020)

Tjonneland (2017) argues that while the enrolment has increased, the majority of students are now Africans. Furthermore, schemes were designed to widen access to students from poor and working-class backgrounds who are mainly black and African (Tjonneland, 2017). In support, Figure 2-7 shows that the majority (75%) of students that are enrolled are African, followed by White and Coloured students at 13% and 12% respectively. As NMU is a comprehensive university and its mission is to service a diverse background of students, Figure 2-7 depicts the diversity in the races enrolled at the university (Gibbon, 2004).

Sustainable Development Goal 4, ensures that access to education must be equal and available to all genders, especially women. NMU, as shown in Figure 2-8, has a higher number of females at 54% compared to males at 46% enrolling in programmes. The number of female enrolments is positive for NMU as female participation at HEIs in Africa is poor (Froehlich et al., 2021).

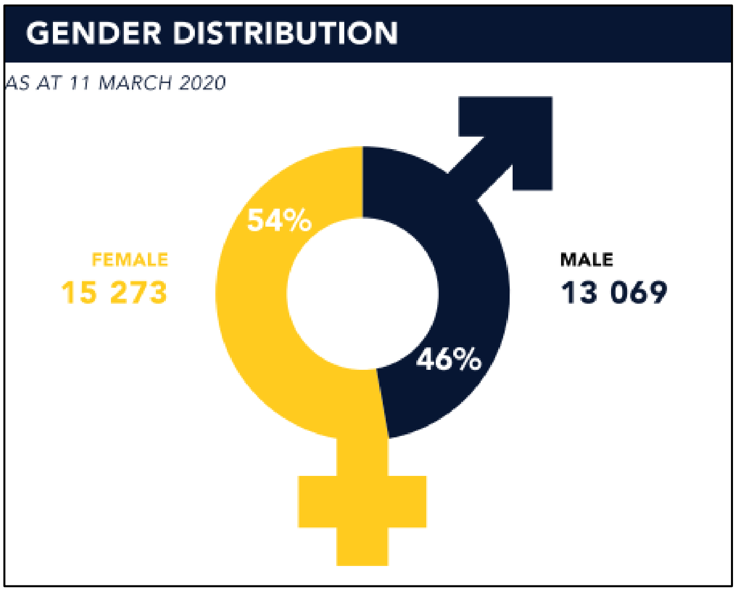


Figure 2-8: Gender Distribution of NMU Students (NMU, 2020)

NMU offers diverse qualifications across seven faculties, as shown in Figure 2-9, Arts, Business and Economic Sciences, Education, Engineering, Built Environment, Information Technology, Health Sciences, Law and Science (NMU, 2020). The Science faculty is one of the four faculties with a lower intake of undergraduates as shown in Figure 2-9 the enrolments for undergraduates.

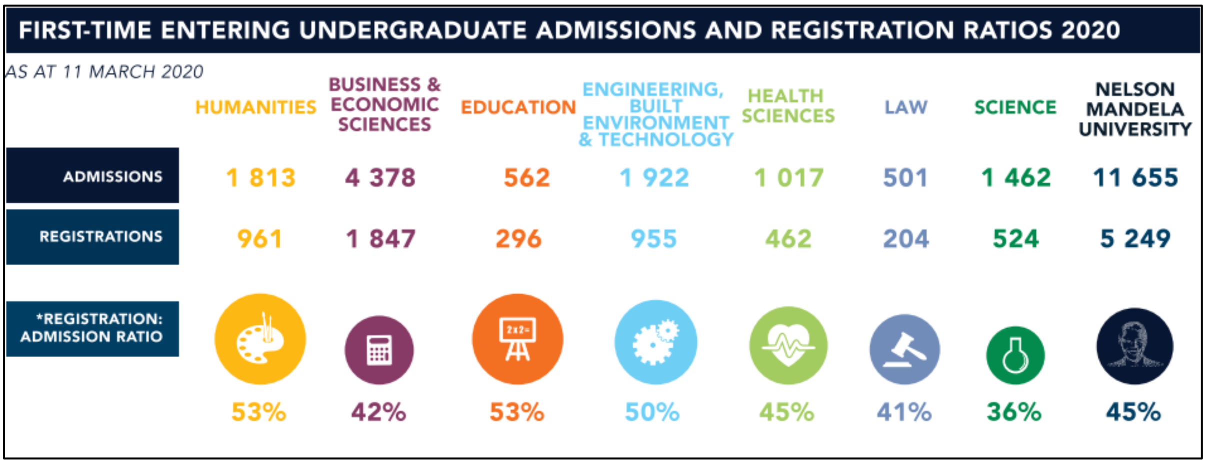


Figure 2-9: First-year Intake at NMU for the year 2020 (NMU, 2020)

This research study mainly focuses on first-year students enrolled on the Science, Engineering, Built Environment and Information Technology, and Business and Economics faculties. The Business & Economic Sciences faculty has the highest enrollment figures compared to the faculties of Engineering, Built Environment and IT, and the Science faculties. Therefore, this study will investigate first-year students registered for major courses in the Business and Economic Sciences faculty, such as

B.Com Accounting, Accounting Sciences, Economics, and Financial Management. The students registered for these qualifications will be referred to as the Non-IT group and will be used to compare them to the IT-group, which are students registered for CS, IS and IT programmes regarding the factors that influence career decisions.

The Science faculty is a custodian to several departments and in particular for this study. Within the Science, faculty is the Department of Computing Science which hosts part of the IT group that includes different degree programmes etc. BSc CS, BSc CS & IS, B.Com Information Systems. Finally, the last part of the IT group is in the Engineering, Built Environment and Technology Faculty which is a custodian to the School of ICT, which has diploma and degree programmes in IT. These include the National Diploma, such as NDip IT (Software, Communication Network, and Support Services), Bachelors in Information Technology and National Higher Certificate in Information Technology.

### 2.7.2 NMU vs other Universities in S.A.

Universities in  South Africa seek to rise in global ranking systems to enhance their prestige to attract top-quality researchers and international students (Swartz et al., 2019). On the contrary, Swartz et al. (2019) assert that the ranking systems can exacerbate the stratification of universities. Swartz et al. (2019) further argue that teaching and research as key missions for public universities and focusing on rankings detract them from the core focus. While opinions differ regarding rankings, this study aims to use two criteria, research outputs and student enrolments, which form part of research and teaching to show NMU’s ranking within the South African HEIs.

The comparison data used is based on the data from the Higher Education Data Analyzer (HEDA) system, one of the focuses of HEDA is to benchmark institutions (HEDA, 2021). While the HEMIS data is annually provided by the DHET, 2020 data will only be available in August 2021 as the final audit will have taken place (HEDA, 2021).

| Institution Active | Calendar year | | |
|---|---|---|---|
| | 2017 | 2018 | 2019 |
| | Headcounts | Headcounts | Headcounts |
| – University of South Africa | 344 015 | 373 979 | 342 797 |
| – Tshwane University of Technology | 63 032 | 65 920 | 67 673 |
| – North West University | 62 558 | 61 212 | 63 671 |
| – University of Pretoria | 50 695 | 50 431 | 50 594 |
| – University of Johannesburg | 50 447 | 50 786 | 50 590 |
| – University of KwaZulu-Natal | 49 096 | 49 645 | 50 158 |
| – University of the Free State | 38 102 | 39 516 | 41 505 |
| – University of Witwatersrand | 38 380 | 40 285 | 40 890 |
| – Durban University of Technology | 29 787 | 31 211 | 35 442 |
| – Cape Peninsula University of Technology | 34 702 | 34 222 | 33 941 |
| – Walter Sisulu University | 30 517 | 32 140 | 33 572 |
| – University of Stellenbosch | 31 114 | 31 261 | 31 523 |
| – Nelson Mandela Metropolitan University | 27 621 | 28 507 | 29 490 |
| – University of Cape Town | 28 724 | 28 744 | 28 641 |
| – University of Western Cape | 22 443 | 22 831 | 23 784 |
| – Vaal University of Technology | 19 218 | 21 067 | 21 927 |
| – University of Limpopo | 20 608 | 21 157 | 21 490 |
| – Central University of Technology | 18 185 | 19 464 | 21 225 |
| – University of Zululand | 17 208 | 17 896 | 17 738 |
| – University of Fort Hare | 15 426 | 16 896 | 16 982 |
| – University of Venda | 15 705 | 16 573 | 16 783 |

Figure 2-10: Student Headcount Enrolment comparison (HEDA, 2021)

Many of the HEIs have had a steady increase in enrolment over the years 2017 - 2019, with at least a 1% average increase as depicted in Figure 2-10. NMU has had a similar increase in overall enrolments. In terms of overall student headcounts per institution, NMU ranks 13th amongst the universities.

| Institution Active | Calendar year | | |
|---|---|---|---|
| | 2017 | 2018 | 2019 |
| | Headcounts | Headcounts | Headcounts |
| – University of South Africa | 344 015 | 373 979 | 342 797 |
| – University of Johannesburg | 50 447 | 50 786 | 50 590 |
| – Walter Sisulu University | 30 517 | 32 140 | 33 572 |
| – Nelson Mandela Metropolitan University | 27 621 | 28 507 | 29 490 |
| – University of Zululand | 17 208 | 17 896 | 17 738 |
| – University of Venda | 15 705 | 16 573 | 16 783 |
| – Sefako Makgatho Health Science University | 5 825 | 6 292 | 6 456 |

Figure 2-11: Student Headcount at Comprehensive Universities Comparison (HEDA, 2021)

As mentioned previously NMU is a comprehensive university, therefore when comparing NMU with the seven comprehensive universities, NMU ranks fourth which is the middle as shown in Figure 2-11. Therefore using the headcounts, NMU is an average university when compared with other compressive universities and in the South African Universities context.

The HEIs are also rated by using research outputs and academic research which includes activities that produce one or more research outcomes including creating new knowledge, the reorganisation of knowledge, application of knowledge, innovation and the transfer of knowledge (DHET, 2015). In HEIs, research and teaching are closely linked as most academic staff do both and infrastructures are designed to handle teaching and research (DHET, 2015). Hence, research output is also used in comparing NMU to other HEIs in South Africa. Figure 2-12 shows the publications output by each HEIs in South Africa for the years between 2017-2019. NMU is ranked 12th in total research outputs with 472.608 units, which places NMU outside the top 10 rankings in 2019. The output from the number of research units for NMU is above the average.

| | Calendar year | | | |
|---|---|---|---|---|
| | 2019 | | | |
| Institution Active | Articles | Books | ConfProc | Total Publication Units |
| – University of Johannesburg | 1 622.570 | 403.677 | 296.505 | 2 329.752 |
| – University of KwaZulu-Natal | 2 072.951 | 156.849 | 62.673 | 2 300.473 |
| – University of Stellenbosch | 1 595.771 | 332.667 | 110.371 | 2 139.475 |
| – University of Pretoria | 1 685.182 | 307.379 | 82.245 | 2 103.115 |
| – University of Cape Town | 1 636.163 | 219.956 | 79.897 | 2 001.302 |
| – University of Witwatersrand | 1 579.326 | 272.440 | 68.486 | 1 944.752 |
| – North West University | 1 237.183 | 193.717 | 118.918 | 1 549.817 |
| – University of South Africa | 1 174.268 | 125.630 | 74.309 | 1 376.207 |
| – University of the Free State | 815.182 | 305.894 | 52.325 | 1 180.734 |
| – University of Western Cape | 515.845 | 82.998 | 12.333 | 616.176 |
| – Rhodes University | 460.522 | 65.833 | 27.208 | 559.233 |
| – Nelson Mandela Metropolitan University | 388.968 | 21.048 | 49.592 | 472.608 |
| – Durban University of Technology | 300.069 | 63.737 | 19.977 | 385.783 |
| – University of Limpopo | 346.217 | 13.132 | 25.875 | 385.224 |
| – University of Fort Hare | 357.706 | 7.625 | 1.500 | 366.831 |
| – Tshwane University of Technology | 296.424 | 8.172 | 58.378 | 362.974 |
| – University of Zululand | 220.376 | 19.064 | 18.125 | 257.565 |
| – Cape Peninsula University of Technology | 179.125 | 35.651 | 32.763 | 249.538 |
| – University of Venda | 190.504 | 6.662 | 1.433 | 198.599 |
| – Central University of Technology | 112.399 | 9.513 | 49.590 | 172.502 |
| – Vaal University of Technology | 127.291 | 4.745 | 30.451 | 162.487 |

Figure 2-12: Research Pubs Units by HEIs (HEDA, 2021)

When comparing NMU research outputs with other comprehensive universities, NMU ranks 3rd behind the University of Johannesburg and the University of South Africa as shown in Figure 2-13. The two HEIs above NMU have higher student headcounts and a large academic staff complement, which logically leads to more outputs, therefore, NMU is doing well with the low numbers of student headcount and ranking third on the research output.

| | Calendar year | | | |
|---|---|---|---|---|
| | 2019 | | | |
| Institution Active | Articles | Books | ConfProc | Total Publication Units |
| – University of Johannesburg | 1 622.570 | 403.677 | 296.505 | 2 329.752 |
| – University of South Africa | 1 174.268 | 125.630 | 74.309 | 1 376.207 |
| – Nelson Mandela Metropolitan University | 388.968 | 21.048 | 49.592 | 472.608 |
| – University of Zululand | 220.376 | 19.064 | 18.125 | 257.565 |
| – University of Venda | 190.504 | 6.662 | 1.433 | 198.599 |
| – Sefako Makgatho Health Science University | 105.468 | 1.238 | - | 106.706 |
| – Walter Sisulu University | 86.666 | 4.500 | 4.017 | 95.183 |
| – Total | 3 788.821 | 581.819 | 443.980 | 4 836.619 |

Figure 2-13 Research Units Pubs Comprehensive Universities (HEDA, 2021)

Therefore, Nelson Mandela University is an above-average university in comparison to the 26 public HEIs in South Africa when considering research outputs. However, when NMU is compared to other Comprehensive Universities, NMU ranks higher in third place on research and fourth on student enrolments, while the student headcounts are lower compared to universities above them. Furthermore, the 2021 global impact rankings third edition, which includes 1115 universities from 94 countries, showed NMU ranked 4th in South Africa. The rankings are assessed on universities' global performance against SDGs (The World University Rankings, 2021). Therefore, in the context of HEIs in South Africa, NMU is an above-average university in student enrolments and research outputs.

## 2.8 ACM Computing Curricula

Calitz (2010) states that the International Education Authorities have been involved with setting up curricula requirements for courses for many years. The International Education Authorities release curricula that have an impact on universities' curricula and qualifications. In South Africa, curriculum programmes are provided by the DHET, additionally, guidelines from international authorities are considered to obtain international accreditation (Calitz, 2010). In the Computing field, authorities that define programmes are the Association for Computing Machinery (ACM), Electrical and Electronics Engineers Computer Society (IEEE) and the Association for Information Systems (AIS) (CS2013, 2013; Wayman & Kyobe, 2012). Since the 1980s, curricula are maintained by the ACM and IEEE as they established a committee to develop computing guidelines for programmes in the computing field (ACM, 2021). Additionally, the AIS has also contributed to the development of curricula by collaborating with the ACM (IS2010, 2010). Task groups have been formed for curricula for the computer fields; Computer Science (CS), Information Technology (IT), Information System (IS), Computer Engineering (CE), Software Engineering (SE), Cybersecurity (CSEC) and Data Science (DS) (CC2020, 2020).

Figure 2-14 depicts the evolution of the curriculum guidelines for each computing field in the past decade. Regarding the IS curriculum, there is an upcoming version entitled IS2020, while the other discipline curricula will be updated in due course (CC2020, 2020). Govender and Khumalo (2014) state that computer-related courses can be classified into three categories Computer Science, Information Technology and Information Systems.

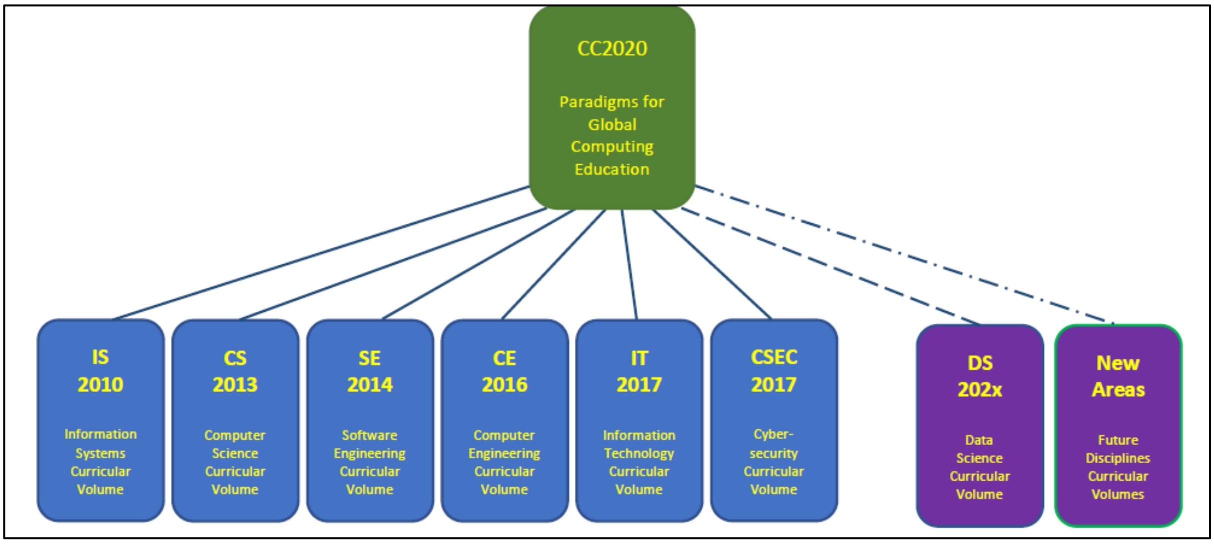

Figure 2-14: Structure of the Computing Curricular Series (CC2020, 2020)

NMU offers CS/IS programmes in the Department of Computing Sciences and IT programmes at the School of IT. Therefore, the focus will be on the curricula in the following sections. This study will focus on CS2013, IT2017 and IS2010 curricula at undergraduate programs as these are offered at NMU.

### 2.8.1 Computer Science (CS2013)

The Computer Science discipline grew rapidly and became accepted as an academic discipline in the 1970s at most American colleges and universities (CC2005, 2005). Additionally, the CS curriculum has evolved over the years, up until Computer Science 2013, which is widely adopted at universities globally (CS2013, 2013). The Computing Curricula (2005) argues that before CS acceptance as an academic discipline, controversy about the legitimacy of the CS as an academic discipline arouse, assertions were, CS is a vocational speciality for technicians, a research platform for mathematicians and CS being a pseudo-discipline for the programmers. However, in the 1990s the controversies ended, the CS had research and knowledge that had spanned from theory to practice and there was a great demand for CS (CC2005, 2005).

The CS curricula have evolved over the years, as computing curricula evolved as shown in Figure 2-15, there was a change from CS2001, CS2008 and currently CS2013 (CS2013, 2013). Calitz (2010) notes that in curricula CS2008 and CS2001, there were fourteen CS knowledge areas identified. In addition to the previous CS curricula, CS2013 has eighteen knowledge areas as shown in Figure 2-15, with each area divided into core or elective, with further division into Tier-1 or Tier-2. The underlying principles of CS2013 overlap significantly with the previous CS curricula (CS2013, 2013).

The CS field spans a wide range of areas, such as algorithms, robotics, computer vision, intelligent systems and other areas (CS2013, 2013). The Computing Curricula 2005 (2005) guidelines argue that CS work falls into three categories:

- Design and implement software;

- Devise new ways to use the computer in areas such as networking, databases, and human-computer-interfaces; and
- Also, solve computing problems.

The Computing Science 2013 (2013) guidelines state that topics under Tier-1 core should be covered by all students, and Tier-2 core should include almost all or all topics. Additionally, the elective material should be covered as the core topics only are not sufficient. The NMU Department of Computing Sciences ensures that the core knowledge areas are covered within its CS courses and elective courses supplement the CS curricula offered using CS2013 guidelines.

| Knowledge Area | CS2013 | | CS2008 | CC2001 |
|---|---|---|---|---|
| | T1-hrs | T2-hrs | Core Hrs | Core Hrs |
| AL-Algorithms and Complexity | 19 | 9 | 31 | 31 |
| AR-Architecture and Organization | 0 | 16 | 36 | 36 |
| CN-Computational Science | 1 | 0 | 0 | 0 |
| DS-Discrete Structures | 37 | 4 | 43 | 43 |
| GV-Graphics and Visualization | 2 | 1 | 3 | 3 |
| HCI-Human-Computer Interaction | 4 | 4 | 8 | 8 |
| IAS-Information Assurance and Security | 3 | 6 | -- | -- |
| IM-Information Management | 1 | 9 | 11 | 10 |
| IS-Intelligent Systems | 0 | 10 | 10 | 10 |
| NC-Networking and Communication | 3 | 7 | 15 | 15 |
| OS-Operating Systems | 4 | 11 | 18 | 18 |
| PBD-Platform-based Development | 0 | 0 | -- | -- |
| PD-Parallel and Distributed Computing | 5 | 10 | -- | -- |
| PL-Programming Languages | 8 | 20 | 21 | 21 |
| SDF-Software Development Fundamentals | 43 | 0 | 47 | 38 |
| SE-Software Engineering | 6 | 22 | 31 | 31 |
| SF-Systems Fundamentals | 18 | 9 | -- | -- |
| SP-Social Issues and Professional Practice | 11 | 5 | 16 | 16 |
| **Total Core Hours** | **165** | **143** | **290** | **280** |

Figure 2-15: Core CS Curriculum (CS2013, 2013)

### 2.8.2 Information Systems (IS2010)

The name Information Systems (IS) suggests a focus on information together with capturing, storage, processing and analyses/interpretation in ways that support decision making (CC2020, 2020). There has been an ongoing debate on the nature and identity of IS as a field. Whether, IS exists only in the business discipline or can it exist in other domains. Furthermore IS should no longer be exclusive to business schools, even though business is the primary domain the discipline provides expertise that is critical in several domains (IS2010, 2010). Avison and Elliot (2006) concur that IS should be viewed as a social science discipline as shown in Figure 2-16, that IS applies in many other disciplines, therefore IS cannot be viewed as mutually exclusive to the business domain. Therefore, the Computing Curricula (2005) purports that IS focuses on computing needs that the business world has faced since the 1960s.

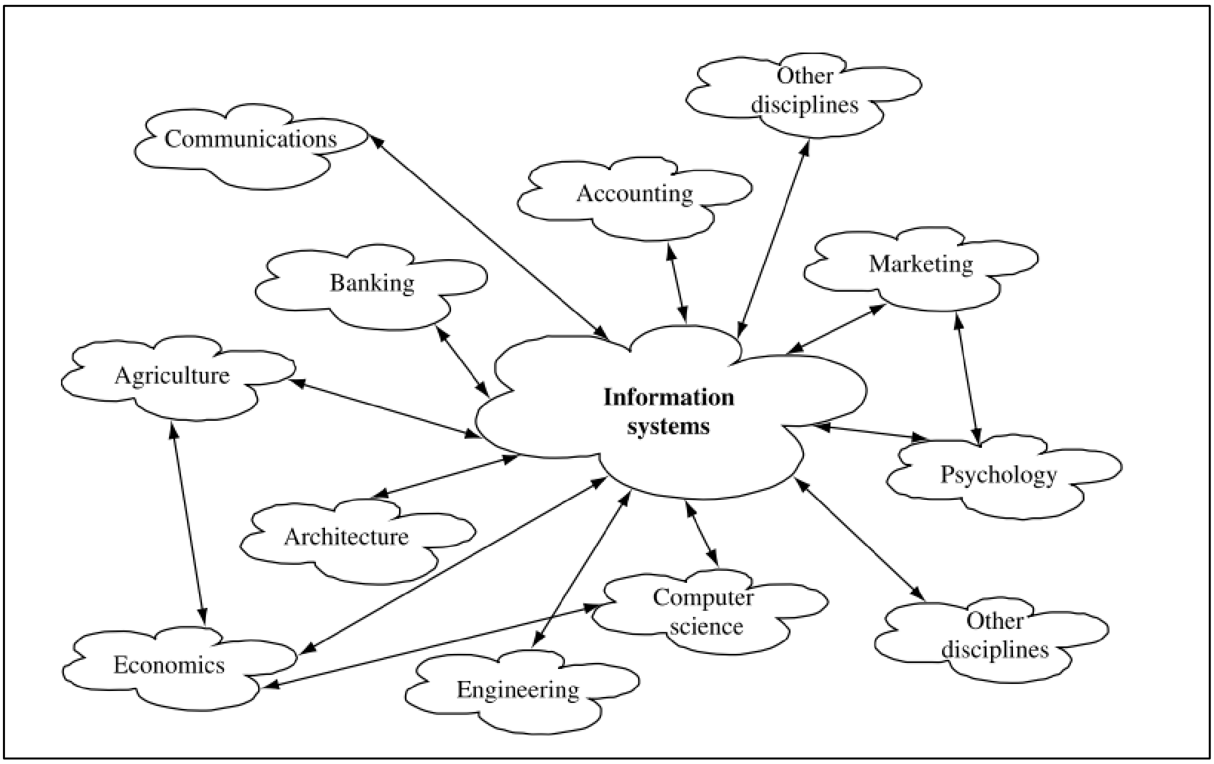


Figure 2-16: IS as a discipline (Avison & Elliot, 2006)

Calitz (2010) states that the B.Com IS degree was introduced in 2010 at NMU. The degree was the first in S.A. as it incorporates Business Process Management at the second-year level and Enterprise Resource Planning (ERP) at the third year. The ERP module includes SAP R/3 as a practical component to prepare students for SAP certification exams. Additionally, Figure 2-16 shows the curriculum guidelines, which allow students to major in functional areas to gain additional IS skills and systems, and an understanding of application packages in fields, such as accounting, finance and marketing (IS2010, 2010).

The Information System 2010 (2010) states the IS majors and minors are designed to target different students groups, minors are the subsets of major courses, which form cohesive knowledge of the majors. Minors can be tailored to functional area requirements such as marketing, accounting. In contrary to minors, the Information System 2010 (2010) argues that majors consist of a curriculum targeting a particular career track. Therefore, the majors as shown in Table 2-1, have competencies in basic technical areas and apply these to business processes and project management (IS2010, 2010).

Table 2-1: IS Curriculum majors (IS2010, 2010)

| Student Groups | Curriculum Model |
|---|---|
| **All Students** | IS 2010.1 Foundations of Information Systems |
| **IS Majors and Minors** | IS 2010.2 Data and Information Management<br>IS 2010.3 Enterprise Architecture<br>IS 2010.7 IS Strategy, Management, and Acquisition |
| **IS Majors** | IS 2010.4 IS Project Management<br>IS 2010.5 IT Infrastructure<br>IS 2010.6 Systems Analysis & Design |

There are four major IS Curriculum areas (IS2010, 2010):

- IS professionals exist in a broad variety of domains, including business, health care, government and non-profit organisations;
- IS professionals must have strong analytical and critical thinking skills to thrive in a competitive and global environment;
- IS professionals must exhibit strong ethical principles and have good interpersonal communication and team skills; and
- IS professionals must design and implement information technology solutions that enhance organisational performance.

The IS discipline is preparing new curriculum guidelines, which will be made available during 2021. The new IS guidelines IS2020, will emphasise that IS as a discipline can make significant contributions in many domains (CC2020, 2020). At NMU, the Department of Computing Sciences is a custodian of both CS and IS programmes. The IS majors are combined in three programs; Business Management, Accounting and Auditing (Calitz, 2010).

### 2.8.3 Information Technology (IT2017)

The Computing Curriculum (2005) states that Information Technology (IT) began to emerge in the late 1990s as computers became essential work tools for most organisations, thus improved productivity and new workplace dependencies became a problem of the computing infrastructure. Lunt et al. (2008) define Information Technology as encompassing all aspects of computing technology, as an academic discipline, IT is concerned with issues related to meeting the organisation's needs.

Lunt et al. (2008) state that organisation needs are in the context of selection, creation, application, integration and administration of computing technologies. Therefore, Information technology focuses more on technology rather than information as Information Systems. The IT field is vibrant as societies experience fundamental change from an industrial society to an information society. Subsequently, computing has become the defining technology changing how society lives and works (Lunt et al., 2008). Information Technology (IT) is further defined as the study of systemic approaches to select, develop, apply, integrate and administer secure computing technologies to enable users to accomplish their personal, organizational and societal goals (IT, 2017). Calitz (2010) adds that IT equips professionals to select, create, apply, integrate and manage organisational IT infrastructure.

Computer Science curricula did not provide for the skills required for IT professionals, only IT as a curriculum can meet the demands (CC2020, 2020). The Information Technology 2017 (2017) guidelines purport that the core skills for information technology are information management, networking, information assurance, human-computer interaction and web systems technologies. The Information Technology 2017 (2017) curriculum guidelines focus on fourteen core bodies of knowledge areas as shown in Table 2-2.

The IT curriculum has five essentials that are core, Information Management, Integrated Systems Technology, Platform Technology, System Paradigms and User Experience Design (Table 2-2). The Information Technology 2017 (2017) curriculum guidelines recommend that 40% of an IT program must contain the above cores, the rest can be supplemental domains. Furthermore, an IT curriculum that covers exceeds

37.5% of the programme shown in Table 2-2, will prepare competent and competitive graduates (IT2017, 2017).

Table 2-2: IT Curriculum Core (IT2017, 2017)

| IT Domains | Essential Percent | Supplemental Percent |
|---|---|---|
| **Essential Only (5)** | | |
| Information Management | 6% | 0 |
| Integrated Systems Technology | 3% | 0 |
| Platform Technologies | 1% | 0 |
| System Paradigms | 6% | 0 |
| User Experience Design | 3% | 0 |
| *Subtotal:* | **19%** | **0** |
| | | |
| **Essential + Supplemental (5+5)** | | |
| Cybersecurity Principles / Cybersecurity Emerging Challenges | 6% | 4% |
| Global Professional Practice / Social Responsibility | 3% | 2% |
| Networking / Applied Networks | 5% | 4% |
| Software Fundamentals / Software Development and Management | 4% | 2% |
| Web and Mobile Systems / Mobile Applications | 3% | 3% |
| *Subtotal:* | **21%** | |
| | | |
| **Supplemental Only (4)** | | |
| Cloud Computing | 0 | 4% |
| Data Scalability and Analytics | 0 | 4% |
| Internet of Things | 0 | 4% |
| Virtual Systems and Services | 0 | 4% |
| *Subtotal:* | **0** | |
| | | |
| ***IT2017 TOTAL:*** | **40.0%** | |

There are several curricular models for information technology, some consist of four-years, interdisciplinary, three-year and 2+2 models (IT2017, 2017). At Nelson Mandela University, the School of IT is the custodian of the IT discipline and applies the curricula for three-year for their degree, diploma and one-year certificate programs. The IT diploma consists of a variety of streams, such as software development, support services, and help desk, support while catering for a single stream degree program.

### 2.8.4 CS/IS/IT differences and overlaps

While CS/IS/IT contributes positively to academics and the workforce, the computing fields are different from one another (McMahon, 2016). The computing disciplines have overlaps, Calitz (2010) states that 40% of modules in computing courses is Software Development, which is covered in all the disciplines, while IS covers more than 50% of business courses. Similarities between CS/IS/IT are discussed below, based on McMahon's (2016) observations.

| Information Technology | Computer Science | Information Systems |
|---|---|---|
| 1. Information Technology Fundamentals | 1. AL - Algorithms and Complexity | 1. Foundations of Information Systems |
| 2. Human Computer Interaction | 2. AR - Architecture and Organization | 2. Data and Information Management |
| 3. Information Assurance and Security | 3. CN - Computational Science | 3. Enterprise Architecture |
| 4. Information Management | 4. DS - Discrete Structures | 4. IT Infrastructure |
| 5. Integrative Programming and Technologies | 5. GV - Graphics and Visualization | 5. IS Project Management |
| 6. Math and Statistics for IT | 6. Human-Computer Interaction | 6. Systems Analysis and Design |
| 7. Networking | 7. Information Assurance and Security | 7. IS Strategy, Management, and Acquisition |
| 8. Programming Fundamentals | 8. Information Management | |
| 9. Platform Technologies | 9. Intelligent Systems | |
| 10. Systems Administration and Maintenance | 10. Networking and Communications | |
| 11. System Integration & Architecture | 11. Operating Systems | |
| 12. Social and Professional Issues | 12. Platform-based Development | |
| 13. Web Systems and Technologies | 13. Parallel and Distributed Computing | |
| | 14. Programming Languages | |
| | 15. Software Development Fundamentals | |
| | 16. Software Engineering | |
| | 17. Systems Fundamentals | |
| | 18. Social Issues and Professional Practice | |

Figure 2-17: CS/IS/IT Overlaps (McMahon, 2016)

In Figure 2-17, McMahon (2016) summarises each discipline's knowledge area and states that there are 12 overlapping learning outcomes between the CS and IT curricula. McMahon (2016) shows similarities amongst CS/IS/IT in the topic of Information management, however, IT and CS have more similarities in topics, such as Networks in red, Human-Computer Interaction in blue, Information Assurance and Security, and Social and Professional Issues in purple. Information Management highlighted in green, covered in all the streams. Therefore at a higher level, similar topics are covered in the disciplines, especially IT and CS curricula.

Furthermore, McMahon (2016) argues that the differences are based on the depth of knowledge or coverage of the topic, for example, Information Assurance and Security (IAS). The IT curriculum for IAS consists of five topics: Security Mechanisms, Attacks, Forensics, Security Services. While CS curriculum for IAS consists of two topics, namely Network Security and Platform (McMahon, 2016). Therefore an in-depth coverage of a topic changes the focus of the discipline.

Finally, in summarising each computing discipline’s focus, the Computer Curricula (2005) developed a snapshot of viewing the commonalities and differences of the disciplines in Figure 2-18. The Computing Curricula (2005) argue that vertically, computer hardware and architecture are at the foundation, while organisational issues and Information Systems are on top, due to the focus on people, information and the organisational workplace.

Horizontally, theory principle and innovation move from ideas to the right, where appropriate technology can be applied to solve organisational problems as shown in Figure 2-18 (CC2005, 2005). Therefore, when comparing the disciplines using Figure 2-18, it is noteworthy that IS focuses on organisational issues and Information systems with applications of deployment configuration rather than focus on theory principles and innovation.

The CS disciple focuses on three areas Application Technologies, Software Methods and Technologies, and System infrastructure, with the development being more theoretical than applied.  Finally, the IT field focuses on  Application Deployment and Configuration development, while focusing on Application Technologies, followed by Organisational Issues and Information Systems and Software methods.

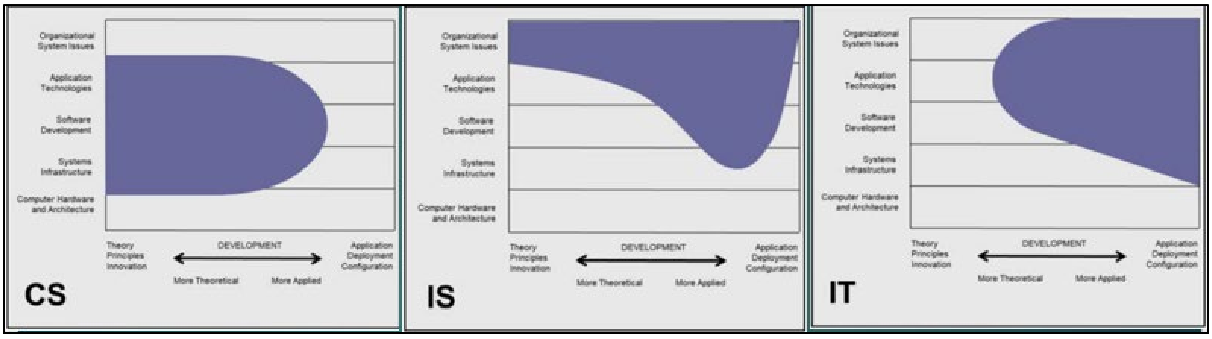

Figure 2-18: Differences of CS/IS/IT (CC2020, 2020)

Furthermore, Computer Science is mainly concerned with computer algorithms and programming. While, Information Technology is concerned with computer networking and hardware and Information Systems is concerned with the enablement of using technology to enhance business decisions (CC2020, 2020). Therefore, the focus on each computing discipline does not determine what a student will be after graduation due to the overlaps and the fact that not all topics are covered, and other students will have careers that go beyond what is described above.

IT2017 (2017) states that there is a lucrative job market for IT graduates with both technical and non-technical skills. The Computing Curricula 2020 (2020) presents skills and the European Competency Framework to differentiate the career paths which are required in the IT industry based on skills, competencies and proficiency levels. Furthermore, they recommend that the Framework can be used by IT organisations and HEIs to define the different IT career paths (CC2020, 2020).

## 2.9 IT Careers

Kaushal and Vashisht (2021) argue that the meaning of a career has changed over the years because of the changes in the work environment, such as technology, global competition and job mobility. Hall (2001) states that careers are individually perceived through attitudes and behaviours associated with activities over an individual's life span. On the other side, the Computing Curricula 2020 (2020) defines careers as composed of sub-disciplines or similar aggregation of jobs where the industry specifies the requirement with a set of competencies. Furthermore, Hall (2001) adds that careers are important as they represent the person's entire life. Careers are a major factor in determining one's overall quality of life. For the purpose of this study, careers will be viewed as a chosen course of life with reference to academic studies with a focus on the IT computing field.

### 2.9.1 Computing careers

Upon students deciding to enrol for a university degree, students face another important decision to choose a career focus (Othman & Mohamad, 2019). Subsequently, students complete qualifications in one of the computing disciplines, to prepare for entry into the computing profession or workforce. Several curricula in the computing discipline provide a different focus and perspective on the computing profession (CC2005, 2005). Therefore, IT graduates as professionals apply their skills in a broad range of sectors that include business, government, services, and other structures that rely on computing to automate their products or services (IT2017, 2017). Additionally, hiring technically competent graduates is critical for the industry. Some technical skills for IT professionals shown in Figure 2-19 are similar to the IS jobs shown in Figure 2-20.

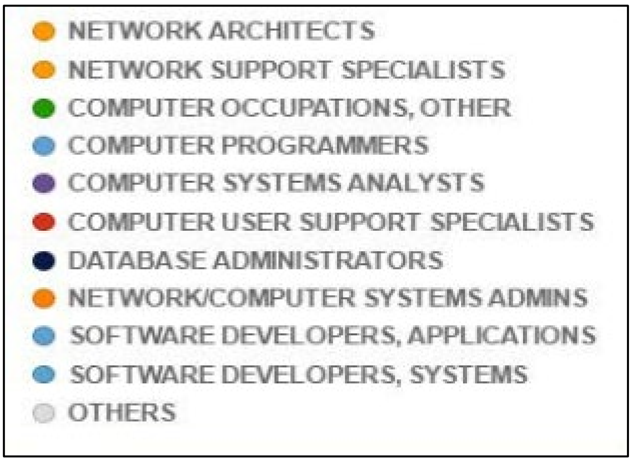


Figure 2-19: Top IT jobs (IT2017, 2017)

The Information Systems 2010 (2010) curriculum guidelines compiled career tracks out of the cores of IS, as shown in Figure 2-20. Most of the careers listed in Figure 2-20 are similar to those listed as IT jobs (Figure 2-19). Therefore, it can be said that when a curriculum in the computing field is adopted by an institution, a high level of flexibility and variability is important while maintaining the core as they could lead to similar careers (IS2010, 2010).

| |
|---|
| Application Developer |
| Business Analyst |
| Business Process Analyst |
| Database Administrator |
| Database Analyst |
| e-Business Manager |
| ERP Specialist |
| Information Auditing and Compliance Specialist |
| T Architect |
| IT Asset Manager |
| IT Consultant |
| IT Operations Manager |
| IT Security and Risk Manager |
| Network Administrator |
| Project Manager |
| User Interface Designer |
| Web Content Manager |

Figure 2-20: IS careers based on IS Curriculum (IS2010, 2010)

Computing Curricula 2020 (2020) purports that the naming of a computing program is not a unique qualification for employment. Therefore, employers are more interested in a graduate’s technical skills. The Computing Curricula 2020 (2020) argues that there are plenty of jobs in the computing industry and the trend will continue up to 2024 (Figure 2-21).

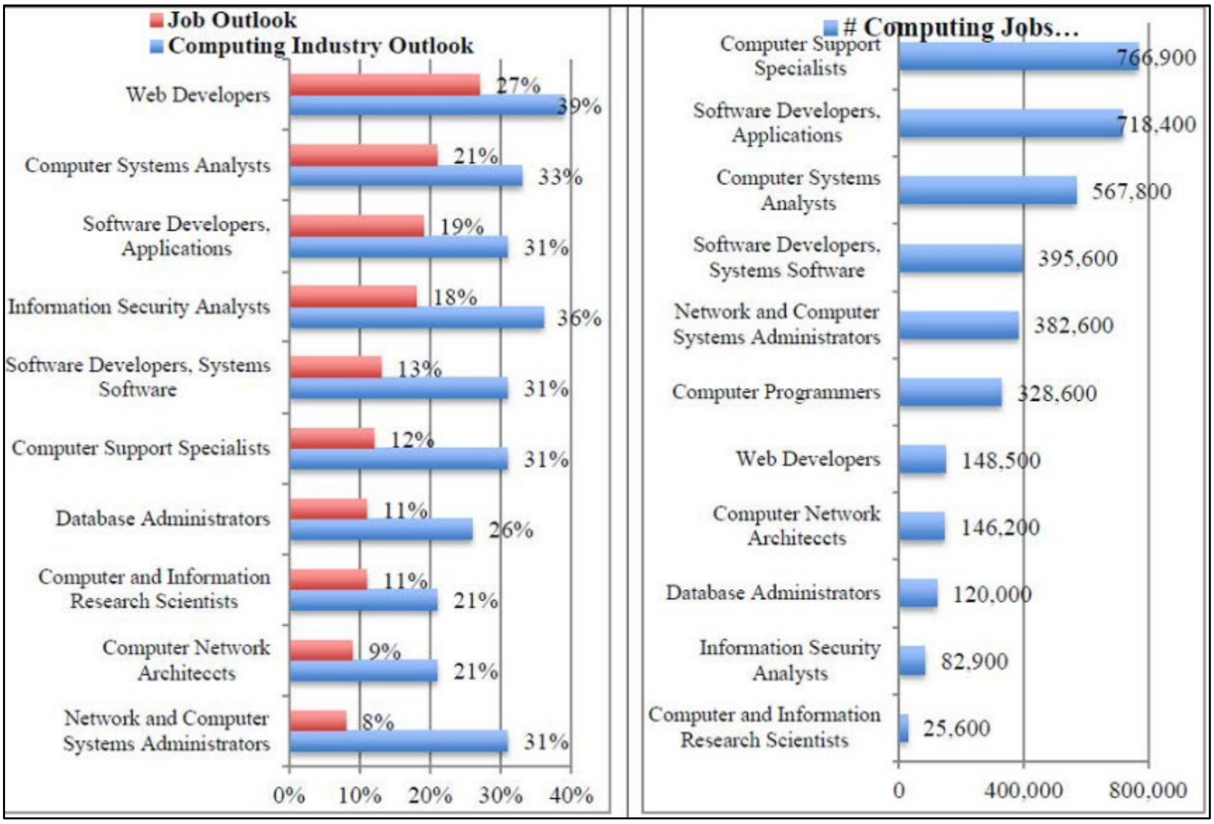


Figure 2-21: Computing jobs projected growth (2014-2024)
vs all sectors (CC2020, 2020)

Computing curricula lead to different jobs as presented above. There is a variety of available IT jobs and students interested in IT careers need to be well equipped with technical and other skills to satisfy the demand.

### 2.9.2 4IR and Careers

Schofield and Dwolatzky (2019) highlight digitisation skills as important to the conversion of data into digital form, whereby data may be captured, stored and manipulated in and between digital devices. Furthermore, this type of skill is needed for careers, such as developers, database administrators and user interface designers (Schofield & Dwolatzky, 2019). Additionally, Schofield and Dwolatzky (2019) argue that skills, such as those that are associated with emerging technologies and the 4IR including Big data, cloud computing and Internet of Things (IoT) specialists will be needed now and in the future. Table 2-3 shows some of the prominent jobs in IT linked with the 4IR, and Table 2-3 shows IT Skills demands in Africa and South Africa.

Table 2-3: 4IR IT prominent jobs

| 4IR IT Prominent jobs | | | | |
|---|---|---|---|---|
| **Critical Skills shortage SA Immigration Act (Feb 2021 release)** | **InformationWeek Top IT Jobs (2020)** | **Business Tech (2020)** | **CIO Africa (2021)** | **ITP skills for 4IR (2020)** |
| ICT systems analyst | Software Engineer | Mobile App developer | ICT Security Professional | Information Security |
| Data Scientist | Cloud Architect | Web developer | Cloud Architect | DevOps |
| Software Developer | Project Manager | Software Engineer | Database Administrator | Big Data design/analytics |
| Programmer Analyst | IoT Specialist | Database Administrators | Programmer analyst | Artificial Intelligence/Blockchain |
| Developer programmer | Application Developer | Cyber Security Expert | Systems analyst | Internet of things Specialist |
| Multimedia Specialist | Information Security Analyst | Network Engineers | Mobile Apps developer | Test automation |
| Web Developer | Digital Transformation Specialist | Data analyst/scientist | Network Administrator | ICT Project Management |
| Application programmer | AI/Machine Learning Specialist | Robotics | Software Developer | Systems design/Architecture |
| Computer quality assurance analyst | Data Analyst/Scientist | Artificial Intelligence/Machine Learning | DevOps | Business Intelligence |
| Database designer and administrator | | Augmented reality | Help desk and desktop support | System/Business Analyst |
| Network analyst | | | | Programming/Software Dev/Mobile and Web Developer |
| ICT security specialist | | | | Process/Change/Configuration Management |
| Information service manager | | | | Quality Assurance |
| Chief Information officer | | | | |
| ICT project manager | | | | |
| Data management manager | | | | |
| Application development manager | | | | |
| Information Technology manager | | | | |
| Information systems director | | | | |

Calitz (2010) notes the need for students to know and describe specific IT careers by comparing the job titles to the tasks using at least 10 careers. Therefore, Table 2-4 shows different computing careers that have become prominent with the 4IR. Careers, such as Information Security Specialist, System Analyst, DevOps, Programming, Network Engineers, Data Scientist, ICT project manager, Artificial Intelligence are prominent jobs for the 4IR.

Table 2-4: Ten 4IR jobs

| Top 10 4IR IT jobs |
|---|
| Information Security |
| DevOps |
| Artificial Intelligence/Blockchain |
| Internet of things Specialist |
| System/Business Analyst |
| Programming/Software Dev/Mobile and Web Developer |
| Database designer and administrator |
| Network analyst/administrator/engineers |
| Data analyst/scientist |
| ICT Project Management |
| Help desk and desktop support |

Subsequently, the careers in Table 2-4 will be used in the questionnaire to evaluate a student's awareness of the job function/title and their differences. The factor entitled career awareness which lists job function/title, students will match the job with title to demonstrate their understanding of IT jobs.

### 2.10 The Career Decision-making Process

Gati and Kulcsár (2021) argue that there is a variety of decisions, some with long-term consequences, such as having a child. Career decisions differ in several ways. Gati and Kulcsár (2021) state that first several alternatives have to be considered, hence, Othman and Mohamad (2019) argue that after high school students have a choice either to start work or attend university. Secondly, choose different degrees and compare them with alternatives, and select which university to attend. Hence, decision making is a process that leads to action from several alternatives, which focus on choosing to study or training.

The process involves gathering and processing information, then using the knowledge to compare relevant alternatives, thus a decision-making model can be applied (Gati & Kulcsár, 2021; Othman & Mohamad, 2019). Thirdly, the consequences of the decision can have financial, and long-term social implications (Gati & Kulcsár, 2021). Additionally, in choosing a university, students focus on various factors, such as good academic reputation, cost, location and programme issues (Othman & Mohamad, 2019). Hence, Gati and Kulcsár (2021) further state that such decisions are challenging for most people and can lead to career indecision and stress. Therefore, career decision-making is a complex process that needs consideration of factors involved.

The Computing Curricula 2020 (2020) notes that a student is interested in completing undergraduate education and focuses and the job opportunities provided in the domain. Furthermore, a student can think about the knowledge and areas of focus for the field, passion, interest and self-motivation can be influencing the decision to choose a field or career (CC2020, 2020). Therefore, this study will examine the process of decision-making in detail, in Chapter 3, by focusing on theories applied in decision-making and factors that influence career decisions.

## 2.11 Summary

The chapter aimed to address the following research question: $RQ_{1.1:}$ What is the environment of Higher Education in South Africa? $RQ_{1.2:}$ What IT Curricula are available at Higher Education Institutions? $RQ_{1.3:}$ What IT Careers are available in Industry? In addressing the research questions the chapter discussed the landscape of education and higher education. Following that, the chapter discussed higher education in particular to Africa. The challenges experienced with higher education globally and in Africa were discussed.

The chapter discussed NMU as the study context, focusing on the history, faculties, demographics and student enrolments. A comparison of NMU with other universities in South Africa was undertaken to give an understanding of the capacity or scale of NMU in research publications and student enrolments.

The chapter further investigated IT curricula using the ACM guidelines. The CS/IS/IT curricula were discussed and compared against each other. Furthermore, differences and overlaps of the CS/IS/IT curricula were examined and IT careers outputs were discussed. Finally, the chapter discussed the different careers and IT jobs and focused on the 4IR IT jobs that are in demand. Additionally, the chapter highlights the decision-making process that a student has to make regarding choosing a career.

Chapter Two addressed all $RQ_{1.1}$, $RQ_{1.2}$ and $RQ_{1.3}$, therefore, attaining $RO_{1}$: Investigate Higher Education in South Africa and current IT Careers. The Higher Education environment was discussed and three ACM IT curricula guidelines were investigated and similarities and differences were highlighted. In reaching the goals of objective one, the IT careers were discussed and compared based on their variety to determine the current top ten demands, additionally, the demands of the IT profession.

Chapter Three will address $RO_{2}$: Develop a conceptual model of the factors influencing career decisions of first-year students. The chapter will introduce literature on theories and factors that influence career decision-making, intending to address $RO_2$.

# Chapter 3: Factors Influencing Students' Career Decisions

## 3.1 Introduction

Chapter Two introduced the context of the study, and key elements of this research study such as Computing Curricula and IT careers. Chapter Two at the end highlighted the decisions that students have to make about careers to choose, therefore addressing $RO_{1:}$ Investigate Higher Education in South Africa and current IT Careers.

This chapter initially uses a Systematic Literature Review (SLR) to investigate the literature about theories and factors that influence a student's career decision. In addressing $RQ_{2.1:}$ What theories are used to understand the factors influencing career decision-making? the results of the SLR findings are synthesised to find theories applied in decision making. The SLR findings of factors that influence a student's choice of career are synthesised to address $RQ_{2.2:}$ What factors influence a student's career choice? Finally, the chapter addresses $RQ_{2.3:}$ Which factors must be included in a conceptual model to understand the career decisions of first-year students by proposing a conceptual model for IT Career Choices?

The chapter aims to address the objective $RO_{2:}$ Develop a conceptual model of the factors influencing career decisions of first-year students. Figure 3-1, outlines how the chapter will aim to meet the research objectives.

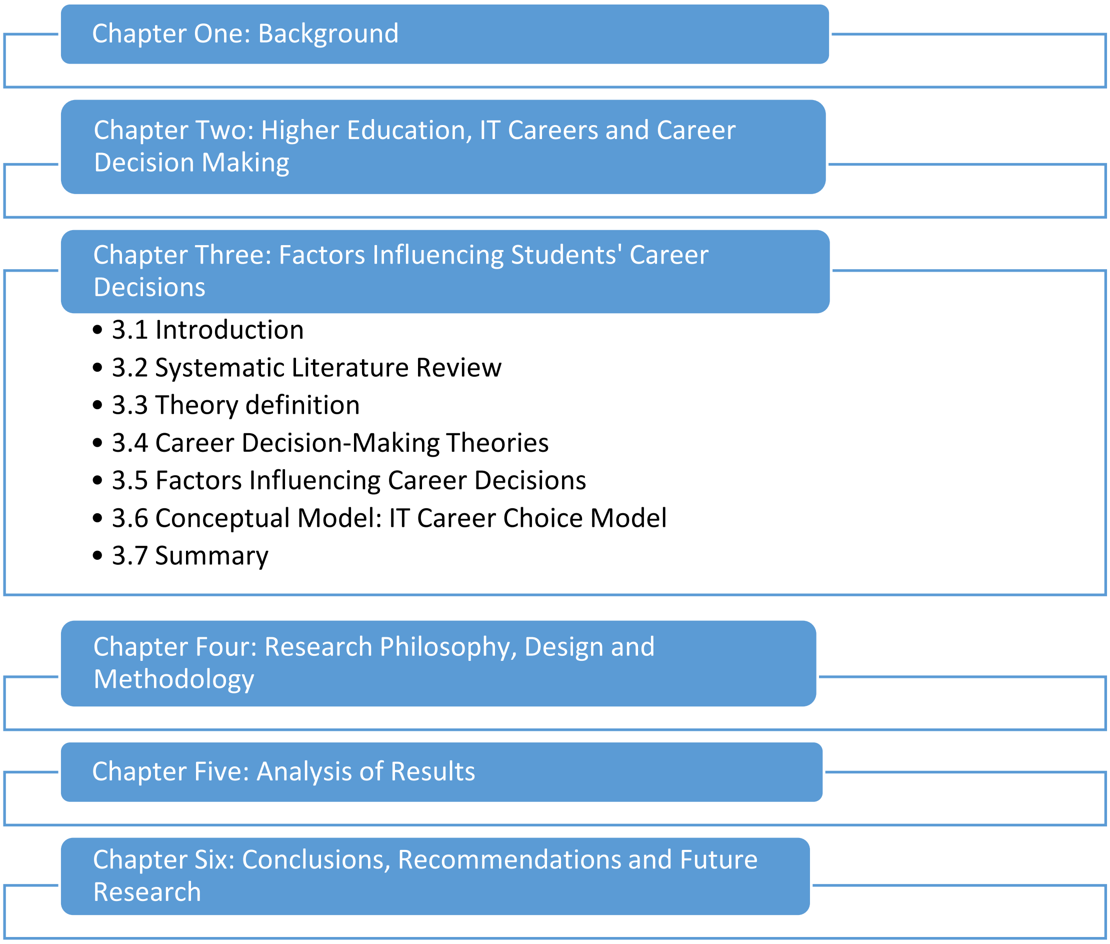


Figure 3-1: Chapter Three Layout

### 3.2 Systematic Literature Review

A Systematic Literature Review (SLR) is defined as rigorous, methodical, and transparent in the methods used to identify the research included in a study (Ward-Smith, 2016). Okoli and Schabram (2010) concur that an SRL is a rigorous approach, especially to conducting a stand-alone literature review. However, Kitchenham et al., (2007) disagree as they add that SLR is performed in academic studies to anchor a scholarly dissertation.

Kitchenham et al. (2007) further note the advantages of an SLR; 1) It summarises existing evidence, 2) identifies limitations and benefits in the current literature, 3) identifies gaps and areas of further investigation, and 4) provides a framework to position new research activities.

For this study, an SLR is used to identify gaps and areas of further investigation and to provide a framework to position this research. The study will identify the factors influencing decision-making in choosing careers and identify theories applied in career decision-making. Secondly, the SLR will provide the basis to contextualise the study and its research activities. The study will follow the SRL guidelines by Kitchenham et al. (2007), planning, selection, extraction and execution.

### 3.2.1 Planning

The planning process focuses on the purpose of the SLR and protocols (Kitchenham et al., 2007). The primary focus of the SLR is to answer $RQ_{2.1:}$ What theories are used to understand the factors influencing career decision-making? $RQ_{2.2:}$ What factors influence students' career choices? The SLR is conducted by one researcher, therefore there is no need for protocol draft and training. However, a protocol was devised and applied during the literature search.

### 3.2.2 Selection

The selection process is about searching for studies and eliminating studies that do not meet the criteria (Kitchenham et al., 2007). Figure 3-2 shows a summary of the selection process for the study.

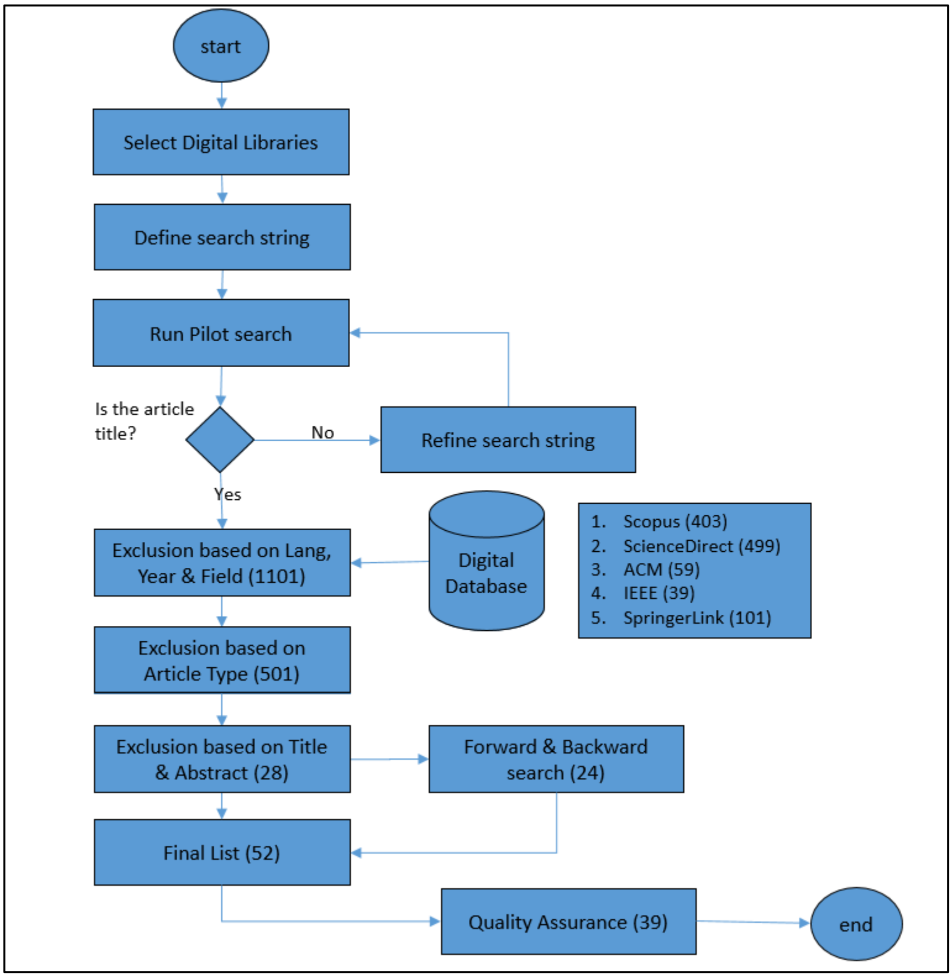


Figure 3-2: Study Selection Strategy adapted from Wahono (2016)

Petticrew and Roberts (2006) state that a massive amount of information is available on subjects, therefore it necessitates consultation with qualified information scientists to produce a high-quality SLR. However, Petticrew and Roberts (2006) argue that a rigorous process is followed. For this study, the researcher followed a rigorous process through consulting with experts and therefore selecting five databases as shown in Table 3-1.

Table 3-1: Database used with justification

| |
|---|
| 1. **Scopus** - covers a wide range of academic fields from sciences, social sciences, arts, and humanities.<br>2. **ScienceDirect** - Covers a wide range of journals from the academic field of physical sciences and engineering, life sciences, health sciences, and social sciences and humanities.<br>3. **ACM** - ACM is a leading global resource for scientific information, ACM promotes computer research and innovation. Additionally, ACM provides access to a Digital Library with more than 600000 articles by leading researchers in the computing field (ACM, 2021).<br>4. **IEEE** - IEEE is a digital library with access to scientific and technical content in the field of electrical, computer, and software engineering, publishing more than 1700 leading-edge conference proceedings every year (IEEE, 2021).<br>5. **SpringerLink** - Springer is a leading global scientific journal providing researchers in academia, scientific institutions with quality content through innovative information. |

Source materials can be grey literature, non-peer-reviewed and peer-reviewed literature (Ward-Smith, 2016). Ward-Smith (2016) defines peer-reviewed literature as having undergone a review process by either an impartial or blinded peer-reviewer. Additionally, peer-reviewed literature can be reference books, journal papers and conference papers. For this study, only full journal articles and full conference articles were mainly used for the SLR.

A search was developed primarily focusing on $RQ_{2.1:}$ What theories are used to understand the factors influencing career decision-making? $RQ_{2.2:}$ What factors influence students' career choices? A combination of keywords was used and the process was iterative until obtaining a final string, as shown in Table 3-2.

Table 3-2: Search String

| **Final Search String** |
|---|
| Search String: ([All factors] AND [All students] AND [[All enrol*] OR (All Intention*) OR [All career*]] AND [[All decision] OR [All path]] AND [[All university] OR [All higher*] OR [All college]]) |

The initial results from the databases articles were Scopus (403), ScienceDirect (499), ACM (59), IEEE (39) and SpringerLink (101). The articles were further scrutinised based on the search string in Table 3-2. The screening of articles had to be planned to weed out irrelevant articles. The elimination of articles allows for the SLR to be practically manageable (Kitchenham et al., 2007). Hence, inclusion and exclusion criteria must be specified.

Exclusion criteria ensured that articles must be in English, peer-reviewed research articles, full paper articles and published between 2015 and 2021. Additionally, the discipline must be Computer Science and/or Social Sciences. Articles were further screened based on titles and abstract relevance.

Inclusion criteria ensured that articles that 1) investigated factors that influence decision making at university and college, and 2) studies discussing theories on decision making. The inclusion and exclusion criteria resulted in 28 articles, which the researcher felt was too low. Wahono (2016) recommends a manual search of the literature checking references from relevant articles, which is called a backward search. Therefore a backward process was undertaken that increased the final list to 52 articles. The process of inclusion and exclusion was discussed with the supervisor to avoid biases by the researcher (Kitchenham et al., 2007).

### 3.2.3 Extraction and Appraisal

Kitchenham et al. (2007) argue that general inclusion/exclusion criteria are considered critical to assess the quality of the studies. In assessing the quality of the study, inclusion and extraction criteria were used to maintain quality. Kitchenham et al. (2007) further focus on accurately recording the information obtained from the primary studies. Therefore, Wahono (2016) purports that extraction involves reading the full-text articles with the information aimed at addressing the purpose of the SLR. Finally, data extraction includes numerical counts for summarising the results of a set of primary studies (Kitchenham et al., 2007). In handling biases for the extraction the supervisor performed the cross-checking of the data. Table 3-3 summarises the extraction of data from the studies.

Table 3-3: Data extraction of SLR

| **Data Extraction** | |
|---|---|
| **Research Choice** | **39** |
| Quantitative | 26 |
| Qualitative | 10 |
| Mixed method | 3 |
| **Research Method** | |
| Surveys | 26 |
| Meta-analysis | 1 |
| Ethnography | 1 |
| Methods not mentioned | 11 |
| **Theories** | **17** |
| SCCT | 12 |
| TRB/TRA | 3 |
| Critical Race Theory | 1 |
| Career Development Theory | 1 |
| **Study Field of Application** | **24** |
| STEM | 22 |
| Hospitality | 1 |
| Accounting | 1 |
| **Country** | **28** |
| America | 11 |
| South Africa | 4 |
| Others | 13 |

For this study, quality appraisal and data extraction were combined into one form as Wahono (2016) suggests. The major focus was on the study design, research strategies, method choices, theories, the field of application and countries. With the results in observance, this study aimed to use some of the findings to identify gaps in the literature and address the research objectives.

### 3.2.4 Execution

Data execution is the last step, which involves an analysis of findings and writing the review (Kitchenham et al., 2007). Furthermore, Kitchenham et al. (2007) argue that data synthesis involves collating and summarising the results from the SLR. In support, Wahono (2016) states that tables should be used to highlight similarities or differences of the findings. Therefore, the analysis will be tabulated by using graphs and tables to represent the results. Finally, the analysis of the findings and write-up for the SLR is carried out in several sections of the dissertation, specifically in Section

3.4 and Section 3.5 as depicted in Table 3-4. Each section focuses on a specific question from the SLR, the end goal will be addressing the main purpose of the SLR.

Table 3-4: SLR Synthesis of Results

| Findings & Synthesis of Results | |
|---|---|
| Section 3.4 | What theories are used in career decision-making? |
| Section 3.5 | What factors influence career decision-making? |

### 3.3 Definition of Theory

Gregor (2006) highlights several views of what is a theory in Information Systems. Each of the three views is different being 1) Theory as statements that say how something should be done in practice; and 2) Theory as statements providing a lens for viewing, a conceptual lens, explaining the world; and 3) theory as statements of relationships among constructs that can be tested. Sutton and Staw's (1995) definition encompass the views listed by Gregor (2006), as they argue that theory is about the connections between phenomena, a story about how acts, events, structure and thoughts occur.

Consequently, a theory emphasises the nature of causal relationships, identifying what comes first as well as the timing of such events. Gregor (2006) further adds that many researchers who use the word theory fail to give any explicit definition of their view of theory. Consequently, the view that will be adopted on theory for this research study is based on Sutton and Staw (1995), which encompasses frameworks and a body of knowledge. Therefore for this study, the combined view of theory by Sutton and Staw (1995) and Gregor (2006) will be adopted.

### 3.4 Career Decision-Making Theories: Analyses and Synthesis SLR

The section aims to analyse and synthesising the results from the SLR. The question answered is $RQ_{2.1:}$ What theories are used to understand the factors influencing career decision-making? Figure 3-3 illustrates the results of the SLR on the theories used for career decision-making.

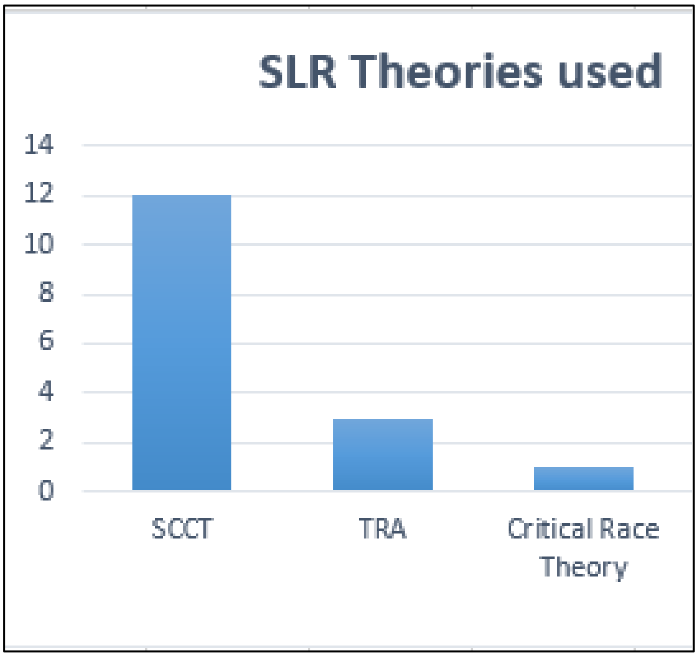


Figure 3-3: SLR Results of Theories

Alshahrani, Ross and Wood (2018) state that there appears to be a lack of studies that use a theoretical basis to investigate the factors that influence a students' decision to pursue a career. The SLR results concur as out of 39 articles, only 17 used theories that are applied to underpin the studies, as shown in Table 3-4, therefore 22 studies lacked theory as the basis of investigation.

Therefore, this study will examine several career decision-making theories that were used in the SLR for understanding the factors influencing a student's career decisions. The SLR results indicate that the most used theory was the *Social Cognitive Career Theory (SCCT)* as it was used twelve times, followed by the *Theory of Reasoned Action (TRA)* used 3 times. Lastly, the *Critical Race Theory (CRT)* was applied in one study. The next session will discuss SCCT, TRA, CRT theories and their applications on the SLR studies.

### 3.4.1 Social Cognitive Career Theory (SCCT)

Patton and McMahon (2014) state that several theories focus on the characteristics of individuals and the persons' environment. Additionally, the theories placed more emphasis on the stages and processes of career development and became known as developmental theories (Patton & McMahon, 2014). Career development theories state that a career choice can be made by individuals once they know what career is available to them and when they have a realistic understanding of how to achieve their career goals. Patton and McMahon (2014) note that there are eight different groupings of career theories, and one that is relevant to this study is the process theories and the SCCT is part of the career development theories.

The SCCT has developed from Bandura's (1986) general Social Cognitive Theory (SCT) and aims to understand the processes and outcomes, of individuals who develop interests and decisions about their educational or occupational pursuits (Lent et al., 1994). A different view by Alshahrani, Ross and Wood (2018) states that the SCCT is a framework for understanding how personal, cognitive and contextual factors influence career choices. Seymour and Serumola (2016) concur that SCCT is a theory that shows the influence of structural and individual factors on students' decisions to pursue careers.

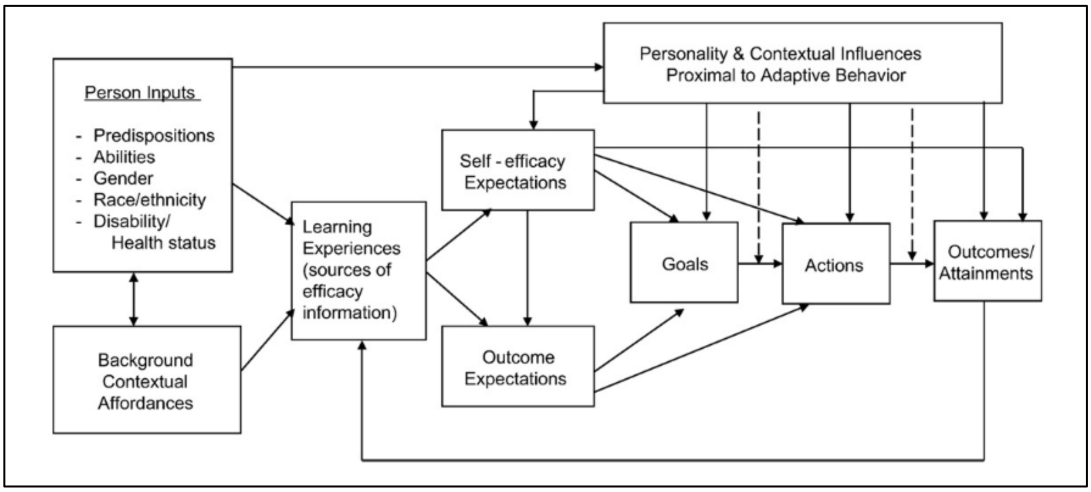

Figure 3-4: Social Cognitive Career Theory (Brown, 2002)

Additionally, the SCCT postulates that the perceived social and cultural environment affects the development of career-related self-efficacy, which moulds experiences related to vocational interests, goal choice, and performances as seen in (Brown, 2002). Therefore, in the SCCT theory, social and structural factors impact career choice indirectly through individual factors. According to Balakrishnan and Low (2016), the SCCT is a theory that has become a fundamental model to study how people form interests, make choices, and achieve different levels of success in both academic and career pursuits.

Lent and Brown (2006) claim that the theory was originally based on three models, namely the development of study and career interest; the leading of those interests into the study and career choices; and the performance and persistence people achieve to realise their choices. A fourth model that aimed to explain satisfaction at study and work was later added (Lent & Brown, 2006). The SCCT thus is a motivational theory driven by self-efficacy, outcome expectations, and goal-directed activity.

### 3.4.2 SCCT Related Work

Findings by Alshahrani et al. (2018) illustrate that social support is key from family, friends, especially for females. In agreement, Nugent et al. (2015) concurred as their results showed that parents, friends and family were key for developing interest amongst students, which in turn predicted self-efficacy and outcome expectation.

Alshahrani et al. (2018) found that the prior learning from school had limited influence on the student’s decision. However, Balakrishnan and Low (2016) in their study found out that Learning Experience was directly related to female students intending to pursue engineering, whereas socio-cultural values have a strong influence on students' pursuit of engineering in general. There seems to be a discrepancy in findings regarding the influence of Learning Experience on career decisions.

Self-efficacy was seen as important for career decisions (Alexander & Twinomurinzi, 2012). In support, Borrego et al. (2018) found that self-efficacy is a strong influence on high school graduates' intentions to choose a career in engineering. In a study by Chachashvili-Bolotin et al. (2016) in Israel, they noted Outcomes Expectations and Self-efficacy had a positive correlation between students entering tertiary education but did not differentiate between the interest of study.

Alshahrani et al. (2018) included career perceptions that are not part of the SCCT, even though the factor did not influence chosen career. Cohen and Parsotam (2010) also highlighted the perception of the Information System course's strong link to the intentions to pursue careers. The SCCT has been used in several studies as noted above, and different findings are well illustrated by the studies depending on the context of the application.

### 3.4.3 Theory of Reasoned Action

The Theory of Reasoned Action (TRA) originated in the field of social psychology. The TRA was developed by Fishbein and Ajzen (1975) who identified the links among the beliefs, attitudes, norms, intentions and behaviour of individuals. The TRA and its subsequent developed version Theory of Planned Behaviour (TPB) are based on the perceived behavioural control component to account for behaviours that occur without a person's volitional control and norms (Joachim et al., 2015). Ajzen (2010) states that theory in human planned behaviour is guided by three kinds of considerations: beliefs about the likely consequences of the behaviour (behavioural beliefs); beliefs about the normative expectations of others (normative beliefs); and beliefs about the presence of factors that may facilitate or impede the performance of the behaviour (control beliefs).

The TRA theory predicts the occurrence of a specific behaviour provided that the behaviour is intentional (Francis et al., 2004). Additionally, behavioural beliefs produce a favourable or unfavourable attitude towards the behaviour; normative beliefs result in perceived social pressure or subjective norm and control beliefs give rise to perceived behavioural control (Ajzen, 2010).

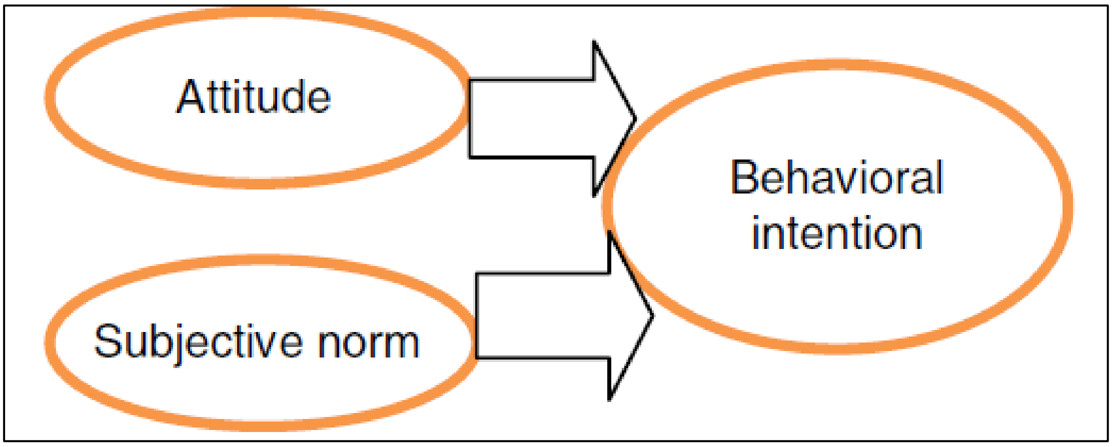


Figure 3-5: Theory of Reasoned Action Model (Fishbein & Ajzen, 1975)

In addition, Ajzen (2010) claims that attitude, subjective norm and perception lead to the formation of behavioural intention, as shown in Figure 3-5. Furthermore, the TRA model provides a social psychological framework that has proven useful in explaining many types of behaviours (Cohen & Hanno, 1993; Sheppard et al., 1988).

### 3.4.4 TRA related work

The TRA framework has been used in diverse contexts for modelling human behaviour and it has proven effective in examining and understanding human behaviour (Govender & Naidoo, 2013). The TRA has been useful in the fields of healthcare in helping people adopt healthy behaviours and to help health practitioners to increase the uptake of behavioural guidelines. Additionally, TRA has been used in environmental studies to explain motivations and expectations for choosing careers (Joachim et al., 2015). Therefore, the theoretical framework has been used successfully in studies of a similar context to the current study (Zhang, 2007; Govender & Khumalo, 2014).

Govender and Khumalo (2014) in their study indicated that interest in IS and perceived self-efficacy accounts mainly for women choosing a career in IS. Also, career awareness was a key influence for women for not choosing IS. A different finding by Babin et al. (2010) argued that parents as career choice influencers had a major influence on their children’s career choices while career guidance counsellors were the weakest influencers to scholars. Additionally, Babin et al. (2010) noted that income potential is a key influencer on career choice decisions and entry into the industry which provides IT skills.

Finzel and Deininger (2018) discovered that mentoring was a key influence to motivate students to choose Computer Science studies. In summary, TRA was applied in several studies with different outcomes within different research areas.

### 3.4.5 Critical Race Theory

Critical Race Theory (CRT) has its roots in the 1960s in America during the Civil rights conflicts where Critical Legal Studies movements critically interrogated how the laws reproduced, relied upon and normalised racism in society (Saetermoe et al., 2017). Ford and Airhihenbuwa (2010) claim that the term "Critical Race Theory" was coined in 1989 by a group of law students who were not happy about how racial power dynamics diverged in important ways from legal ways. However, Ford and Airhihenbuwa (2010) state that the CRT is not like behaviour change or other theories, rather it is an iterative methodology for helping investigators remain attentive to equity while carrying out research.

In agreement Treviño, Harris and Wallace (2008) state that CRT has many rigorous concepts and methods, but these have not been coherently integrated in a way that would give CRT a systematic structure. Hence Treviño et al. (2008) contend that CRT is less theory than it is an intellectual movement in thought and work about race. Therefore, Delgado and Stefancic (2017) define CRT as a collection of activists and scholars engaged in studying and transforming the relationship between race, racism and power. For this study, CRT will be considered as a theory as several authors are disagreeing whether it is a theory, a movement or a methodology.

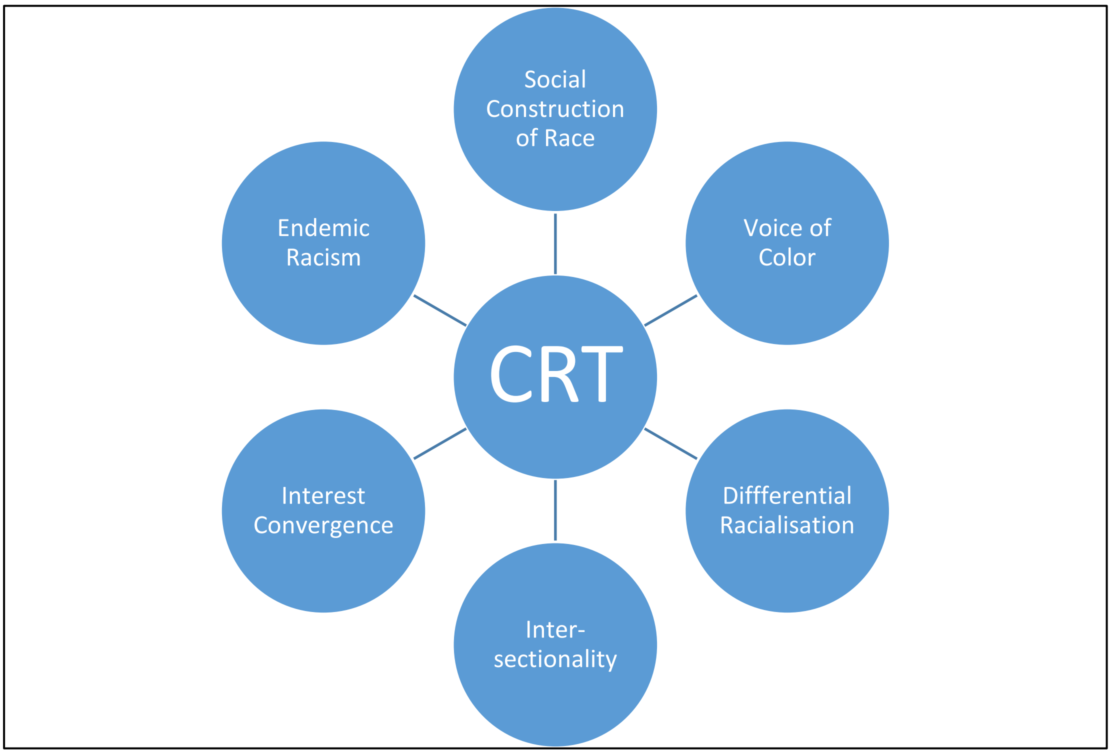


Figure 3-6 Critical Race Theory: Six basic tenets (Delgado & Stefancic, 2017)

### 3.4.6 CRT Related work

The CRT theory focuses on race consciousness, contemporary orientation, centring margins rather than in the mainstream and praxis (theory-informed action) (Ford & Airhihenbuwa, 2010). However, other authors argue that there are five basic constructs for CRT; the centrality of race and racism, the challenge to the dominant ideology, and interdisciplinary perspective, the importance of student's experiential knowledge, and a commitment to social justice (Saetermoe et al., 2017; Treviño et al., 2008). Six basic tenets of CRT as depicted in Figure 3-6, highlight; Social Construction of Race, Voice of Colour, differential racialisation, intersectionality, Interest convergence and Endemic Racism (Abrams & Moio, 2009; Delgado & Stefancic, 2017). The study focused on the six constructs as they are inclusive of the five constructs as shown in Figure 3-6.

### 3.4.7 Summary of Theories

The theories (SCCT, TRA and CRT) discussed in the section are summarised in Table 3-5. The SCCT with five constructs used to determine career choice, while the TRA has three constructs to determine the outcome of interest. Finally, the CRT has six constructs that influence decisions.

Table 3-5: Summary of Theories based on SLR

| Theories | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 |
|---|---|---|---|---|---|---|
| SCCT | Personal Inputs | Background | Learning Experience | Outcome Expectation | Self-efficacy | |
| TRA | Attitudes | Behaviour | Perceived Behaviour Control | | | |
| Critical Race Theory | Social Construct of Race | Voice of Color | Differential Racialisation | Inter-sectionality | Interest Convergence | Endemic Racism |

In conclusion, several factors were combined from each theory as building blocks to form a conceptual model as depicted in Figure 3-7. From the SCCT: personal inputs, background, learning experience, outcome expectation and self-efficacy. From the TRA: Attitudes and from the CRT Social Construct of race. The factors will be used in combination or as a single factor of the conceptual model.

The conceptual model will be used to steer the discussion addressing the factors influencing students' career decisions.

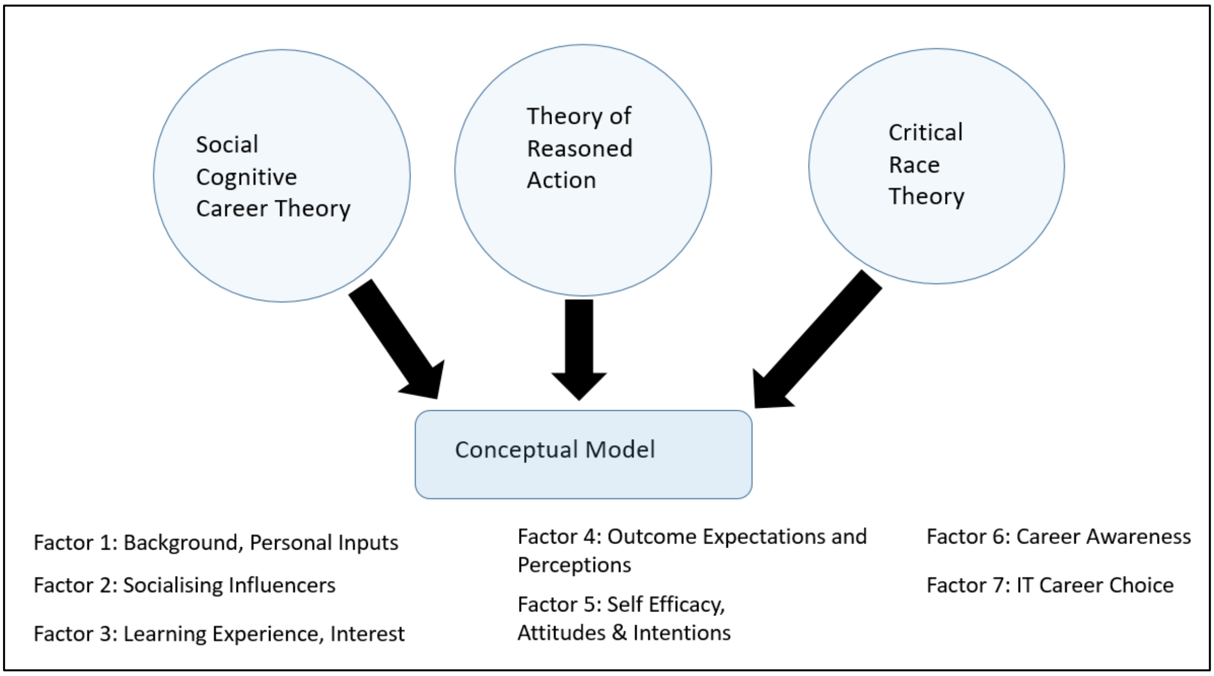


Figure 3-7: Theories and Factors for the Conceptual Model

### 3.5 Factors Influencing Career Decision: Analysis and Synthesis SLR

The SLR question answered is $RQ_{2.2}$: What factors influence students' career choices? Table 3-6 – Table 3-11 illustrate the results of the SLR on the factors that influence career decision-making. The results were divided into five factors namely Background Information, Socialisers, Learning Experiences, Outcome Expectations, Self-efficacy and Career Awareness. The factors have sub-themes in which counts were used to summarise the results from the selected articles. The process of reading through the articles and identifying the factors and classifying them into sub-themes was undertaken and finally, counts were used to totalling the occurrence of each sub-theme.

#### 3.5.1 Background information

The SLR results indicate that background information as a sub-theme included gender and race as important variables. Race and gender were included in most of the SLR studies, with a combined count of 31 out of 39 articles. The variables age, disabilities and years of study were included, as they influence students' career choice. Therefore the section will syntheses the discussion of the background variables as presented in Table 3-6.

Table 3-6: SLR results on Background Information

| RQ$_{2.2}$: What factors influence students' career choices? | Variable and Themes | Counts (n=39) |
|---|---|---|
| Background information | Race | 11 |
| | Language | 1 |
| | Age | 3 |
| | Gender | 20 |
| | Disabilities | 2 |
| | Year of study | 1 |

Therefore, twenty studies use gender as a variable (Table 3-6). Matthew et al. (2018) state that gender can influence the type of careers students pursue. In support, Bock et al. (2013) include gender as one of the variables that affect a person's decision of choosing a career. Furthermore, Bock et al. (2013) concluded that gender is a significant factor determining the interest, which influences the career choice decision of a person.

Matthew et al. (2018) in their study examining students' interest in accounting courses, identified that the age of students can determine the choice of career. However, they do admit that it could be that the age range was not large. On the contrary, Aivaloglou and Hermans (2019) in their study, that examined the Hispanic students', interest in STEM fields, found that age did not affect students' career orientation.

Elias and Brian (2015) state that a few studies examine racial and ethnic groups career decision influencers. The SLR results support Mein et al. (2018) in a study that examined Hispanic undergraduates and their choice to study engineering. Mein et al. (2018) results indicate that ethnicity plays a role in career choice, as it highlighted different challenges amongst races. In this study, the Background Information (gender, race, disabilities and age) is linked with the factor Learning Experiences and Socialisers.

### 3.5.2 Socialisers

The SLR results indicated 26 articles out of 39 articles in total applied socialisers (family, friends, teachers and friends) as influencers for career choices the influences were either positive or negative. The prominent influencers were family, which includes parents and teachers and career guides with a combined occurrence of 28 (Table 3-7). Friends, mentors and role models were the second-largest occurring theme.

Table 3-7: SLR Results on Socialisers

| $RQ_{2.2}$: What factors influence students' career choices | Variables and Themes | Counts(n=39) |
|---|---|---|
| Socialisers | family & parents | 18 |
| | friends | 6 |
| | teachers & Career Guides | 10 |
| | Mentors and Role Models | 8 |
| | Culture | 2 |

Nugent et al. (2015) state that studies can focus on sources of information, such as teachers, parents and peers as they may help elucidate the impact of such support systems in decision making. Additionally, background influences involve support and barriers, such as parents and family attitudes (Brown, 2002). In agreement, social encouragement includes positive reinforcement from family, teachers and peers (Wang et al., 2015).

Downes and Looker (2011) in their study discovered that parental education was a key influencer for career choices. Their study examined factors that contribute to low participation in computing and information technology courses at secondary schools. In support, Mein et al. (2018) noted that students whose parents were engineers, the parents were involved in engineering talk and activities from a very young age. Therefore, indicating the influence that parents have on their children. Mein et al. (2018) further noted positive school-based support from teachers and mentors that also plays a positive role in guiding students to STEM fields.

In their study, Govender and Khumalo (2014) indicated that a lack of knowledge by influencers, such as family and friends led to students not choosing to pursue IS studies. Additionally, Seymour and Serumola (2016) found that students' decisions to enrol or not to enrol for IS-related courses were influenced by the lack of information from their teachers. Their study examined events leading to students changing their major to Information Systems. Lee et al. (2019) note that social media has changed the way people and organisations share information. Additionally, input from social media was considered the least important in influencing a student's career choice. In this study, the Socialisers (culture, home environment and sources of influence) are linked with Learning Experiences.

### 3.5.3 Learning Experiences

Out of the 39 articles of the SLR a few studies examined learning experiences, a total of 18 articles only. Table 3-8 results indicate interest in school subjects (maths and science) is important for students' career choice. Early exposure to computer clubs and programming is important as six studies have shown that interest at school is a key factor for students' decisions. Lastly, computer education and problem-solving were key as a learning experience that has influences on students' career decisions.

Table 3-8: SLR Results on Learning Experiences

| **$RQ_{2.2}$: What factors influence students' career choices** | **Variables and Themes** | **Counts(n=39)** |
|---|---|---|
| Learning Experiences | Interest in School subjects (maths and science) | 6 |
| | Early exposure to computer clubs & Programming | 6 |
| | Computer education | 4 |
| | Problem-solving | 2 |

Learning experiences include performance accomplishments in subjects, verbal encouragement and vicarious learning (Lent & Brown, 2006). Seymour & Serumola (2016) note that students' enjoyment is a learning experience that directly influences their interest in pursuing IS courses. In support, Chen et al. (2013) state that enjoyment is an intrinsic value and has a direct influence on intention to study. The enjoyment is based on the students' experience of working with computers.

A career choice often starts with personal interest and curiosity about a certain field. In support, interests will lead to the setting of career goals (Alexander & Twinomurinzi, 2012). In highlighting the importance of interest, Downes and Looker (2011) indicated that interest in the subject is the most important factor, which influences a student's decision in choosing an ICT career. Furthermore, Mein et al. (2018) state that interest is important for involvement in computer projects and programming from a young age and studying experiences from school and teachers are helpful. For this study, Learning Experiences (interest, programming knowledge, enjoyment) are closely linked with Career Awareness, Self-Efficacy, Career Perceptions and Expectations.

### 3.5.4 Career Perceptions and Expectations

Outcome expectations involve individuals' beliefs about the consequences of actions, which can be social, functional and are shaped by influencers and learning experiences (Carrico et al., 2019). Additionally, outcome expectations focus on the consequences a  student believes will occur as a result of performing the task or behaviour (Brown, 2002).

Salaries are an important career perception and expectation as the SLR results in Table 3-9 indicate seven articles indicated students focused on salaries. Job security and availability followed with three occurrences, therefore, students' perceptions are as important as the expectations of a specific career choice. Lastly, learning new skills, opportunities and career-image were also important as they had a combined occurrence of four counts.

Table 3-9: SRL Results on Career Perceptions and Expectations

| **$RQ_{2.2}$: What factors influence students' career choices** | **Variables and Themes** | **Counts(n=39)** |
|---|---|---|
| Career Perceptions and Expectations | Stereotypes and Perceptions | 2 |
| | Salaries | 7 |
| | Learning new ideas & Skills | 2 |
| | Job security & Availability | 3 |
| | Opportunities | 1 |
| | Career-image | 1 |

Seymour and Serumola (2016) identified perceptions to have a high value, as IS was linked with future salary expectations and high job prospects. While perceptions can be positive, Hodges and Corley (2016) found that many students had a negative view of the geeky or nerdy image associated with choosing IT careers, which is a negative personal image.

Personal image and fear that IT professionals are geeks or nerds are factors affecting students not to choose IT careers (Croasdell, McLeod & Simkin, 2011). However, a study in the USA by Hodges and Corley (2016) indicated that some students believe that by choosing IT careers, they would receive a well-paying job and are guaranteed good job security. In support of their study, Sharif et al. (2019) indicated that future income is a strong influencer on the students' career decisions. Additionally, students' career choice is influenced by careers that would give them a boost in society and the ability to afford a lavish lifestyle. Another factor that cannot be ignored is that students believe that a genuine interest in job security is very important, which influences their career choice (Alexander & Twinomurinzi, 2012).

Seymour and Serumola (2016) state that students have misconceptions of the IT field, due to limited exposure at high school. The perceptions were dominated by the misperception of the value of IT and a lack of IT information. In support, Govender and Khumalo (2014) concur that some students make their decision not to enrol for IT studies, due to a lack of access to information regarding IT courses. Additionally, there is a lack of publications to inform students about IT courses and careers. Furthermore, students had a misconception that there were no jobs in the IT field and that the IT field was predominantly technical (Seymour & Serumola, 2016). For this study, Career Perceptions and Expectations (salaries, lifestyle, job prestige and career image) are linked with Career Awareness and influence career choice.

### 3.5.5 Self-Efficacy

The SLR results in Table 3-10 indicate interest as important for career decisions as highlighted in 10 articles. Self-efficacy and ability with a count of seven and eight articles are important factors that can influence a person's career choice. Problem-solving, grades and enjoyment are also factors that are considered for career choice.

Table 3-10: SLR Results on Self-efficacy

| $RQ_{2.2}$: What factors influence students' career choices | Variables and Themes | Counts(n=39) |
|---|---|---|
| Self-efficacy | Self-efficacy | 7 |
| | Interest | 10 |
| | Problem-solving | 3 |
| | Ability | 8 |
| | Grades | 4 |
| | Enjoyment | 3 |

Self-efficacy is defined by Bandura (1986) as belief in one's capability to organise and execute a course of action required to achieve a given goal. Self-efficacy according to Alexander et al. (2010) is considered the most important mechanism in career choice. The commonly agreed-upon factor in studies done on this topic is that of computer self-efficacy (Govender & Khumalo, 2014). Furtheromore, Downes and Looker (2011) add that ability is key to self-efficacy, and the ability is linked to a person's learning experience with home and school-based tasks.

In addition to self-efficacy, Lewis and Anderson (2011) observed beliefs about CS as important for students' achievements. The beliefs are linked with self-perception, according to Wang et al. (2015), which is the same as self-efficacy and provides internal encouragement for students' ongoing confidence and abilities. High self-perception is key to choosing to study computing courses.

For this study, Self-Efficacy (self-efficacy, abilities and attitudes) is linked with Career Perceptions and Expectations and Learning Experience (problem-solving and grades). Furthermore, self-efficacy influences a person's IT Career Choice.

### 3.5.6 Career Awareness

The Systematic Literature Review showed perceptions, knowledge and stereotypes are key things for career awareness, as they have a combined occurrence of 10 in all articles (Table 3-11). Career exploration was also important as an influencing point to career awareness.

Table 3-11: SLR Results for Career Awareness

| **$RQ_{2.2}$: What factors influence students' career choices** | **Variables and Themes** | **Counts (n=39)** |
|---|---|---|
| Career Awareness | Perceptions | 4 |
| | Knowledge | 3 |
| | Stereotypes | 3 |
| | Exploration | 1 |

Kirlidog and Coetzee (2018) allude to ignorance and lack of information on IT career as a reason for students not enrolling in the IT field. Awareness can be increased through exposure, and support that can provide a broader picture of IT as relevant to students' lives and help widen participation (Wang et al., 2015).

In their study, Kirlidog and Coetzee (2018) discovered that students even in their senior years at university, were unaware of IT programmes and their functions. Similar findings by Calitz, Greyling and Cullen (2011) indicated that students at the senior level lacked knowledge and awareness of IT careers. In support Seymour and Serumola (2016) noted that while students were enrolled at university they were not exposed to IS, hence they did not choose IS. Furthermore, their findings showed that teachers did not mention IS at high school recruitment. Govender and Khumalo (2014) further found that a lack of knowledge by influencers, such as family and friends led to students not choosing to pursue IS studies.

An incomplete understanding of the discipline dissuades women, from considering a career choice in the field (Wang et al., 2015). Limited awareness of computer careers does impact final career decisions. However, academic exposure to computer careers is important to generate interest and curiosity in the field and provide a broader picture.

Therefore, Kapoor and McCune-Gardner (2019) identified interventions such as clubs, projects and hackathons which could provide students with opportunities of learning different computing disciplines and understand various computing careers to increase awareness and interest in the computer field. In support, Kirlidog and Coetzee (2018) recommended a nationwide awareness campaign that can be implemented with the campaign to address IT careers awareness and knowledge for all students.

For this study, Career Awareness (job titles and job descriptions) is linked with Career Perceptions and Expectations and Career Awareness influences IT Career Choice.

### 3.6 Conceptual Model: IT Career Choice

Several factors influence career decisions (Sharif et al., 2019). To identify the major concepts of this study, a conceptual model was developed. Leshem and Trafford (2007) state that a conceptual model is a justification tool for the research for equally insiders' and outsiders' views, which highlights specific concepts and their relationships. A conceptual model is a structure that guides research by relying on a formal theory constructed by using an established, coherent explanation of certain phenomena and relationships (Kumar & Antonenko, 2014; Leshem & Trafford, 2007). Furthermore, a conceptual model is a structure that serves to hold parts together and tries to anticipate what explanation will be used for understanding the data (Leshem & Trafford, 2007). The study identified seven factors depicted in Figure 3-8 and developed a conceptual model. The conceptual model address $RQ_{2.3}$: Which factors must be included in a conceptual model to understand the career decisions of first-year students?

The conceptual model is based on the SCCT theory, TRA/TBA Theory and CRT, the conceptual framework includes factors such as Personal Inputs, Background Influences, Learning Experiences, Outcome Expectations and Self-Efficacy.

Twani et al. (2020) in their exploratory study used the IT Career Choice Model to explore factors influencing career decisions. The findings indicated that socialisers, learning experiences, career perceptions and awareness were major influencers to IT Career Choices. Furthermore, Twani et al.'s (2020) recommendations were to test the model with a larger sample and to validate the model statistically.

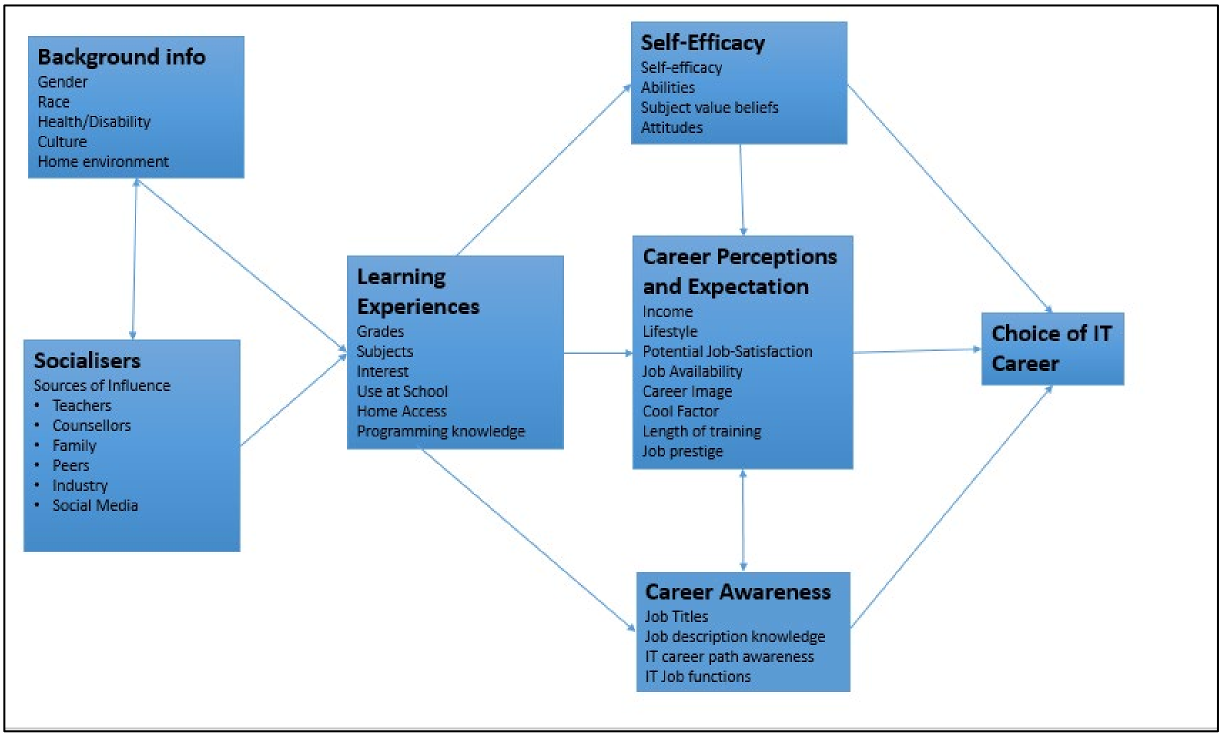


Figure 3-8: IT Career Choice Conceptual Model (Twani et al., 2020)

### 3.7 Summary

Chapter Three focused on developing a conceptual model for IT Career Choices. In doing so the chapter initially conducted a Systematic Literature Review, which aimed at 1) finding theories for decision making and 2) finding factors that influence decision making. The SLR findings were synthesised and used to answer $RQ_{2.1}$: What theories are used to understand the factors influencing career decision-making? The SLR demonstrated three theories used; SCCT, TRA and CRT from the results. Furthermore, the chapter focused on the related work for the theories and finally summarised the theories with their constructs. The second SLR results were used to address $RQ_{2.2}$: What factors influence students' career choices? The results presented many factors that the literature indicated as factors that influence students' career decisions. In examining the factors, the chapter discussed the factors using themes or constructs from three theories which were presented in the results for $RQ_2$.

The chapter presented a conceptual model developed from the theories and factors SLR synthesises. Therefore, the chapter addresses $RQ_{2.3}$: Which factors must be included in a conceptual model to understand the career decisions of first-year students? The question was addressed as factors that can be included in the model were identified. Finally, a proposed conceptual model was presented. Therefore, addressing $RO_2$: Develop a conceptual model of the factors influencing career decisions of first-year students.

The following chapter will address $RO_3$: Develop a data collection instrument that can be used to evaluate the conceptual model of the factors influencing career decisions of first-year students at NMU.

# Chapter 4: Research Philosophy, Design and Methodology

## 4.1 Introduction

Chapter Three addressed $RO_2$: Develop a conceptual model of the factors influencing career decisions of first-year students. Chapter Four will be focusing on addressing $RO_{3:}$ Develop a data collection instrument that can be used to evaluate the conceptual model of the factors influencing career decisions of first-year students.

Chapter Four introduces the concept of research and discusses the research philosophies and paradigms. The chapter focuses on the research design. Primarily mixed methods designs are used as the primary data collection choice and the survey strategy will be used in the study. The chapter further details how mixed methods are applied to this study. Subsequently, by discussing the research design the study addresses $RQ_{3.1}$: What research design can be used for the study?

Thereafter, the chapter focuses on surveys, particularly questionnaires as the tool discussed as they will be used for data collection. The chapter discusses how the questionnaire will be designed and administered to the participants. The chapter will discuss how the instruments were tested for validity and reliability, using a pilot study. Furthermore, the chapter discusses the pilot study conducted and the results. In doing so the chapter addresses $RQ_{3.2}$: What research instruments can be used for data collection? Figure 4-1 shows outlines of the chapter in addressing $RO_3$.


Figure 4-1: Chapter Four Layout

## 4.2 Definition of Research

The results of research are all around us, whether one is watching TV or listening to the radio. Saunders et al. (2009) claim that it is difficult to avoid the term research. Although the term is often used, Walliman (2005) warns that the term is loosely used to describe a multitude of activities. Saunders et al. (2009) support the thought as they highlight examples of how the term is used for polls to gather people's opinions, and that is defined as research because of the way data were collected. Additionally, examples of documentary programmes tell their viewers about research findings and advertisers mention research results to encourage customers to buy a particular product. Academics need to have a clear idea of what the word research means and clear away misconceptions (Walliman, 2005). For the study, the focus is to understand what is research in the academic environment.

The term research has been defined differently by many authors, therefore, there are differing opinions about the term. Research is defined by The Oxford Encyclopedic English Dictionary as:

- a systematic investigation into the study of materials, sources, etc., to establish facts and reach a new conclusion; and
- an endeavour to discover new or collate old facts etc. by the scientific study of a subject or by a course of critical investigation.

A second definition, by Creswell (2011) defines research as a process of steps used to collect and analyse information and to increase understanding of a topic or issue. Furthermore, Creswell (2011) adds that research consists of three steps:

- Pose a question;
- Collect data to answer the question; and
- Present an answer to the question.

A third definition, by Collis and Hussey (2014) states that the current definitions have the following common components:

- A procedure of inquiry and examination;
- Are organised and systematic; and
- Increase knowledge.

According to Saunders, et al. (2009), based on the most common definitions including those discussed in this study, research has several characteristics, namely:

- Data are collected systematically;
- Data are interpreted systematically; and
- There is a clear purpose to finding things out.

Saunders, et al. (2009) add that research is something that people undertake to find out things in a systematic way, thereby increasing their knowledge.

Collis and Hussey's (2014) definition is similar to Creswell's (2011) as both start by posing a question or inquiry. While Saunders, et al. (2009), and the Oxford Encyclopaedia both highlight the systematic collection of facts or data as the first step.

All of the authors' definitions do include data collection. Therefore, data collection can be deemed as a key component of the term research.

The second key phrase is a systematic data collection and interpretation of their definitions is found in The Oxford Encyclopaedia, Saunders et al. (2009) and Collis and Hussey (2014). Therefore, a systematic approach, whether it is for collection of data or interpretation of data is a key term that must be part of the definition of the term research.

Finally, the authors do not differ vastly on the purpose of research as Saunders et al. (2009) state research needs to have a clear purpose in finding out things. Collis and Hussey (2014) and The Oxford Encyclopaedia use finding new knowledge and new conclusions which in turn indicate new findings. Creswell (2011) highlights the fact that an increase of understanding is a reason for conducting research. Therefore, the definition of the word research should include new findings or new understandings.

In conclusion, having discussed the definitions and the common terms used for research, this study will adopt Saunders' et al. (2009) definition when defining the term research which encompasses all the key terms of the word research found on the discussed scholars.

Research is conducted when there are certain distinct processes or steps followed and the steps are identified as the scientific method of enquiry (Creswell, 2011). The scientific method components are:

- Identify the problem that defines the goal of research;
- Predict that, if confirmed, the results resolve the problem;
- Gather data relevant to this prediction; and
- Analyse and interpret the data to see if they support the prediction and resolve the question that initiated the research.

Furthermore, Creswell (2011) claims that the scientific method applied today forms the foundation of the steps followed for education research. The modern application of the scientific method will be applied for this study. The scientific method steps are as follows:

- Identifying a research problem;
- Reviewing the literature;
- Specifying a purpose for research;
- Collecting data;
- Analysing and interpreting the data; and
- Reporting and evaluating research.

In this study, the modern scientific method steps, as highlighted by Creswell (2011), will be followed, as a process combined with the research onion metaphor, as shown in Figure 4-2. The research onion metaphor shows the layers, which must be peeled away first, before discussing choices and data analysis procedures. Each of the layers will be unpacked in the sub-sections below and the research philosophy is identified. The metaphor depicts how all components of research are interlinked and what underlying choices for data collection and analysis procedures (Saunders et al., 2009).

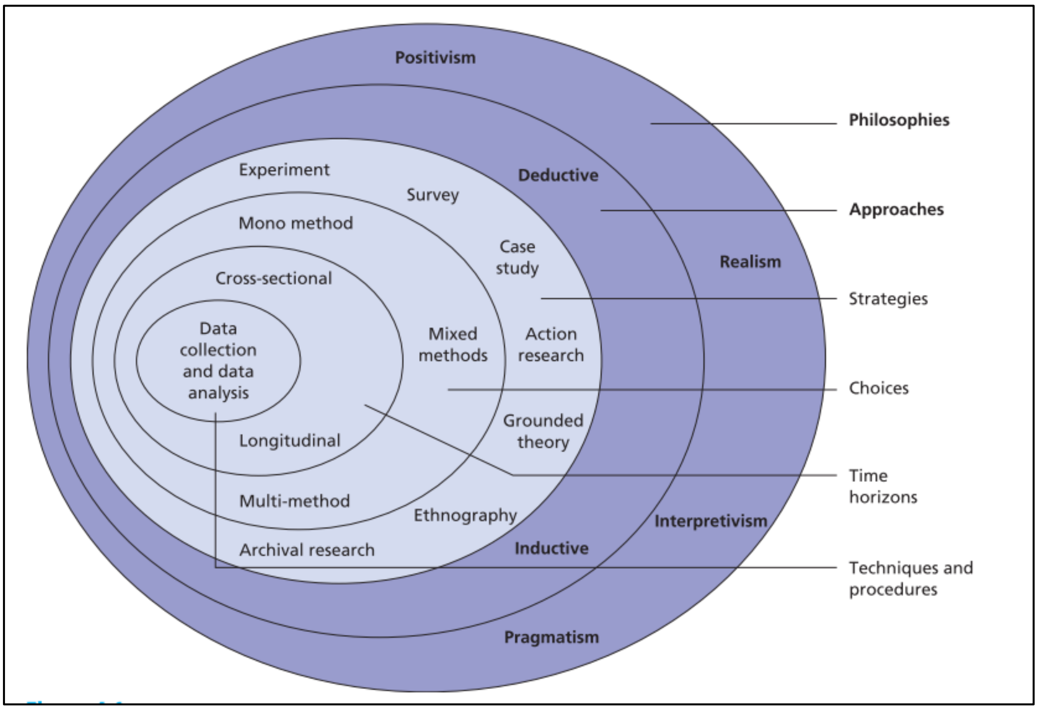

Figure 4-2: The research onion metaphor (Saunders et al., 2009)

## 4.3 Research Philosophies

Research philosophy is a system of beliefs and assumptions about the development of knowledge (Saunders et al., 2019). Crotty (1998) states assumptions inevitably shape how to understand the research questions, methods and how findings are interpreted in a research study. Furthermore, a well thought out, consistent set of assumptions will constitute a credible research philosophy that will underpin methodological choice, research strategy and data collection, whether consciously or not, assumptions at all stages of research. The assumptions further shape how research questions are understood, methods are used and how data findings are interpreted (Burrell & Morgan, 1979; Crotty, 1998). Therefore, choosing a philosophical framework is the initial step for the research process. Saunders et al. (2009) highlight four major philosophies. as shown in Figure 4-2, namely Positivism, Realism, Interpretivism, and Pragmatism, and they are discussed in the following sub-sections.

### 4.3.1 Positivism

Positivism relates to a stance of the natural scientist and works with an observable social reality intending to produce law-like generalisations (Saunders et al., 2019). Additionally, the positivist approach relies on large samples, is usually concerned with hypothesis testing and yields precise, objective and quantitative data. The data are high in reliability and validity and allow for the results from the sample to be inferred to a population (Collis & Hussey, 2014). Surveys and experimental designs are used as primary methods and using statistical techniques to achieve generalisation across a population.

### 4.3.2 Realism

Given (2008) states that realism offers an ontology that can conceptualise reality, support theorising, and guide empirical work in the natural and human sciences. Saunders et al. (2009) concur as they state that the philosophy of realism focuses on explaining what we see and experience in terms of the underlying structures of reality that shape the observable events. Houston (2001) retorts that realism argues that the natural world comprises a range of heterogeneous systems each with distinct mechanisms.

The combined effects of such countervailing and sometimes complementary mechanisms ensure that one can never predict the outcome of any interventions. In that case, realism does not promote hard determinism rather, it posits that mechanisms produce tendencies. In doing so, Houston (2001) adds that realism would then direct attention to understanding and explaining those tendencies. Realism views reality as complex and recognises the role of both agency and structural factors in influencing human behaviour. Therefore, realism can be used with qualitative and/or quantitative research methods (Given, 2008).

### 4.3.3 Interpretivism

Saunders et al. (2019) infer that Interpretivism emphasises that humans are different from physical phenomena because they create meanings and the meanings are studied. Additionally, Interpretivism argues that human beings cannot be studied the same way as physical phenomena and their social world. Therefore, social sciences research needs to be different from the natural sciences (Saunders et al., 2019). Collis and Hussey (2014) state that Interpretivism is focussed on social sciences and rooted in idealism, additionally, it is in contrast to positivism's objective beliefs, its underpinnings are highly subjective as it is formed by perceptions of the individual’s view of reality.

### 4.3.4 Pragmatism

The central notion of pragmatism focuses on the nature of the truth, therefore, its pragmatism definition states that truth is found in what works, and that truth is relative to the current situation (Given, 2008). Saunders et al. (2009) add that pragmatism aims to reconcile both objectivism and subjectivism, facts and values, accurate and rigorous knowledge and different contextualised experiences. Given (2008) states that pragmatism, when treated as an epistemological construct, fails at every measure because it violates too many empirical conventions. Therefore, it is quite easy to attack pragmatism.

### 4.3.5 Philosophy choice for this study

This study will follow the positivism research philosophy for which the ontology is external, objective and precise rather than subjective as with interpretivism studies (Collis & Hussey, 2014). The research will be undertaken with an objective view of the phenomenon. Additionally, the epistemology of positivistic research is to solely observe singularities that can deliver credible facts and data, concentrate on law and causality-like generalisations and reduce singularities to their simplest form (Saunders et al., 2009). In this study, facts and data will be collected to generalise the results. Quantitative methods will be used to find a causal relationship between the dependent variable of career choice and the independent variables of personal inputs, background influences, learning experiences, outcome expectations, personal attributes and perceptions about the IT industry. The positivistic paradigm allows a large sample to be examined and conclusions on the population to be inferred from statistical analyses.

## 4.4 Research Approach

There are two contrasting approaches to research, the deductive and inductive approach, according to the research onion (Saunders et al., 2009). This section will discuss the two approaches and the choice for this study.

### 4.4.1 Deductive Approach

In its earliest formulation, the deduction approach was the mode of valid inference that drew implications from true premises (Given, 2008). Saunders et al. (2009) state that deduction involves the development of a theory that is then subjected to a rigorous test. Feather (2012) agrees that the deductive approach begins with a general idea and then bases conclusions on those ideas. The power of deduction according to Given (2008) is if the premise is true, then implications derived from the process of deductive reasoning were guaranteed to be certainly true as well. The other side of the deduction approach deals with argumentation.

The deductive approach became a tool for valid reasoning in developing valid arguments and for determining whether or not existing arguments are valid or not. A deduction is the dominant research approach in the natural sciences according to Saunders et al. (2009), additionally, role of the deductive approach is very important for all forms of research writing, qualitative and quantitative. Yin (2011) further adds that the deductive approach can save a researcher a lot of uncertainty, as rather than waiting for concepts to emerge from data collection, the researcher starts with relevant concepts and does not wait for data.

### 4.4.2 Inductive Approach

Saunders et al. (2009) state that induction was formulated in social sciences as researchers were wary of deductive research approaches. Researchers were critical of a reasoning approach that enabled the cause-effect link to be made between particular variables, without an understanding of how humans interpreted their social world. Saunders et al. (2009) note that the strength of an inductive approach is to develop an understanding of the way humans interpret the social world. According to Given (2008), an inductive approach starts with evidence, particulars, and builds theories, explanations and interpretations to reflect or represent those particulars. Additionally, the close relationship between empirical observation and conceptual formulation guides most inductive approaches. Similarly, Saunders et al., (2009) add that an inductive approach involves collecting data, conducting data analysis, and developing a theory based on the analysis.

### 4.4.3 Approach for the study

Yin (2011) states that inductive approaches tend to let data lead to the emergence of concepts, while deductive approach tends to let the concepts lead the data that needs to be collected. A deductive approach allows data collection and analysis of results within specified concepts, which are defined through theories (Saunders et al., 2019; Yin, 2011).

Therefore, the deductive approach will be used in the study, as the approach fits well, as the study will aim to theorise the phenomena by using existing theories and frameworks, which will lead to the development of a conceptual model. Therefore, the boundaries of the study are set by the conceptual model that was derived in Section 3.6.

### 4.5 Research Strategies

Saunders et al. (2019) state that while strategies can be used for exploratory, descriptive and explanatory research, some of the strategies belong to either deductive or inductive approaches. Saunders et al. (2019) caution that it would be unduly simplistic to allocate strategies to specific approaches and there are no strategies superior or inferior to others. Many authors list different strategies as shown in Table 4-1, as it has been noted that different authors list different strategies, that can be used for research. While all the authors in Table 4-1 list different strategies, the minimum number of strategies listed by an author is seven and the maximum is eight. All the authors have three common strategies, which are Grounded theory, Action Research and Ethnography. The differences in Archival, Historical from Saunders et al. (2019) and Given (2008) could be the terminology. The fact is that research strategies do not differ much. As there are many research strategies applied to research, the following section will focus on the strategy applied in this study.

Table 4-1: Research Strategies by Authors

| Research Strategies | Author |
|---|---|
| Experiments, Survey, Case Study, Action Research, Grounded Theory, Ethnography, and Archival Research | Saunders et al. (2019) |
| Grounded theory, Case Study, Historical, Biographical, Ethnographical, Action and Clinical Research | Given (2008) |
| Experimental, Correlational, Survey, Grounded Theory, Ethnographic, Narrative, Mixed and Action Research | Creswell et al. (2006) |

#### 4.5.1 Surveys

For the study, the research strategy chosen is a survey. Saunders et al. (2019) state that the survey strategy is usually associated with the deductive approach. Therefore, it is a popular strategy and is most frequently used to answer questions, such as who, what, where, how much and how many questions. Creswell (2011) concurs that surveys are popular in research as they can be administered to a sample to describe attitudes, opinions, behaviours or characteristics of the population. Survey research is commonly used in social sciences research (Given, 2008). Given (2008) further retorts that surveys research refers to a set of methods used to gather data systematically. Surveys are used to determine individual opinions about a phenomenon and also describe trends in the phenomena.

### 4.5.2 Surveys Rationale

Surveys allow for the collection of a large amount of data from a sizeable population in a highly economical way (Saunders et al., 2019). While surveys allow for large data collection, Yin (2011) states that surveys are limited in the number of questions devoted to any contextual condition of the study. For this study, surveys will be used in collecting data from a large body of first-year students enrolled for specific IT and Non-IT modules. Data will be interpreted to give meaning to the data by relating results of statistical tests to the past research studies (Creswell, 2011). Additionally, Saunders et al. (2019) add that data collection through surveys can be used to suggest possible reasons for particular relationships between variables. Creswell (2011) contrasts that surveys do not involve treatments for their studies, so there is no manipulation of conditions as experiments. Therefore, the cause and effect of the results cannot be explained through a survey.

Therefore, for this study, data will be interpreted by relationships between variables and factors and will be scrutinised based on the results. The results will be compared with results from previous research studies that have applied similar methods in understanding the factors influencing students' career decisions. Finally, this study will aim to generalise the results to contribute to the wider body of knowledge, regarding factors influencing career decisions. The advantages of using surveys outweigh the disadvantages, fittingly for this research study, the survey strategy will be used at identifying beliefs (Creswell, 2011), such as factors that influence students' career decisions in pursuing an IT career.

### 4.6 Research Choices

The research onion metaphor, as shown in Figure 4-2, depicts the next layer, which is the research choice. Saunders et al. (2019) define how a researcher chooses to combine quantitative and qualitative techniques and procedures as research choices. Creswell (2011) defines quantitative research as identifying a research problem based on trends in the field or the need to explain why something occurs. In contrast, qualitative is used with any data collection technique that generates or uses non-numerical data (Saunders et al., 2019). Figure 4-3, depicts research choices which comprise: mono method, mixed methods and multiple methods.

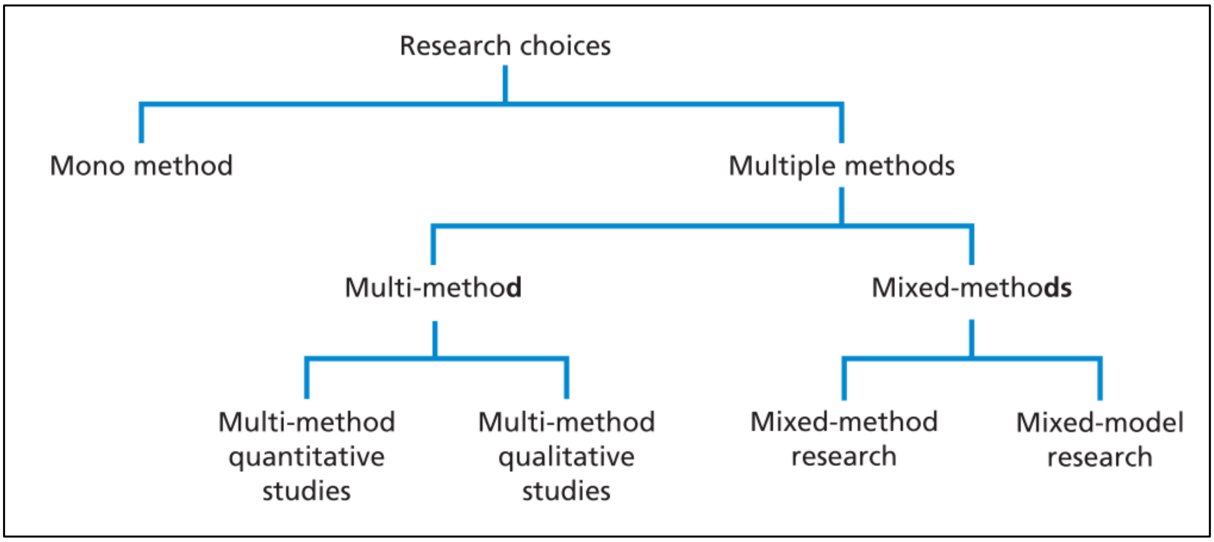


Figure 4-3: Research Choices (Saunders et al., 2019)

Saunders et al. (2019) state that when a researcher chooses to use a mono method, the study will combine a single quantitative data collection technique with quantitative data analysis procedures; or a single qualitative data collection technique with qualitative data analysis.

Within multiple methods as shown in Figure 4-3, there are four different possibilities. Tashakkori and Teddlie (2003) define multi-method, whereby a researcher can choose to combine data collection techniques using some form of multiple methods, but it is restrictive within either a quantitative or qualitative world. A multi-method qualitative study uses two methods for data collection, while analysis applies qualitative analysis. Alternatively, researchers use a multi-method quantitative study which collects quantitative data using two methods and analyses that data using qualitative procedures (Saunders et al., 2019). Therefore, the use of Multi-Methods does not mix quantitative and qualitative techniques and procedures.

The Mixed-Model research (Figure 4-3) combines quantitative and qualitative data collection techniques and analysis. Furthermore, Mixed-Model research combines qualitative and quantitative approaches at other phases of the research (Saunders et al., 2019).

### 4.6.1 Mixed Methods Design

This research study, as shown in Figure 4-4, will use more than one research method (quantitative and qualitative) for data collection and analysis, therefore the study is categorised as a mixed-method study (Creswell, 2011). Shea and Onwuegbuzie (2004) concur that mixed methods research are studies where a researcher employs quantitative and qualitative approaches in one study. Additionally, Creswell and Clark (2006) state that mixed methods design is a procedure that used both quantitative and qualitative methods in a single study or series of studies to understand a research problem.

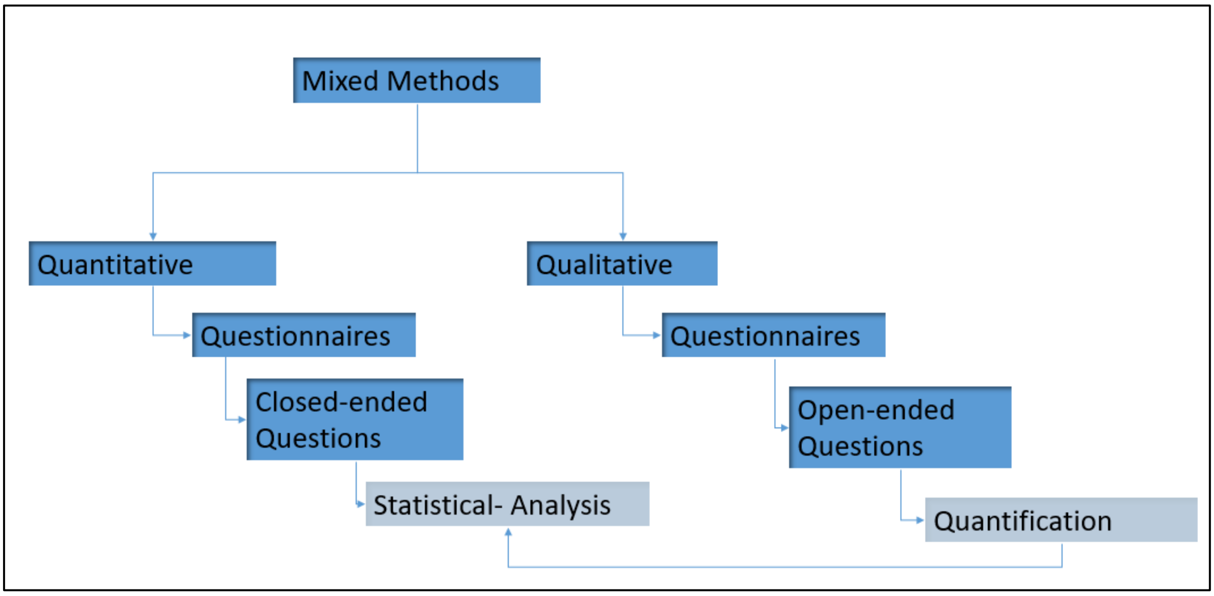


Figure 4-4: Methods Applied in this Study

Given (2008) argues that qualitative research has been relegated to secondary status in mixed methods, while mixed methods are attracting interest and reaching an increasing audience. Additionally, Given (2008) highlights further concerns surrounding mixed methods:

- the concern about the dominance of certain voices in the discussion around mixed methods and whether the discourse is open and accessible to all writers;
- Issues of confidentiality in using the same participants in both phases of a sequential two-phase design; and
- The concern about integrating incompatible views of reality when the researcher combines post-positivist views of single reality with constructionist views of multiple realities.

While there are challenges posed by mixed methods designs, Given (2008) argues that the movement of mixed methods continues to advance and the growth is seen in an enhanced understanding of it as described in journals, books and conferences.

Therefore, this research study focuses on the general advantages of using a mixing of methods (Figure 4-4) namely, to provide a better understanding of the research problem and question than either method by itself (Creswell & Clark, 2006; Given, 2008). Saunders et al. (2019) add that mixed methods are used when an author wants to provide an alternative perspective of the study. For this study, the aim of using mixed methods is to gain an in-depth understanding of the factors and or find alternative perspectives to the current understanding.

**Mixed Methods Applied on this study**

QUANT + qual

Notation Used:

\+ shows the concurrent collection of quantitative and qualitative data.

Uppercase letters indicate priority or increased weight for either the quantitative or qualitative data

Lowercase letters indicate a lower priority or weight for either the quantitative or qualitative dat.

Figure 4-5: Weight of Mixed Methods adapted from Creswell (2011)

For this research study, mixed methods application is depicted in Figure 4-5. The figure indicates the priority given to the mixing of methods, with QUANT capitalised meaning the main method of the mix will be quantitative data collection and analysis. However, the data analysis will be qualitatively converted to quantitative data. The qualitative techniques for collecting and analysis will be secondary in priority, as they will be used to deepen the understanding of the phenomena. Finally, the additions symbol illustrates the concurrent collection of data in the study.

### 4.6.2 Quantitative Methods

For the quantitative method, a survey strategy will be applied, as surveys are usually associated with the deductive approach and are used in research to answer questions relating to what, how much and how many. The survey strategy allows the researcher to collect mainly quantitative data that are analysed by using descriptive and inferential statistics and generates findings that are representative of the whole population (Saunders et al., 2009). Additionally, tools commonly associated with surveys are questionnaires. Questionnaires will be used for this research study and applied as a quantitative method for mixed-method research.

### 4.6.3 Qualitative Methods

Frels and Onwuegbuzie (2013) state that interviews are the most common ways of collecting qualitative data, the reason being they provide researchers with opportunities to collect rich meaning-making data. Onwuegbuzie, Leech and Collins (2010) assert that interviews contain nonverbal communication, which can be important for attaining a deeper shared meaning. Therefore, the interviewer and interviewee increase their awareness of the contextual nature of voice. Thus the nonverbal communication can be viewed as an extra data collection method within interviews. For the study, open-ended questions will be conducted as part of the qualitative part of the mixed-method approach.

### 4.6.4 Types of Mixed Methods Design

There are six basic types of mixed-methods designs, according to Creswell (2011) with four basic designs more in use and the other two are more complex designs that are gaining popularity too. The six designs are the following; triangulation (convergent) design, explanatory sequential, exploratory sequential, embedded being the four basic designs. Additionally, transformative and multiphase are complex designs. For this study, Convergent Design by Creswell (2011) has been the chosen approach, the rationale for using the approach will be discussed in the following sub-section.

### 4.6.5 Convergent Design

Creswell (2011) states that triangulation design is the most common and well-known approach to mixing methods. The purpose of the design is to obtain different but complementary data on the same topic (Morse, 1991). The triangulation design is a one-phase design in which researchers implement quantitative and qualitative methods, during the same timeframe. The design generally involves the concurrent, but separate, collection and analysis of quantitative and qualitative data so that the researcher may best understand the problem (Creswell et al., 2006) As depicted in Figure 4-6, the triangulation intends to converge two data collection forms and compare the results with the outcome to interpret the results.

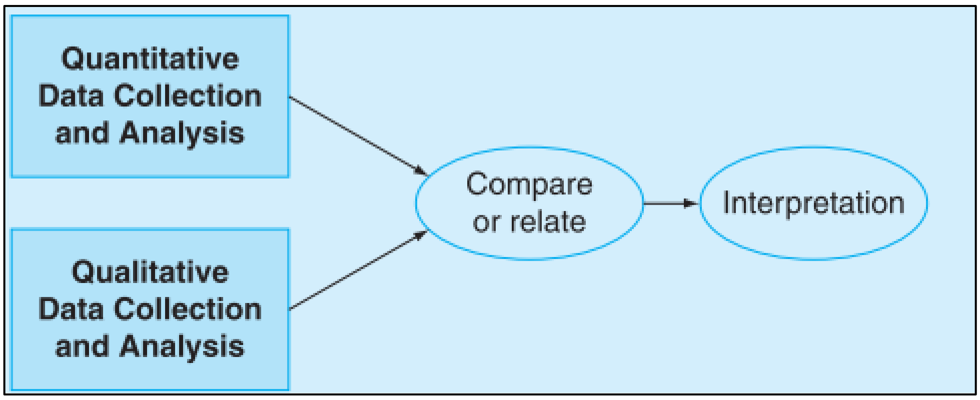


Figure 4-6: Convergent Design by Creswell (2011)

### 4.6.6 The rationale for Convergent Design

The strength of the method is that it combines the advantages of each form of data, the quantitative data provide generalisability and qualitative data offers information about the context (Creswell & Clark, 2006). Additionally, one data collection form supplies strengths to offset the weaknesses of the other form, and a more complete understanding of a research problem results from collecting both quantitative and qualitative data. The Convergent design is an efficient design in which both types of data are collected at the same time.

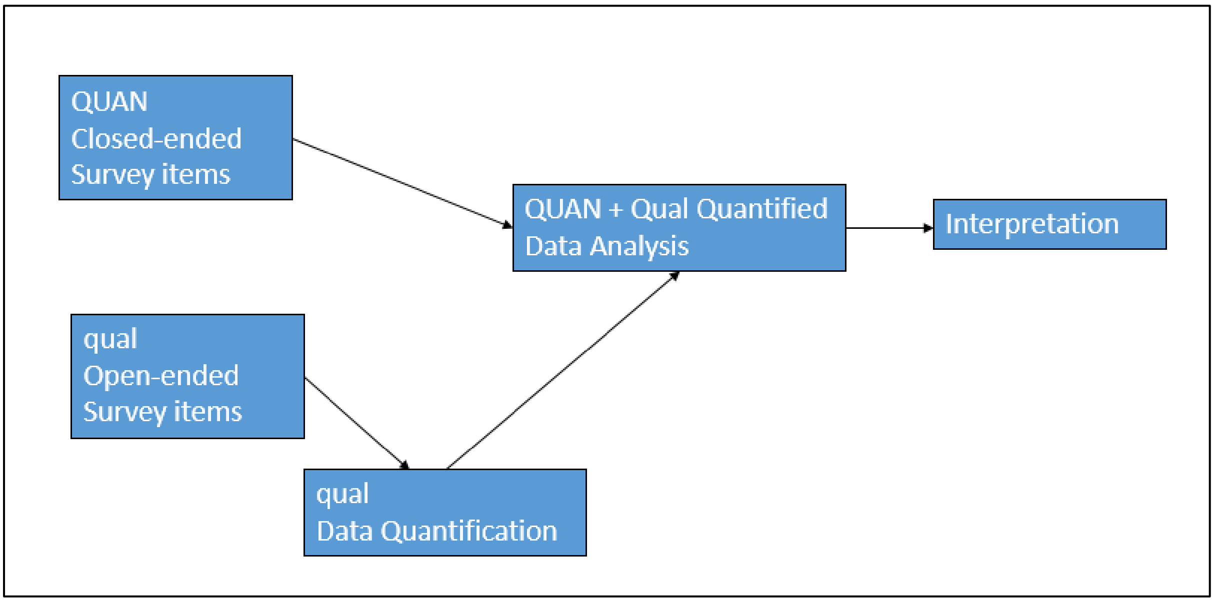


Figure 4-7: Mixing of Methods for this study adapted from Creswell (2011)

This study's application of triangulation is depicted in Figure 4-7, which shows that the data collection will be a single-phase design study. The strategy will be for both the quantitative and qualitative data collection, using a questionnaire. The timing of the collection of data will be concurrent, with the emphasis or weighing of methods being quantitative data over the qualitative data. The convergence of data will be merging the data during the analysis of the results, this will be done by quantifying qualitative data. The analysis can be done by combining quantitative and qualitative data and interpretation can be done by combining the results. Finally, the data findings will be interpreted by comparing them with the literature.

### 4.6.7 Challenges with Convergent Design

The challenge is often how to merge the two forms of data, and when is it done to determine how to assess results that diverge (Creswell, 2011). Furthermore, much effort and expertise are required, particularly because of the concurrent data collection. Creswell et al. (2006) point out that the challenge can be overcome by training a single researcher in both quantitative and qualitative research.

This study will aim at overcoming the challenges for the design by the researcher being trained on both qualitative and quantitative data analysis methods. The author attended research workshops that have an emphasis on mixed methods and gained needed support from experts in the mixed-method field. Furthermore, in collecting the data, the study will collect the data concurrently using a questionnaire. Lastly, the analysis of data will follow a sequential approach as qualitative data will be quantified and both sets of data statistically analysed and compared.

## 4.7 Time Horizons

Saunders et al. (2019) define time horizons as a snapshot taken at a particular time or a series of snapshots representing a given period. The time horizons are a research design, that is independent of which research strategy or method choice is used in a study. Saunders et al. (2019) identify the snapshot time horizon as cross-sectional, while the series of snapshots is called longitudinal.

There are also different types of survey designs, Creswell (2011) calls them two basic types of research surveys: cross-sectional and longitudinal surveys, which are both determined by the time of data collection. Furthermore, Creswell (2011) distinguishes cross-sectional surveys, with their aim of collecting information at one point in time. While longitudinal surveys collect data about trends with the same population, changes in a cohort group, or changes in a panel group over time.

Most research undertaken for academic courses is necessarily time-constrained, therefore most academic studies are cross-sectional. In contrast, longitudinal studies allow for a long period in observing change and development (Saunders et al., 2019).

Additionally, cross-sectional studies often explain how factors are related in different organisations, and therefore, surveys are often employed in the studies (Robson, 2002). This research study falls within the cross-sectional study, as it will use surveys and the study will be conducted in a limited time.

## 4.8 Techniques and Procedures

The final section of the research onion metaphor is on data collection, procedures, and data analysis. There are two types of data: primary data and secondary data. This study focused on primary data which, as defined were data gathered primarily using strategies such as surveys. The following subsections focus on the data collection process, followed by data analysis and procedures.

### 4.8.1 Questionnaire Design

The questionnaire developed for the study was determined by the data needed to address the research objectives (Saunders et al., 2009). Therefore, in designing the questionnaire, multiple approaches were used for identifying the questions and items. Questions were collected from related research studies. Adopting and adapting questions was necessary for the study as the researcher wished to compare the findings with other studies (Saunders et al., 2009). The advantage of using the combination of approaches is that reliability can be assessed. Additionally, this study's data collection methods applied closed-ended and open-ended questions as a means of gathering primary data.

The questionnaire was pilot tested before being administered to the respondents, with the ultimate goal to ensure that the questionnaire accurately achieved its intended purpose (i.e. reliability and pilot testing) (Saunders et al., 2009). Table 4-2 depicts the questionnaire layout which shows the sections contained, the number of items, and the type of questions in each section.

Table 4-2: Questionnaire Framework

| Factors | Code | Items No | Question Types |
|---|---|---|---|
| Background Information | BI | 15 | Multiple choice,dichotomous, Lists, Open-ended |
| Career Choice Influencers | CCI | 18 | Likert Scale, Open-ended |
| Learning Experiences | LE | 12 | Likert Scale, dichotomous, Open-ended |
| Personal Attributes/Self-Efficacy | PA | 17 | Likert Scale, Lists |
| Career Perceptions & Expectations | CPE | 13 | Likert Scale |
| Career Awareness | CA | 20 | Likert Scale, Open-ended, Lists |
| Perception of the chosen career | PCC | 10 | Likert Scale |
| | | 105 | |

As the factors were used for statistical analysis, each factor had been assigned a unique code for this purpose (Saunders et al., 2009). The questions and items within the factors were assigned codes as it further simplified the analysis.

The respondents were offered in some instances, a list of responses, from which they could choose (Saunders et al., 2009). Such questions are useful to ensure that the respondent has considered all the possible responses. Examples that were used in the questionnaire are shown in Table 4-3 to Table 4-9.

Saunders et al. (2009) state that rated questions are often used for collecting opinion data. Rating scales use Likert scales, which require responses from the respondent. Several types of ratings were used such, as agreement and likelihood. The 5-Point Likert Scales had five categories (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree) and the likelihood has five categories (Not at all confident, Slightly confident, Fairly confident, Quite Confident, Extremely confident).

Table 4-3: Demographics - Operationalisation

| Code | Background Info | Source |
|---|---|---|
| BI_1 | Gender | Downes & Looker, 2011; Chinyamurindi et al., 2021 |
| BI_2 | Race | Chinyamurindi et al., 2021 |
| BI_3 | How old are you? | Downes & Looker, 2011 |
| BI_4 | Please indicate your home language | Chinyamurindi et al., 2021 |
| BI_5 | Do you have any Disabilities? | Downes & Looker, 2011 |
| BI_6 | Indicate your father's occupation | Balakrishnan & Low, 2016 |
| BI_7 | Indicate your mother's occupation | Balakrishnan & Low, 2016 |
| BI_8 | My father's highest qualification | Bolotin & Bakaev, 2015; Matthew, Owusu, & Bekoe, 2018 |
| BI_9 | My mother's highest qualification | Bolotin & Bakaev, 2015; Matthew et al., 2018 |
| BI_10 | There are professionals (e.g. doctors, accountants, lawyers) in my family | Matthew et al., 2018 |
| BI_11 | There are IT professionals in my family | Balakrishnan & Low, 2016 |
| BI_12 | I have family working in the IT industry | Balakrishnan & Low, 2016 |
| BI_13 | I have friends working in the IT industry | Balakrishnan & Low, 2016 |
| BI_14 | I have IT role models | Balakrishnan & Low, 2016 |
| BI_15 | I have role models for my chosen career | Balakrishnan & Low, 2016 |

The section aimed to collect information about the demographics of the respondents. This information serves two purposes; firstly it allowed the researcher to use collected data about the factors and compare results from different participating demographic groups. The section gathered information on age, race, disability and the major chosen by the students (Brown, 2002).

Table 4-4: Career Choice Influencers - Operationalisation

| Code | Career Choice Influencers | Literature |
|---|---|---|
| CCI_1 | In my culture, people have a clear understanding of professional careers, such as a chartered accountant | Dubow, 2014; Pretorius & De Villiers, 2010 |
| CCI_2 | In my culture, people have a clear understanding of IT careers | Dubow, 2014; Pretorius & De Villiers, 2010 |
| CCI_3 | In my culture, a woman is expected to have a family and children | Dubow, 2014; Pretorius & De Villiers, 2010 |
| CCI_4 | In my culture, having a large family is important | Dubow, 2014; Pretorius & De Villiers, 2010 |
| CCI_5 | In my culture, IT is seen as a career for men and women | Dubow, 2014; Pretorius & De Villiers, 2010 |
| CCI_6 | In my culture, it is important to have a qualification | Dubow, 2014; Pretorius & De Villiers, 2010 |
| CCI_7 | In my culture, it is important that women have a formal qualification | Dubow, 2014; Pretorius & De Villiers, 2010 |
| CCI_8 | In my culture, people encourage children to study towards professional careers, such as a doctor or a chartered accountant | Dubow, 2014; Pretorius & De Villiers, 2010 |
| CCI_9 | In my culture, women are expected to have a full-time job | Dubow, 2014; Pretorius & De Villiers, 2010 |

| | | |
|---|---|---|
| CCI_10 | People in my culture are religious | Dubow, 2014; Pretorius & De Villiers, 2010 |
| | **Please indicate to what extent did the following influence your career choice** | |
| CCI_11 | Family | Matthew et al., 2018 |
| CCI_12 | Friends | Matthew et al., 2018 |
| CCI_13 | Teachers | Matthew et al., 2018 |
| CCI_14 | Career guidance advisors/teachers | Govender & Khumalo, 2014; Lee et al., 2019; Matthew et al., 2018 |
| CCI_15 | Role models | Matthew et al., 2018 |
| CCI_16 | My religious circle | Appianing & Van Eck, 2015 |
| CCI_17 | Internet | Matthew et al., 2018 |
| CCI_18 | Social media | Balakrishnan & Low, 2016; Matthew et al., 2018 |

Table 4-4: Career Choice Influencers - Operationalisation aimed to collect information about the respondents' cultural backgrounds.

Table 4-5: Learning Experiences - Operationalisation

| Code | Learning Experiences | Literature |
|---|---|---|
| LE_1 | I had access to a computer in my primary school(s) | Armstrong & Riemenschneider, 2014; Cohen & Parsotam, 2010 |
| LE_2 | I had access to a computer in my secondary school(s) | Armstrong & Riemenschneider, 2014; Sahin, Ekmekci, & Waxman, 2017 |
| LE_3 | I used a computer at home when I was growing up | Aivaloglou & Hermans, 2019; Downes & Looker, 2011 |
| LE_4 | I found IT to be enjoyable whilst growing up | Alexander & Twinomurinzi, 2010 |
| LE_5 | I received adequate IT training at school, which prepared me for university | Armstrong & Riemenschneider, 2014; Michael Njoki, Wabwoba, & Muthoni Micheni, 2016 |
| LE_6 | I was involved in computer projects at school | Aivaloglou & Hermans, 2019; Alshahrani et al., 2018 |
| LE_7 | I had an interest in IT during my school years | Alexander & Twinomurinzi, 2010; Matthew et al., 2018 |
| LE_8 | I started computer programming whilst at school | Aivaloglou & Hermans, 2019; Sahin et al., 2017 |
| LE_9 | I used computers when I was at school | Aivaloglou & Hermans, 2019; Downes & Looker, 2011 |
| LE_10 | I did some programming on my mobile phone (e.g. Tanks or Boats) whilst growing up | Alexander & Twinomurinzi, 2010; Matthew et al., 2018 |
| LE_11 | Which programme are you registered for? | Matthew et al., 2018 |
| LE_12 | Select the first-year modules you are enrolled for? | Matthew et al., 2018 |

Table 4-5 focused on the respondents learning experiences before their career choice.

Table 4-6: Personal Attributes (Self-efficacy) - Operationalisation

| Code | Personal Attributes | Literature |
|---|---|---|
| PA_1 | I expect to do well in my subjects at university | Alexander & Twinomurinzi, 2010; Bock, Taylor, Phillips, & Sun, 2013; Matthew et al., 2018 |
| PA_2 | I am confident working with computers | Alexander & Twinomurinzi, 2010; Matthew et al., 2018 |
| PA_3 | I take responsibility for my learning | Matthew et al., 2018 |
| PA_4 | I do my work as well as most other people | Bock et al., 2013 |
| PA_5 | I am a good problem-solver | Croasdell et al., 2011 |
| PA_6 | It is easy for me to achieve my goals I work well under pressure | Govender & Khumalo, 2014 |
| PA_7 | I am a confident person | Main & Schimpf, 2017 |
| PA_8 | I feel I have a number of good qualities | Croasdell et al., 2011; Main & Schimpf, 2017 |
| PA_9 | On the whole, I am satisfied with myself | Main & Schimpf, 2017 |
| PA_10 | Self-confidence: How confident are you that you will be able to: | Chinyamurindi et al., 2021 |
| PA_11 | Complete all the work that is assigned to you in your modules? | Matthew et al., 2018 |
| PA_12 | Understand complicated ideas when they are presented in your modules? | Balakrishnan & Low, 2016 |
| PA_13 | Learn all of the material presented in your modules? | Aivaloglou & Hermans, 2019; Balakrishnan & Low, 2016 |
| PA_14 | Do the difficult work that is assigned in your modules? | Alexander et al., 2011 |
| PA_15 | Remember what you have learned in your current modules? | Balakrishnan & Low, 2016 |
| PA_16 | Complete your diploma/degree programme in the required minimum time? | Matthew et al., 2018 |
| PA_17 | Pass all your modules? | Matthew et al., 2018 |

Table 4-6 interrogated the personal attributes and beliefs that respondents have to do well in the chosen career.

Table 4-7: Career Perceptions & Expectations - Operationalisation

| Code | Career Perceptions & Expectations | Literature |
|---|---|---|
| CPE_1 | An IT career has a good image/status | Alexander & Twinomurinzi, 2010 |
| CPE_2 | An IT career provides a flexible work schedule between work and social life | Alexander & Twinomurinzi, 2010; Matthew et al., 2018 |
| CPE_3 | An IT career ensures long term employment | Alexander & Twinomurinzi, 2010; Matthew et al., 2018 |
| CPE_4 | IT is regarded as a male profession | Balakrishnan & Low, 2016; Bock et al., 2013 |
| CPE_5 | People working in the IT industry earn good salaries | Alexander et al., 2011; Cohen & Parsotam, 2010 |
| CPE_6 | A person with an IT qualification will find work easily | Bock et al., 2013 |
| CPE_7 | A person with an IT qualification can work internationally | Bock et al., 2013 |
| CPE_8 | There is good job security in the IT industry | Bock et al., 2013; Govender & Khumalo, 2014 |
| CPE_9 | People with an IT qualification are 'geeks' | Bock et al., 2013; Govender & Khumalo, 2014 |
| CPE_10 | There are many jobs available in the IT industry | Alexander & Twinomurinzi, 2010; Dick & Rallis, 1991 |
| CPE_11 | The IT industry provides many job opportunities for women | Pretorius & De Villiers, 2010 |
| CPE_12 | There are good prospects for developing new skills in the IT industry | Matthew et al., 2018; Bock et al., 2013 |
| CPE_13 | The IT industry provides the opportunity to become an IT entrepreneur | Cunningham & Menter, 2020 |

Table 4-7 focused on the respondents' perceptions and expectations about the chosen career.

Table 4-8: Career Awareness - Operationalisation

| Code | Career Awareness | Literature |
|---|---|---|
| CA_1 | I do have an understanding of the career paths available for students with my qualifications | Calitz et al., 2011 |
| CA_2 | I did have an understanding of Information Technology (IT) careers before I enrolled at university | Kirlidog & Coetzee, 2018; Wang et al., 2015 |
| CA_3 | I had an understanding of Computer Science (CS) careers before I enrolled at university | Kirlidog & Coetzee, 2018; Wang et al., 2015 |
| CA_4 | I did have an understanding of Information Systems (IS) careers before I enrolled at university | Kirlidog & Coetzee, 2018; Wang et al., 2015 |
| CA_5 | I understand the differences between IT, CS, and IS careers | Kirlidog & Coetzee, 2018; Wang et al., 2015 |
| CA_6 | I know what job I want to do in the future | Calitz et al., 2011 |
| CA_7 | I know which company I want to work for after I graduate | Dubow, 2014 |
| CA_8 | I can explain the main job functions for my future job | Calitz et al., 2011; Wang et al., 2015 |
| CA_9 | What career do you want to pursue, after completing your studies | Calitz et al., 2011 |
| CA_10 | What do you think your first job title will be? | Calitz et al., 2011 |

| | Which job title would you associate with each job description? | |
|---|---|---|
| CA_11 | A professional person who reviews the financial statements and accounting principles of a business | AGSA, 2021; targetjobs, 2020 |
| CA_12 | A person who manages sales and promotional activities to increase the sales or the use of a product or service in a business and ultimately market share | InformationWeek, 2021; targetjobs, 2020 |
| CA_13 | A person who manages the data, information, systems, network, and cloud security in an organisation | CIOAfrica, 2021 |
| CA_14 | A person providing IT customer support and troubleshoot daily user IT queries | BusinessTech, 2021b; CIOAfrica, 2021 |
| CA_15 | A person responsible for designing, writing code, and testing new programmes | targetjobs, 2020 |
| CA_16 | A person who manages the daily financial transactions and information in a business | SAIPA, 2020; targetjobs, 2020 |
| CA_17 | A person responsible for handling LAN/WAN, network hardware, software, and installations | BusinessTech, 2021b; InformationWeek, 2021 |
| CA_18 | A person working with Big data, applying statistical techniques to analyse, model, and interpret the results to create actionable plans for companies | BusinessTech, 2021b; InformationWeek, 2021 |
| CA_19 | A person responsible for maintaining the databases and ensuring data availability in a business | BusinessTech, 2021b; CIOAfrica, 2021 |
| CA_20 | A person who solves business problems by analysing and designing IT systems in the organisation | CIOAfrica, 2021 |

Table 4-8 investigated the respondents' awareness of their careers. Items CA_11 to CA_20 required the participants to match job titles with job descriptions.

Table 4-9: Perception on Chosen Career - Operationalisation

| Code | Perception on Chosen Career | Literature |
|---|---|---|
| PCC_1 | I am happy with my career choice | Njoki et al., 2016 |
| PCC_2 | My family respects my career choice | Appianing & Eck, 2018; Pretorius & De Villiers, 2010 |
| PCC_3 | My chosen career will be rewarding | Njoki et al., 2016 |
| PCC_4 | I would recommend my career choice to others | Dubow, 2014; Pretorius & De Villiers, 2010 |
| PCC_5 | I have to keep ahead of change and new technologies in my chosen career | Pretorius & De Villiers, 2010 |
| PCC_6 | I will learn new skills in my chosen career | Matthew et al., 2018 |
| PCC_7 | There are many jobs available in the career I have chosen | Alexander & Twinomurinzi, 2010; Dick & Rallis, 1991 |
| PCC_8 | There are good prospects for a better than average starting salary in the career I have chosen | Alexander et al., 2011; Cohen & Parsotam, 2010 |
| PCC_9 | I will have opportunities to work in different kinds of business functions in my chosen career | Matthew et al., 2018; Bock et al., 2013 |
| PCC_10 | I can become an entrepreneur with my career choice | Cunningham & Menter, 2020 |

Table 4-9 examined the respondents' perceptions about their career choice.

### 4.8.2 Qualitative Instrument Development

Open-ended questions were used as a qualitative data collection method for this study (Creswell, 2011). Furthermore, open-ended questions can be used for collecting data as the qualitative phase of a mixed-methods research approach. Open-ended questions were used widely in in-depth and semi-structured interviews. In questionnaires, they are useful if the response is not definite, such as in exploratory research, when searching for a detailed answer or when the researcher wants to find out what is uppermost in the respondents' mind (Saunders et al., 2009). Additionally, open-ended questions allow participants to voice their experiences unconstrained by any perspective of the researcher's past findings. An advantage of open-ended questions allows the researchers to explore the reasons for closed-ended responses and identify comments beyond the responses of closed-ended questions (Creswell, 2011).

Saunders et al. (2009) state that when a questionnaire is administered to a large number of respondents, responses to open-ended questions are extremely time-consuming. Therefore, Saunders et al. (2009) advise the researcher to keep the use of open-ended questions to a minimum. For this study, open-ended questions were used for each factor, which kept the number of open-ended questions to the minimum for the questionnaire.

### 4.8.3 Data Analysis

The study applies mixed methods, therefore, data will be analysed by using quantitative and qualitative methods, as shown in Figure 4-8. The dominant method of the analysis is quantitative in the mixing of methods. The section will discuss each of the analysis methods, qualitative followed by quantitative analysis, as Figure 4-8 indicates.

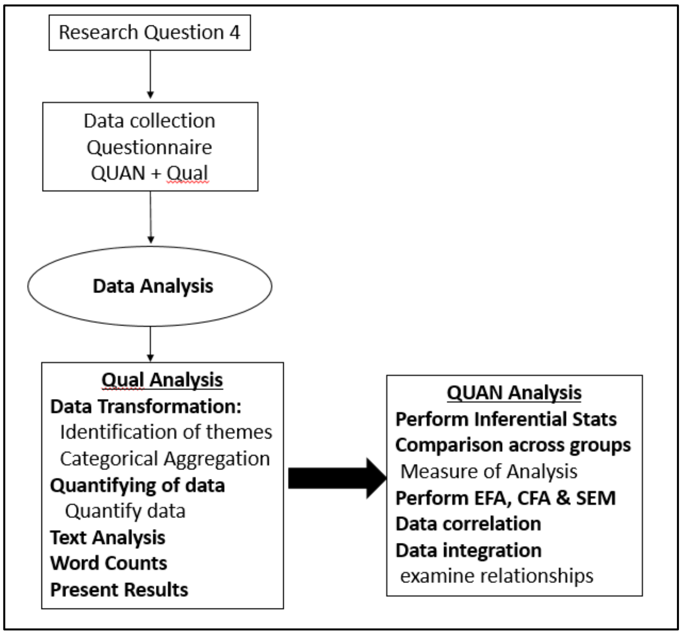


Figure 4-8: Data Analysis process adapted from Benge (2012)

#### 4.8.3.1 Qualitative Analysis

One of the many approaches to analysing data in the mixed approach is to quantify qualitative data and compare them with statistical results (Creswell, 2011). Johnson et al. (2009) argue that word counts, coding, and categories are analysis methods that form part of a quantitative-dominated mixed-method analysis. Therefore, this section focuses on qualitative data transformation and, quantification for the quantitative data analysis. Finally, the section highlights how data will be analysed and represented in the text.

##### 4.8.3.1.1 Data Quantification

Sandelowski et al. (2009) argue that quantification refers to the process of assigning numerical values to data conceived as not numerical. The non-numeric data are values or text gathered through interviews. Creswell (2011) further adds that in the quantification of data, qualitative data codes are assigned and numbers and counts are recorded for the number of times the code appears. The method used for this study is the quantification of data, and there is a comparison of data to codes that are derived from segments of text, as shown in Figure 4-9. Quantifying data is used to form quantitative data in ways that allow researchers to discern and show irregularities or peculiarities in qualitative data that might be missed in normal qualitative analysis (Sandelowski et al., 2009). Quantification allows qualitative data so it could be correlated with the quantitative data which are used to examine potential relationships (Stewart, 2012).

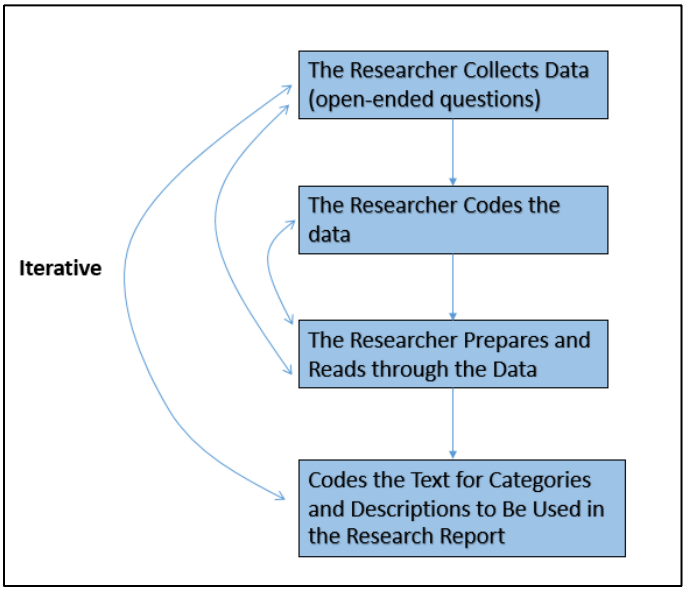


Figure 4-9: Data quantification process adapted from Creswell (2011)

For this study, quantifying the qualitative data was done to statistically assimilate that data with already understood data in a quantitative format. Therefore, the data were produced using qualitative instruments to collect the data, and the data were quantified applying descriptive and inferential statistics (Sandelowski et al., 2009). Figure 4-9 shows the process that was undertaken by the researcher in quantifying the qualitative data, the process was iterative, until the desired results were achieved. Table 4-10 presents the open-ended items that quantification was applied to.

The open items were quantified as shown in Table 4-10, different codes were assigned to the data, which was used for descriptive and inferential statistics. For this study, the purpose of the quantification of data was to examine the relationships between the dependent and the independent variables.

Table 4-10: Items Quantification

| Open-ended Questions | Data Type |
|---|---|
| How old are you? | Category of Ages and counts |
| Indicate your Home Language Other | Counts for different languages and counts |
| Indicate your father's occupation | Category of Occupations and counts |
| Indicate your mother's occupation | Category of Occupations and counts |
| What career do you want to pursue, after completing your studies | Category of Careers and counts |
| What do you think your first job title will be? | Category of Jobs and counts |

#### 4.8.3.1.2 Text Analysis

Traditionally, analysing text data involves using colour coding to mark parts of the text or cutting and pasting sentences onto cards. However, computer analysis of qualitative data is when a researcher uses a computer program to facilitate the process of storing, analysing and representing the data visually (Creswell, 2011; Sandelowski, 2009). When the researcher is adequately trained and comfortable with using the program, he or she makes use of computer analysis instead of traditional ways. For this study, the researcher used MS Excel as the software for analysing the qualitative data, quantifying the data and textual analysis.

#### 4.8.3.1.3 Computing Counts

Sandelowski et al. (2009) argue that counting is an important part of quantifying data, as the process of quantification depends on quantifying data. Furthermore, Sandelowski et al. (2009) state that judgements of similarity are foundational claims of reliability, confirmation of having found themes and patterns on qualitative data. Therefore, similarity and difference judgements were made on computing the counts.

For the study, counts will be used for Age, Home language and Parents Occupation items, as different categories will be created and counts used for the categories. Additionally, counts for the different groups IT and Non-IT groups were created and counts used.

It is important to consider each respondent’s response to the questions and that will be solicited through the frequency distribution tables. The tables will count and describe in percentages the respondent's replies to the Yes = 1, No = 2 items. There was three items scale, namely Not at all= 1, A little = 2, A lot = 3. The final factors categories were based on two different five-point Likert scales, Strongly Disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, Strongly Agree = 5 and Not all Confident = 1, Slightly Confident = 2, Fairly Confident = 3, Quite Confident = 4, and Extremely Confident = 5.

The five-point Likert Scales were combined for analysis, and reporting purposes, Strongly Disagree and Disagree into one item Disagree, Agree and Strongly Agree into one item Agree. Not at all Confident and Slightly Confident into Not Confident and Quite Confident and Extremely confident into Confident. Analysis and conclusions were drawn from the results obtained from these frequency distribution tables and used to assess the effects on the designated outcome of the career choice model.

#### 4.8.3.1.4 Presenting Data

The data are presented using graphs and tables after the data have been transformed using descriptive frequencies. Furthermore, software was used to do word-cloud analysis for the variables home language data and father/mother occupations.

#### 4.8.3.2 Quantitative Analysis

The questionnaire was captured in QuestionPro and completed online. The QuestionPro website stores the completed questionnaires. The benefit of an online questionnaire tool is that the data are already in a machine-readable format, allowing the data to be easily downloaded and manipulated.

Saunders et al. (2009) retort that quantitative data in raw form are data that has not been analysed and conveys little meaning to most people. Therefore the data must be processed to be useful and converted into information. Hence, Creswell (2011) states that there are interrelated steps used in the process of analysing quantitative data: Prepare data for analysis, Begin data analysis, Conduct sophisticated inferential statistics to test the hypothesis, and Report on the results using tables and finally interpret the results from data analysis. Saunders et al. (2009) agree that all the steps should be considered after obtaining data, as the steps are important for data analysis. Therefore, for this study, all steps for analysis were considered during the design of the questionnaire.

Creswell (2011) states that academic researchers use available statistical programs for data analysis. Software programmes, such as Microsoft Excel, Atlas.ti and Statistical Package for the Social Sciences (SPSS) are widely used due to their ability to process and manipulate large quantities of data. Additionally, the statistical programmes permit the exploration and analysis of survey data (Collis & Hussey, 2014). For this study, Microsoft Excel, Statistica and AMOS were used by the qualified statistician from Nelson Mandela University in Port Elizabeth, who was consulted about the statistical analysis.

#### 4.8.3.2.1 Descriptive Statistics

Descriptive statistics help summarise overall trends or tendencies in the data set, furthermore, it provides an understanding of how varied the scores are (Creswell, 2011; Pyrczak, 2018). Additionally, Creswell (2011) states that there are three ideas addressed by descriptive statistics; central tendency, variability and relative standing. Additionally, frequency distribution lists are used, which are an arrangement that is a systematic representation of data based on its uniqueness and ranking (Pyrczak, 2018).

For this study, descriptive statistics on the collection of demographic and sociological characteristics data formed an important element of the research study. The descriptive statistics collected the background information, which included items such as gender, race, disability and field of study. The data will be used to explore the differences in behaviours, opinions, and attitudes and to check that the data are representing the population. Additionally, a variety of graphical (i.e. bar, line graphs) representations of data are provided.

#### 4.8.3.2.2 Descriptive Statistics for the Factors

Descriptive statistics were used to provide an exploration of the independent factors and dependent factors. The statistics applied were central measures, such as mean and median, dispersion, the minimum numeric value and maximum numeric values.

#### 4.8.3.2.3 Reliability

For a scale to be considered reliable, Cronbach's Alpha coefficient should be greater than or equal to a score of 0.8. The Cronbach's Alpha coefficient was applied to the study to test reliability and Table 4-11 was used for determining the reliability statuses of the factors.

Table 4-11: Cronbach Alpha Coefficient

| Cronbach's Alpha (α) Coefficient | Indication |
|---|---|
| α value between 0.81 and 1.0 | Very good reliability |
| α value between 0.71 and 0.80 | Good reliability |
| α value between 0.61 and .70 | Fair reliability |
| α value < 0.60 | Poor reliability |

The reliability of a research instrument needs to be as high as possible, usually above 0.7, which is considered as reasonable reliability for research purposes. While a score over 0.8 is necessary when making high stake decisions (Muijs, 2012). Furthermore, Collis and Hussey (2014) view an **α** between 0.50 and .69 as acceptable for new experimental research.

#### 4.8.3.2.4 One sample t-test and Inferential ranking

Jackson (2011) states that t-tests are the statistical test that compares the means of two samples. t-tests are used for hypothesis testing. The means of the participants' group to the control group mean (Gravetter & Wallnau, 2009).

Factors in this study were ranked using matched-pair t-tests (statistical significance) and Cohen's d (practical significance). Gravette and Wallnau (2017) suggest that a statistically significant effect and effect size need to be reported by researchers. Cohen's d value is important in measuring how many standard deviation intervals the means of the experimental groups fall above or below the control group's mean

(Rubin, 2013). Cohen's d is known as a statistical measure for practical significance and its interpretation intervals are listed in Table 4.12.

Table 4-12: Interpretation intervals for Cohen's *d* (Gravetter & Wallnau, 2009)

| Cohen's d interval | Interpretation |
|---|---|
| d > 0.80 | Large |
| 0.50 > d < 0.79 | Medium |
| 0.20 > d < 0.49 | Small |
| d < 0.20 | Not Significant |

#### 4.8.3.2.5 Correlations

Pearson's *r* is a commonly used measure of association that measures the strength, direction, and probability of the linear association between two factors; whether they share variance if the relationship is positive or negative and the degree to which correlate. The study will use Pearson correlation to explore relationships between the various dependent and independent factors. Correlation coefficients show the strength and direction of the relationship between two variables (Jackson, 2011). Table 4-13 shows the interpretations for correlations.

Table 4-13: Correlation Interpretation (Gravetter & Wallnau, 2009)

| Size of correlation | Interpretation |
|---|---|
| .90 to 1.00 (-.90 to -1.00) | Very high positive (negative) correlation |
| .70 to .90 (-.70 to - .90) | High positive (negative) correlation |
| .50 to .70 (-.50 to - .90) | Moderate positive (negative) correlation |
| .30 to .50 (-.30 to -.50) | Low positive (negative) correlation |
| .00 to .30 (-.00 to - .30) | Negligible correlation |

#### 4.8.3.2.6 Cramer's V

Cramer's V indicate the practical significance between two factors within a table. The different practical significance interpretation intervals used to interpret the significance of certain research findings captured in the survey are illustrated in Table 4.14 (Gravetter & Wallnau, 2009). The target Chi-square ($X^2$) is $p > 0.05$ and the target $X^2$ per degrees of freedom is ≤ 3.

Table 4-14: Interpretation intervals for Cramer’s V
(Gravetter & Wallnau, 2009)

| Cramér's V Interpretation | | | |
|---|---|---|---|
| | **Small** | **Medium** | **Large** |
| df* = 1 | .10 <V< .30 | .30 <V < .50 | V > .50 |
| df* = 2 | .07 <V< .21 | .21 <V < .35 | V > .35 |
| df* ≥ 3 | .06 <V< .17 | .17 <V < .29 | V > .29 |
| *** df = minimum (Rows – 1, Columns – 1)** | | | |

#### 4.8.3.2.7 Exploratory Factor Analysis (EFA)

Factor analysis is a multivariate exploratory technique and it examines the correlation between pairs of factors measured on rating scales, such as the Likert scale (Collis & Hussey, 2014). Factor analysis points to the cluster of highly correlated factors. Instrument validity is done using EFA and the number of factors to be used was determined by using Eigenvalues and Screen Plots.

#### 4.8.3.2.8 Confirmatory Factor Analysis (CFA)

Confirmatory Factor Analysis (CFA) aims to analyse the relationship between one quantitative dependent variable and the quantitative independent variable. However, multiple regression analyses the relationship between one quantitative dependent variable and two or more quantitative independent variables (Jackson, 2011). Additionally, CFA can be expanded to an SEM modelling approach, which yields several useful insights (Hitchcock et al., 2015).

#### 4.8.3.2.9 Structural Equation Modeling (SEM)

Given (2008) states that structural equation modelling (SEM) attempts to identify causal relationships through analysis of correlations between variables. Newman et al. (2015) argue that SEM involves building and testing a statistical model and therefore encompasses aspects of CFA and regression analysis.

#### 4.8.3.2.10 Relationship between the Factors and Demographic variables

Analysis of Variance (ANOVA) partitions the observed variance into components based on different sources of variation (Newman et al., 2015). To check whether two measures are statistically dependent on one another, an Analysis Of Variance (ANOVA) is undertaken to explore the relations between factors in a study.

Additionally, a Multivariate Analysis Of Variance (MANOVA) was used in the study. Newman et al. (2015) state that a MANOVA examines whether one or more factors have an effect or are related to two or more outcome variables. The study will use ANOVA and MANOVA to explore the relationship between independent factors and dependent factors.

#### 4.8.3.3 Summary of statistics

For this dissertation, a summary of the descriptive statistics is tabulated in Table 4-15.

Table 4-15: Summary of descriptive statistics applied in this study

| Number | Data Analysis | Statistical Test |
|---|---|---|
| 1 | Demographic profile of the sample. | Frequency distribution of the sample |
| 2 | Measurement items from the questionnaire. | Frequency distribution of the measurement items. |
| 3 | Descriptive statistics for factors. | Central tendency and dispersion; frequency distribution for the factors |

The inferential data analyses techniques adopted in the dissertation included Exploratory Factor Analysis (EFA), Cronbach's Alpha test for reliability, one-sample and matched-paired t-test for statistical significance, Cohen's d practical significance test, Pearson Product Moment Correlation Coefficient, univariate ANOVA and CFA and its associated goodness-of-fit-test. A summary of the empirical statistics is listed in Table 4-16.

Table 4-16: Summary of empirical statistics applied in this study

| Number | Data analysis | Statistical Test | Reason for the statistical test |
|---|---|---|---|
| 4 | Factor Analysis | Exploratory Factor Analysis (EFA) | The EFA was used to determine the number of factors sufficient to explain the intercorrelations amongst factors |
| 5 | Reliability | Cronbach's Alpha coefficient | The Cronbach's Alpha coefficient was used to measure the internal consistency of the measuring instrument (questionnaire). A set of indicators were applied, which are used as a threshold for determining reliability. |
| 6 | One-Sample t-test for the factors | One-sample t-test by determining statistical significance (p-value) and practical significance (Cohen's d). | A one-sample t-test measured whether the null hypothesis would be accepted or rejected. The results from the one-sample t-test would inform which factors to be omitted from the multi-dimensional model. |
| 7 | Relationships between the Factors. | Pearson's product moment correlation coefficient. | To determine the relationship between the set of factors. |
| 8 | Relationships: Factors & Demographic variables. | Univariate ANOVA, followed by a comparison between groups and a series of independent samples t-test to determine the p-value, using the Scheffé p. | To investigate the effects of the important demographic variables on the set of factors influencing an entrepreneurial ecosystem. |
| 9 | Inferential Ranking of the Independent factors. | Matched-paired t-test and Cohen's d. | The inferential ranking was performed to determine the level of importance of factors. |
| 10 | Validity of constructs. | CFA is followed by the 'goodness-of-fit' test. | CFA was used to determine the construct validity of the questionnaire and response pattern comparisons. |
| 11 | Validity of the structural model | SEM uses the 'goodness-of-fit' test | SEM was used to determine the conceptual model validity based on the predetermined criteria. |

### 4.8.4 Sampling Process

The section investigates the population of the study, determining the sample, selecting the sampling technique, and other sampling techniques.

#### 4.8.4.1 Determining the Population

A unit of analysis is defined as the level at which data will be gathered from either individuals or groups, these could be students, teachers or entire schools or districts (Creswell, 2011). Furthermore, some researchers gather data from multiple levels while others collect from only one level, depending on the research questions. For this study, the unit of analysis is defined as first-year students at Nelson Mandela University.

#### 4.8.4.2 Determining the Sample

Creswell (2011) states that if an entire school is selected for the study, the researcher needs to consider what individuals will be part of the study. A population is a group of individuals who have the same characteristics. For the study, the population will be first-year students. The target sample is a subgroup that will be used for generalising the target population. For this study, the sample is the students enrolled in first-year for Computer Science, Information Systems and Information Technology courses at Nelson Mandela University.

#### 4.8.4.3 Selecting a Sampling Technique

Creswell (2011) states that a stratified sampling technique is a probability sampling used when the researcher divides the population on some specific characteristic and by using simple random sampling, obtains a sample from each group of the population. The advantage of using stratified sampling is that it guarantees that the sample will include specific characteristics that the researcher wants to be included in the results. Creswell et al. (2006) add that two things make up the procedure for selecting a stratified random sample; a) dividing a population by the stratum, and b) sampling within each group in the stratum. The advantages of stratified sampling bring balance to the analysis of results. If there are a few participants for a specific group then stratified sampling rectifies the situation. Therefore for this study, a stratified sampling procedure was applied as it allowed for balanced numbers to analyse the results.

#### 4.8.4.4 Determining appropriate sample size

The study applies stratified sampling. The target group of students were 2730, which was the target population of students enrolled for the different programmes (BSc IS, B.Com CS&IS, BIT, NDip IT, HCert in IT and others).

The sample size was worked out using the target population. Combined with the margin of error (confidence interval), which is the difference between the mean number of the sample and the mean number of population with an allowance of 5% margin of error. A confidence level of 95% was chosen and the final step was to use a standard deviation of .5 to make sure that the sample was large enough. The sample size for the study was 337, therefore the minimum number of respondents needed for the study was 337 and the maximum can be 800 respondents.

#### 4.8.4.5 Addressing issues of sampling error and sampling bias

In selecting a sample size it is best to select a large sample size from the population. This allows for less potential of error as there will be fewer differences between the sample and the true population. Dillman (2007) states that large surveys consist of between 100 and 200 responses. While Creswell (2011) recommends a rough estimate of approximately 350 individuals for a survey, the size may vary depending on several factors. Therefore for this study, the minimum population size was 337 and the maximum number of participants 800. Furthermore, to address sampling biases, all the participant groups received a standard invitation.

#### 4.8.4.6 Addressing issues of non-sampling error

Laxton (2004) states that in non-sampling, or measurement, an error occurs from how responses or data are obtained. Additionally, non-sampling errors can also result in samples being underrepresented in the target population. Laxton (2004) identifies issues that cause a rise of the above error:

- Biased observations;
- Biased communication; and
- Induced bias.

The non-sampling error issues were addressed by clear details about the purpose of the study to all respondents before the respondents completed the questionnaire. Induced biases were handled by using a pilot study with experts in the field, which allowed the researcher's preferences and prejudices to be eradicated. Additionally, the questionnaire addressed holistically the factors in the IT field.

#### 4.8.4.7 Enhancing the reliability of data

Validity and reliability are important issues (Creswell et al., 2006; Gray, 2004), therefore, an instrument must be used that reports individual scores that are reliable and valid (Creswell, 2011). Reliability means that scores from an instrument are stable and consistent. Therefore scores need to be nearly the same when the instrument is administered multiple times and also consistent (Creswell, 2011). The reliability of the responses from the pilot test provided the researcher with the opportunity to test the research instrument (Saunders et al., 2009). Reliability is improved if sampling bias and sampling error are minimised (Guler, 2004). Furthermore, reliability contributes to data integrity. For the study to enhance the reliability of the data collected, a stratified sampling technique was chosen and the sample size was as large as possible.

***Internal consistency*** is when the scores from an individual are reliable and accurate on the items of the instrument. Internal consistency is important for the researcher because the reliability of an instrument increases as more items are added to the instrument. Therefore, to ensure internal consistency the Cronbach's Alpha coefficient was used to test internal consistency (Creswell, 2011).

#### 4.8.4.8 Enhancing the validity of data

***Internal validity*** refers to the accuracy of a specific study's findings and the clear illustration of cause and effect relationships (Gray, 2004). Internal validity depends on various factors, namely, the respondents completing one questionnaire, spoilt questionnaires, and whether the researcher influences the participants to provide certain responses (Laxton, 2004). For this study, participants were encouraged to complete the questionnaire online and in their own time. The use of an electronic tool to collect data helped to minimise the chances of spoilt questionnaires and the researcher did not come into contact with the participants not to influence the participants' responses.

***External validity*** is the extent to which the finding of the study can be applied in other situations or generalised to a larger population. External validity can be undermined by the nature of the participants, the period of data collection (Laxton, 2004). To enhance external validity for the study, a stratified sampling method was used which allowed for the collection of data with a sample that is representative of the population. Therefore the sampling method used further allowed findings to be generalised to other situations.

***Content validity*** is associated with validating the content of a test or inquiry therefore it involves the alignment between what is theorised and what is tested (Gray, 2004). Guler (2004) states that improving the questionnaire's content validity allows the research instrument to comprehensively assess the area it purports to investigate. The study's content validity was enhanced by the questionnaire's covering of various aspects of factors affecting each student's decisions to pursue an IT career.

***Face validity*** was conducted by making use of a pilot study which ensured that the questionnaire appears to make sense (Gray, 2004). Furthermore, the pilot study allowed the researcher to check if respondents had problems in understanding and answering the questionnaire (Saunders et al., 2009). In addition, the NMU statistician and two academics checked the question for face validity.

### 4.8.5 Procedures

This section examines the procedure for administering the questionnaire, the pilot study, addressing the pilot study issues, and the ethical clearance procedure for the study.

#### 4.8.5.1 Administering the Questionnaire

All participants had agreed to the consent (Figure 4-10) and the instructions were clear that participants could terminate their participation at any interval during the questionnaire.

Dear Student

Students make important career decisions during their school years. This is an invitation to participate in a survey to determine the factors that influenced your career choice. The Nelson Mandela University researchers seek to understand your views and the factors that influenced your decision to choose a specific career path. Your responses are important to assist future scholars in choosing a career path.

The questionnaire should take you about fifteen minutes to complete. The information you provide will be treated in the strictest confidence and your response will be anonymous.

Please follow the link to complete the questionnaire:
https://mandela.questionpro.com/t/ASHF4Zk9df

The study has been approved by the NMU Research Ethics Committee under this ethics number: H20-SCI-CSS-008

I hope that you will find completing the question enjoyable. If you have any questions or would like further information, please do not hesitate to email me: mtwani@mandela.ac.za

Thank you for completing the survey.

NMU Researchers
Mr Malibongwe Twani and Prof Andre Calitz

Figure 4-10: Email invitation to the study participants

The final stage was administering the questionnaire and Saunders et al. (2009) recommend a 5 step approach with distributing email questionnaires, which were followed for the study:

1. Contact was made with all recipients by the course email groups and all participants were advised, to expect a link to the questionnaire (pre-survey). The purpose of the pre-survey was given to request participation from the participants. For the study, this step was a concern, due to not wanting to overwhelm the first-year students with emails, as they had just started the academic year.
2. An email was sent with the direct web link including a covering letter. Where possible the letter and hyperlink should be part of the email message rather than an attached file to avoid viruses. The researcher made sure the email was sent at a time when the recipient was likely to act on it. Furthermore, the researcher should avoid sending the invitation on Fridays and public holidays.

The researcher sent the invitation early morning on Wednesday (14 April 2021), the invitations had a cover letter as part of the email and hyperlink to the questionnaire as shown in Figure 4-10. The email invitation was sent to the following email groups:

- WRSC111 – Computer Fundamental for Scientists,
- WRFV101 - Computer Fundamentals,
- ITS1011 – Information Technology Skill 1,
- WIH101 – Information systems 1,
- IITF101 – Introduction to Information Technology,
- WRAV101 – Programming Fundamentals,
- ONT1030 & SDS1010– Development Software,
- MSEV101 – Computer Science for Engineers, and
- IOSF101 – Operating Systems Fundamentals.

Sending an email to the specific groups ensured that there was no cross-posting for participants (Figure 4-10).

3. The researcher was encouraged to email the first follow-up one week after emailing the first request to all recipients. The email thanked the early respondents and reminded non-respondents to follow a hyperlink to the survey. For the study, on Monday 19 April 2021, the researcher sent the first follow-up email a week later, indicating the 109 responses so far and encouraging those who have not participated to do so (Figure 4-11).

> Dear Student
>
> We have had a limited response to this survey request. Your input is essential and thanks to the 109 respondents so far.
>
> Students make important career decisions during their school years. This is an invitation to participate in a survey to determine the factors that influenced your career choice. The Nelson Mandela University researchers seek to understand your views and the factors that influenced your decision to choose a specific career path. Your responses are important to assist future scholars in choosing a career path.
>
> The questionnaire should take you about fifteen minutes to complete. The information you provide will be treated in the strictest confidence and your response will be anonymous.
>
> Please follow the link to complete the questionnaire: https://mandela.questionpro.com/t/ASHF4Zk9df
>
> The study has been approved by the NMU Research Ethics Committee under this ethics number: H20-SCI-CSS-008
>
> I hope that you will find completing the question enjoyable. If you have any questions or would like further information, please do not hesitate to email me: mtwani@mandela.ac.za
>
> Thank you for completing the survey.
>
> NMU Researchers
> Mr Malibongwe Twani and Prof Andre Calitz

Figure 4-11: First reminder

4. Step 4, email the second follow-up to people who have not responded after three weeks. This should include another covering letter and a hyperlink to the questionnaire. The covering letter should be reworded to further emphasise the importance of completing the questionnaire. The researcher sent a second follow-up email two weeks later with the cover letter, indicating the 310 respondents and with the hyperlink to the questionnaire and thanked all who have responded (Figure 4-12).

> Dear Student
>
> We thank you for your participation in the study. Your input is essential and thanks to the 310 respondents so far. We encourage those who have not responded to the call to do so, this is the last opportunity.
>
> Students make important career decisions during their school years. This is an invitation to participate in a survey to determine the factors that influenced your career choice. The Nelson Mandela University researchers seek to understand your views and the factors that influenced your decision to choose a specific career path. Your responses are important to assist future scholars in choosing a career path.
>
> The questionnaire should take you about fifteen minutes to complete. The information you provide will be treated in the strictest confidence and your response will be anonymous.
>
> Please follow the link to complete the questionnaire: https://mandela.questionpro.com/t/ASHF4Zk9df
>
> The study has been approved by the NMU Research Ethics Committee under this ethics number: H20-SCI-CSS-008
>
> I hope that you will find completing the question enjoyable. If you have any questions or would like further information, please do not hesitate to email me: mtwani@mandela.ac.za
>
> Thank you for completing the survey.
>
> NMU Researchers
> Mr Malibongwe Twani and Prof Andre Calitz

Figure 4-12: Two weeks reminder

5. Also, use the third follow-up if time allows or the response rate is low. The researcher will use the third follow-up after three weeks provided the study is below the minimum sample size response and time still allows (Figure 4-13).

Dear Student

We thank you for your participation in the study. Your input is essential and thanks to the 350 respondents so far. We encourage those who have not responded to the call to do so, this is the last opportunity.

Students make important career decisions during their school years. This is an invitation to participate in a survey to determine the factors that influenced your career choice. The Nelson Mandela University researchers seek to understand your views and the factors that influenced your decision to choose a specific career path. Your responses are important to assist future scholars in choosing a career path.

The questionnaire should take you about fifteen minutes to complete. The information you provide will be treated in the strictest confidence and your response will be anonymous.

Please follow the link to complete the questionnaire: https://mandela.questionpro.com/t/ASHF4Zk9df

The study has been approved by the NMU Research Ethics Committee under this ethics number: H20-SCI-CSS-008

I hope that you will find completing the question enjoyable. If you have any questions or would like further information, please do not hesitate to email me: mtwani@mandela.ac.za

Thank you for completing the survey.

NMU Researchers
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Figure 4-13: Final Reminder

#### 4.8.5.2 Definition of a Pilot Study

Creswell (2011) states that after a questionnaire has been developed using principles of question construction, a researcher must pilot test the questionnaire. Saunders et al. (2009) agree that before using a questionnaire to collect data, it should be piloted. The reason is to determine if individuals in the sample are capable of understanding and completing the questions. Therefore, the pilot test will lead to feedback for the researcher to make changes on the instrument based on the feedback from those who complete and evaluate the instrument. Additionally, it will enable the researcher to gain some assessment of the questions' validity and likely reliability of the data that will be collected. (Creswell, 2011; Saunders et al., 2009). Therefore this study administered the questionnaire as a pilot study before the main study data collection.

##### 4.8.5.2.1 Administering the Pilot Study

Initially, an expert group should be approached to comment on the representation and suitability of the questions. Allowing suggestions to be made on the structure of the questionnaire will help with validity and amendments can be made before the pilot (Saunders et al., 2009). The number of people to be chosen should be sufficient to include any major variations in the population that are likely to affect responses. Therefore for most student questionnaires, this means that the minimum number for a pilot study is 10 (Fink, 2003).

Therefore for this study, a group of experts was approached to comment on the questionnaire and amendments addressed before the questionnaire was piloted to the minimum number of people.

Dear [redacted]

Hope you are well. I am currently embarked on a research study for my masters and I need contact with lectures in your department. Particularly lectures in the first year level for the following modules: **NHCert**: WIH1011, ITS1011, **NDip**: IOFS101, ONT1030 **BIT**: SDS1010, IITF101.

My study involves a questionnaire, that studies the first-year student's decision in choosing IT(CS, IS, and IT) as careers. The questionnaire investigates several factors that influenced the student's choice. Being in contact with the lecturers will help me to get their expert opinion on the questionnaire before distribution to the participants.

Your help in this regard will be much appreciated

Regards,

Figure 4-14: Email request to the HOD's

A small pilot study was performed, to assess the appropriateness of the questionnaire. The participants of the pilot study were experts in the field and familiar with the background of those who would later be participants of the main study. Approval was sent through the Heads of Department (HOD) of the respective departments as the lecturers for the modules, as lecturers were unknown to the researcher (Figure 4-14).

Several of the participants were lecturers who are teaching first-year students, as shown in Figure 4-15. The lecturers were invited to participate with the ethics board approval attached and four participated in the pilot study. One particular participant is a language expert and an academic with many years of experience in research. The participants were assured of the confidentiality of their feedback and participation as they were invited. The pilot study was conducted via the online survey tool, QuestionPro and feedback were received via email.

Approval H20-SCI-CSS-008 Prof A Calitz-Mr M Twani.16Mar2021.pdf
179 KB

Dear [redacted]

Hope this email finds you well.

I would like your expert input in evaluating my questionnaire that I will be sending out to first years students across the department. Your module (ITS1011) selected as it is a compulsory module for the HCert IT programme.

The questionnaire investigates the career choice and influences of the student's decision to choosing IT(CS, IS, IT) at the first-year level. This questionnaire is part of my research study. Attached is the ethical approval for the study and your HOD has been approached and granted approval.

I would like you to evaluate the questions, on the questionnaire and please you can send me any comments regarding (grammar, length of the questionnaire and the timing or any other issues)

I am hoping to distribute the questionnaire starting this Easter weekend through your module distribution list. If you can complete the pilot within this week, your contribution will be greatly appreciated.

Please find the questionnaire link:
https://mandela.questionpro.com/t/ASHF4Zk9df

Regards,

Figure 4-15: Invitation to the Lecturers to participate in the Pilot Study

In the pilot study, the following issues were solicited based on Bell (2005); How long it takes to complete the questionnaire; clarity of instructions; unclear questions; questions that were not clear; the layout was clear and attractive; and participants were asked about any other comments on the questionnaire.

#### 4.8.5.3 Addressing Pilot Study Issues

Based on the above-mentioned pilot study, feedback was obtained from 5 participants and the changes were undertaken to the questions of the questionnaire. The participants of the pilot study comprised language experts, NMU statisticians and subject experts. A Language Expert from the NMU Business School participated as a language editor and made minor language corrections. One Lecturer that participated and evaluated the questionnaire was the subject expert and made the following statements:

1. The statement at home, I used the computer daily was updated to I used the computer daily at home;
2. When I was at school, I would spend many hours using computers, changed to I would spend many hours using computers when I was at school
3. How confident are you that you do the hardest work that is assigned in your modules? was changed to How confident are you that you do the difficult work that is assigned in your module?
4. How confident are you that you will remember what you have learned in your current modules, next year? changed to How confident are you that you will remember what you have learned in your current modules?
5. The following module details and code were corrected;
    - Computing Fundamentals for Scientist (WRSC111),
    - Computing Fundamentals (WRFV101, WRFV102),
    - Programming Fundamentals (WRAV101, WRAV102),
    - Computer Science for Engineers (MSEV101, MSEV102),
    - Information Technology Skills (ITS1011), and
    - Information Systems 1 (WIH1011).

The following additions were made to the questionnaire in the following factors:

6. Under the factor Culture a new item was added, and the statement is "*In my culture, people encourage children to study towards professional careers, such as doctors or charted accountants",*
7. Socialisers added an item statement *"I have IT role models",*

8. Learning experience an item *"I did some programming on my mobile phone (e.g. Tanks or Boats)", and*
9. My career choice is an item "*I can become an entrepreneur with my career choice."*

Many participants were satisfied with most of the questions in the questionnaire and indicated that the questions were clear and understandable. The average time taken for the questionnaire was between Twenty minutes and Thirty minutes. The questionnaire was finally forwarded to the NMU statistician. The NMU statistician recommended changes to the original conceptual model shown in Figure 4-16 and proposed in Section 3.6, which are explained in the following sections.

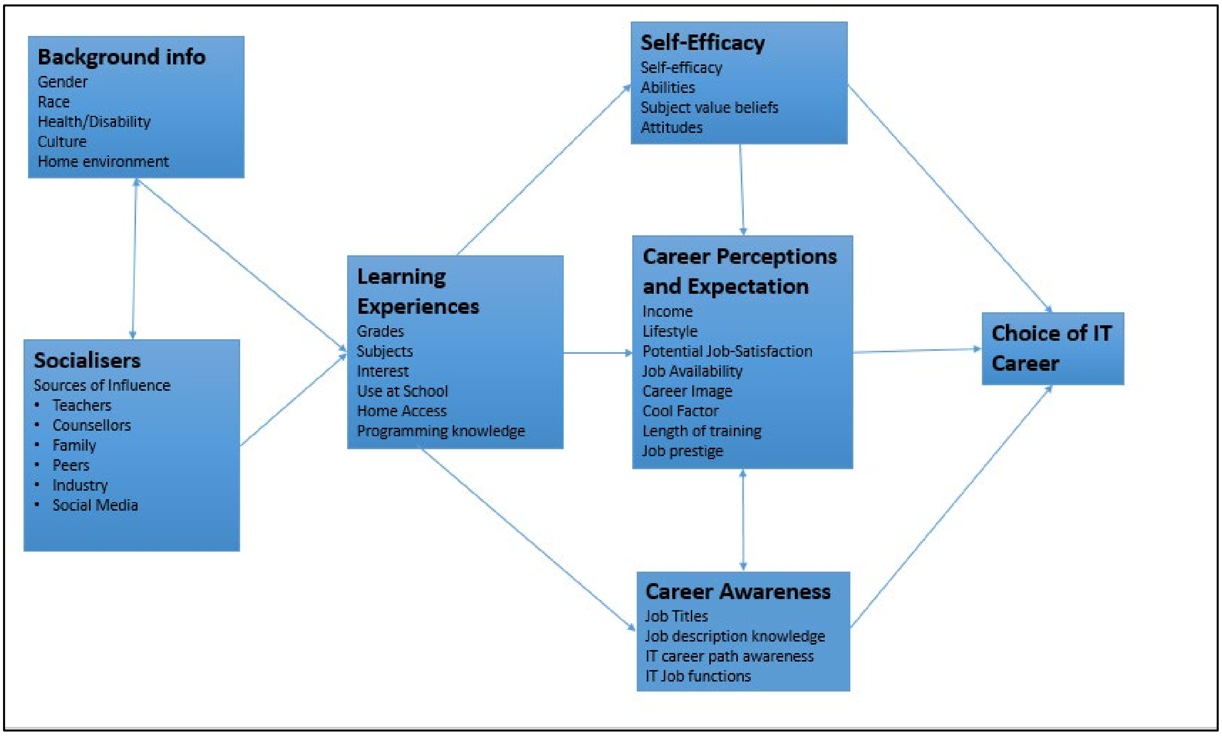


Figure 4-16: Original Proposed Conceptual Model from Twani et al. (2020)

#### 4.8.5.3.1 Biographical Information - Factor

I. A new item Age was added entitled "How old are you?"
II. A list item was added with several languages spoken in the Eastern Cape was added and the item is entitled " What is your home language?"
III. Two list items were added probing both parents' highest qualifications, the qualifications were defined based on the SAQA qualifications standards, the

questions prompt the respondents to “Indicate your father’s highest qualification” and “Indicate your mother’s highest qualification”.

IV. Under the background information item from Figure 4-16, Figure 4-17 details the background information statements that probe the background of the participants. The items were Yes/No items;
   - There are professionals (e.g. doctors, accountants, lawyers) in my family;
   - There are IT professionals in my family;
   - I have family working in the IT industry;
   - I have friends working in the IT industry;
   - I have IT role models; and
   - I have role models for my chosen career.

#### 4.8.5.3.2 Career Choice Influencers - Factor

The above factor name was changed, compared to Figure 4-16 and Figure 4-17, it was felt that the original name Socialisers is closely linked with social media and therefore does not give the true meaning of the factor. Hence the factor name was changed to Career Choice Influencers, which encompasses all influencers including social media.

Five new items that are Rating Likert Scale items were added to the factor as they further addressed the culture item:

I. In my culture, people have a clear understanding of professional careers, such as chartered accountant;
II. In my culture, a woman is expected to have a family and children;
III. In my culture, having a large family is important;
IV. In my culture, women are expected to have a full-time job; and
V. People in my culture are religious.

#### 4.8.5.3.3 Learning Experiences – Factor

I. A new item was added, “I used a computer at home whilst growing up.”;

II. An item was deleted entitled “I had access to a computer when I was growing up.”;
III. A list item was added, “Indicate if you took any of these subjects at school.”;
IV. The programme registered for was moved from Biographical Info Factor to within this factor entitled “Which university programme are you registered for?”; and
V. An item was added, “Indicate the first-year module you are enrolled for?”

#### 4.8.5.3.4 Personal Attributes – Factor

The factor name was changed from Self-Efficacy to Personal Attributes. The following items were added:

I. It is easy for me to achieve my goals;
II. I work well under pressure;
III. I am a confident person;
IV. I feel I have a number of good qualities;
V. On the whole, I am satisfied with myself;
VI. Complete your diploma/degree programme in the required minimum time?; and
VII. Pass all your modules?

#### 4.8.5.3.5 Career Perceptions & Expectations – Factor

The following items were deleted from the factor:

I. The IT industry provides opportunities to work in different kinds of business functions;
II. There is a good prospect of developing new skills in the IT industry; and
III. IT career provides the opportunity to become an entrepreneur.

#### 4.8.5.3.6 Career Awareness – Factor

Items that were added were:

I. I do have an understanding of the career paths available for students with my qualifications;

II. Which job title would you associate with each job description? Ten titles were added listing the job functions, which the respondents had to match job titles with as shown in Table 4-17.

Table 4-17: Job Titles and matching descriptions

| Title | Job Description |
|---|---|
| Auditor | A professional person who reviews the financial statements and accounting principles of a business |
| Sales and Marketing representative | A person who manages sales and promotional activities to increase the sales or the use of a product or service in a business and ultimately market share |
| Information Security Specialist | A person who manages the data, information, systems, network and cloud security in an organisation |
| Help desk and Support Consultant | A person providing IT customer support and troubleshoot daily user IT queries |
| Software Developer/programmer | A person responsible for designing, writing code and testing new programmes |
| Accountant | A person who manages the daily financial transactions and information in a business |
| Network Engineer | A person responsible for handling LAN/WAN, network hardware, software and installations |
| Data Scientist | A person working with Big data, applying statistical techniques to analyse, model and interpret the results to create actionable plans for companies |
| Database Administrator | A person responsible for maintaining the databases and ensuring data availability in a business |
| Business Analyst | A person who solves business problems by analysing and designing IT systems in the organisation |

#### 4.8.5.3.7 Perception on Chosen Career – Factor

The name of the factor was changed from Choice of IT Career to Perceptions on Chosen Career. The initial name focused on the IT Industry while the latter name focuses on careers generally as it is reflected on the items that are interrogated within the factor.

The following items were added:

I. There are good prospects for a better than average starting salary in the career I have chosen;

II. I will have opportunities to work in different kinds of business functions in my chosen career; and

III. I can become an entrepreneur with my career choice.

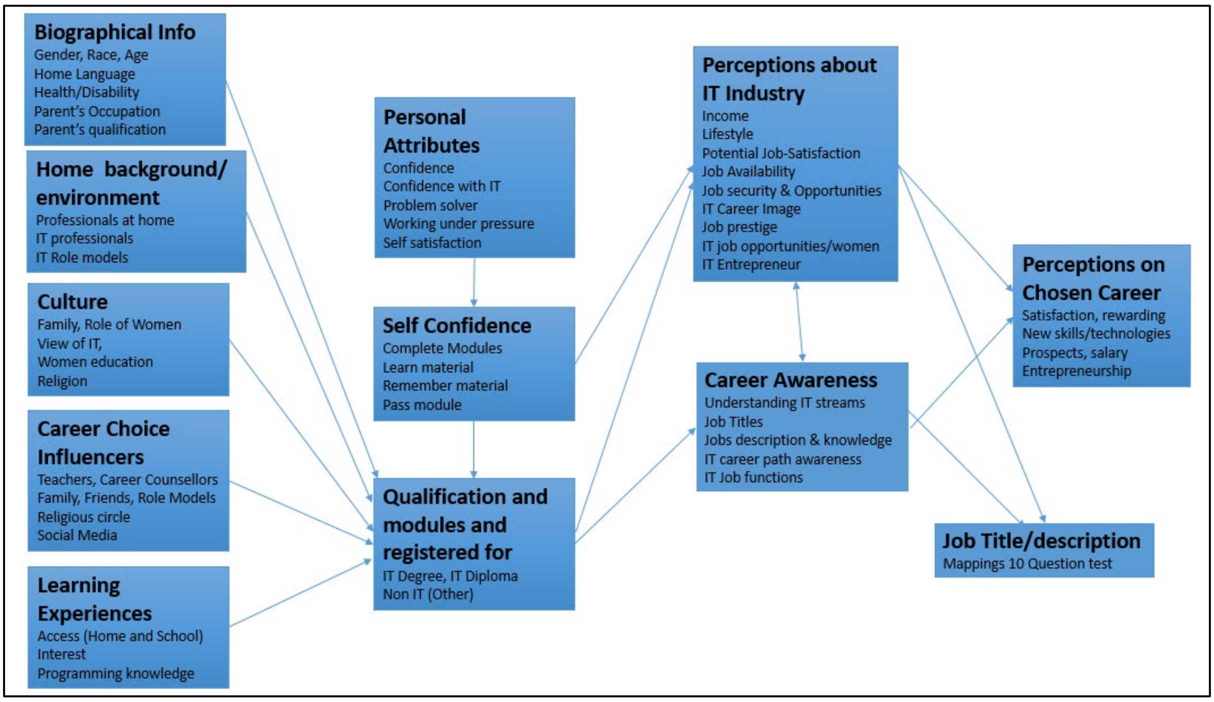

Figure 4-17: Revised Conceptual Model

The Pilot study was concluded and the results have been addressed and presented as the updated conceptual model in Figure 4-17. The questionnaire was updated, see Appendix E – Questionnaire.

### 4.8.5.4 Research Hypotheses

The hypotheses are intended to help establish the relationships between factors and illustrated in Table 4-18 on the proposed conceptual model. The theoretical model was used to determine the influence factors have on perceptions about the chosen career (dependent factor). The hypotheses were based on independent, interdependent and dependent factors. Table 4-18 presents the conceptual model hypotheses.

Table 4-18: Conceptual Model Hypotheses

| Hypothesis | Hypothesis Description |
|---|---|
| $HA_1$ | Biographical information positively influences Qualifications and Modules registered for. |
| $HA_2$ | Home background/environment positively influences Qualifications and Modules registered for. |
| $HA_3$ | Culture positively influences Qualification and Modules registered for. |
| $HA_4$ | Career Choice Influencers positively influences Qualification and Modules registered for. |
| $HA_5$ | Learning Experiences positively influence Qualification and Modules registered for. |
| $HA_6$ | Personal Attributes positively influence Qualifications and Modules registered for. |
| $HA_7$ | Self Confidence positively influences Qualifications and Modules registered for. |
| $HA_8$ | Self Confidence positively influences Perceptions about IT Industry. |
| $HA_9$ | Learning Experiences positively influence Perceptions about IT Industry. |
| $HA_{10}$ | Qualifications and Modules registered positively influence Career Awareness. |
| $HA_{11}$ | Perceptions about the IT industry positively influences Career Awareness. |
| $HA_{12}$ | Perceptions about the IT industry positively influences Perceptions of chosen careers. |
| $HA_{13}$ | Perceptions about the IT industry positively influences Job Title/Descriptions. |
| $HA_{14}$ | Career Awareness positively influences Perceptions of the chosen career. |
| $HA_{15}$ | Career Awareness positively influences Job Title/Descriptions. |

Table 4-18 illustrates 15 hypotheses indicating how each hypothesis influences a factor in the conceptual model. Figure 4-18 illustrates the hypothesised model that was used for the data collection from the survey. Questions were based on the hypothesised conceptual model.

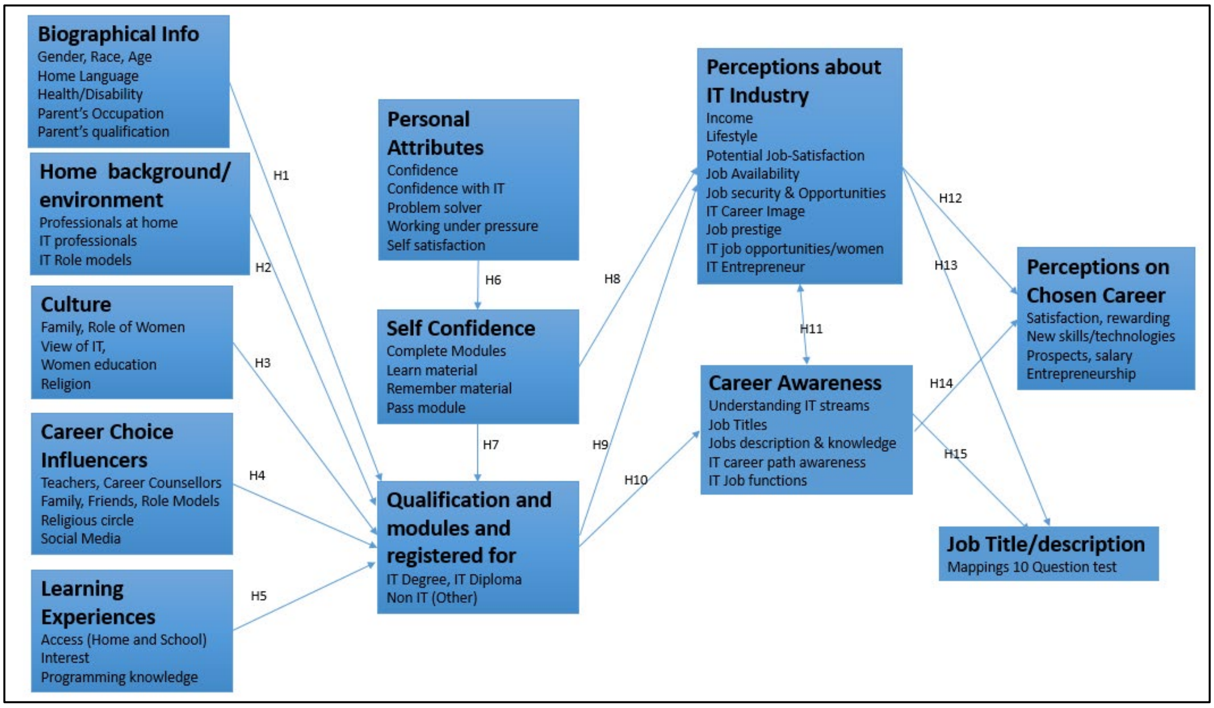


Figure 4-18: Hypothesised Conceptual Model

#### 4.8.5.5 Ethical Considerations

The term ethics refers to the moral values or philosophies that form the basis of a code of behaviour that dictates rules for acceptable conduct (Collis & Hussey, 2014). As this study gathers data from human participants via a questionnaire, it is necessary to obtain ethical clearance from NMU REC-H Committee.

The NMU research ethics committee requires the following; 1) a research methodology that ensures the study follows accepted research methodology in approaching the research; 2) a participants consent form which ensures that the researcher will have considered the participants to the study (Appendix A – Participants Consent); 3) an informed consent which shows what has been considered by the participants (Appendix B – Informed Consent); 4) Written information to participants (Appendix C – Oral Information); and a letter requesting permission from the gatekeepers (Appendix D – Letter to Gate Keepers). Finally the questionnaire (Appendix E – Questionnaire).

This study met all ethical requirements and obtained ethical clearance from Nelson Mandela University. The ethics clearance number obtained from NMU is H20-SCI-CSS-008 and the ethics approval letter is attached (Appendix F – REC-H Approval).

### 4.9 Summary

In Chapter Four, the primary focus was on addressing $RO_3$: Develop a data collection instrument that can be used to evaluate the conceptual model of the factors influencing career decisions of first-year students. The Chapter addressed the objective by answering first, $RQ_{3.1}$: What research design can be used for the study? The chapter discussed research philosophies, approaches and strategies and focused on their application to this research study. Figure 4-19: Summary of design summarises the nature of the study as it adopts the positivism philosophy while using deductive approaches. The method choice applied is a mixed-methods approach, the justification and detailed application of the mixed-method were discussed. The study used the convergence mixed method, which ensured that data were collected concurrently and mixed in analysis. In this research, the mixing of analysis of data will be undertaken through data quantification.

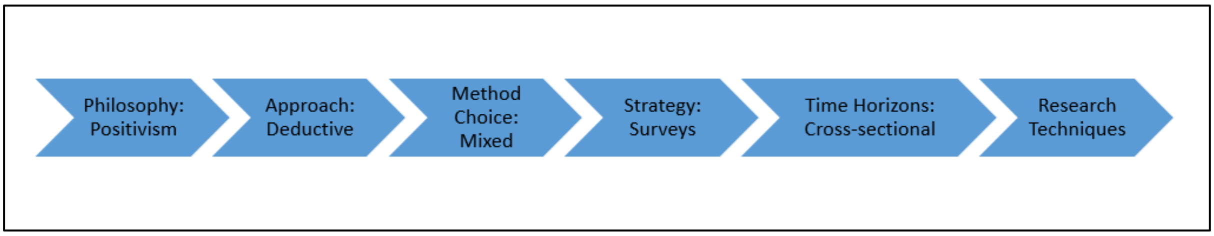


Figure 4-19: Summary of design

The chapter answered $RQ_{3.2}$: What research instruments can be used for data collection? The strategy applied in this study is the survey which used questionnaires as a data collection tool. Additionally, the study was a cross-sectional study as it focuses on a specific point in data collection in addressing the main research question. The data collection and analysis adhered to normal research techniques and procedures for collecting and analysing the data. The chapter finally, discusses procedures, the administering of the questionnaire and ethical procedures. The pilot study mainly addressed the reliability of the study and validated the instruments. The results from the pilot study were discussed and addressed with the proposed updated model and hypotheses were presented based on the theoretical model.

The next chapter, Chapter Five will address $RO_{4:}$ Empirically evaluate the conceptual model of the factors influencing first-year students' career decisions. Additionally, Chapter Five will present the results from the statistical analysis. The data will be explored, analysed, and summarised, and the results will be presented by means of graphs and tables.

# Chapter 5: Analysis of Results

## 5.1 Introduction

Chapter Four discussed the research design underpinning this study. Furthermore, Chapter Four addressed the $RO_{3:}$ Develop a data collection instrument that can be used to evaluate the conceptual model of the factors influencing career decisions of first-year students. Chapter Five focuses on the empirical evaluation of the conceptual model proposed in Chapter Four, therefore, addressing $RO_{4:}$ Empirically evaluate the conceptual model of the factors influencing first-year students' career decisions.

Chapter Five details and reports the results from the questionnaire administered and discussed in Chapter Four. The chapter discusses the data analysis and presentation of the research findings. First, the chapter explores the data collected from the questionnaire, by using frequency distribution analysis focusing on the demographic information of the students. Secondly, the chapter answers $RQ_{4.1:}$ What factors did the empirical study highlight as influencing students, IT career decisions? Item analysis was performed using the following statistical methods: Exploratory Factor Analysis (EFA). Thirdly, addressing $RQ_{4.2:}$ What factors influence the career decisions of the IT students, compared to Non-IT students? Inferential statistics were performed, such as the $Chi^2$ test, t-test, and the relationships between the demographic variables. Finally, in addressing $RQ_{4.3:}$ What factors influence first-year students' IT career choice? The chapter highlights the Confirmatory Factor Analysis (CFA) performed, with a Structural Equation Model (SEM) to allow the conceptual model to be tested for fitness in measuring the factors that first-year students' chosen careers.

In addressing $RO_{4:}$ Empirically evaluate the conceptual model of the factors influencing first-year students' career decisions. Figure 5-1: Chapter Layout illustrates the chapter outline with all sub-headings.


Figure 5-1: Chapter Layout

## 5.2 Data Analysis and Interpretation Methods

This section focuses on the data wrangling methods applied and the data analysis, which focuses on data quantification of the open-ended questions.

### 5.2.1 Data Cleaning

After the questionnaire was closed, the data analysis could be undertaken. The data had to be checked for all errors, before the statistical analysis. The data were visually inspected during the cleaning process and three records: cases 235, 307 and 378 were removed as they had missing data, therefore making the total number of usable records 405 for this study.

### 5.2.2 Data Coding and Transformation

Collis and Hussey (2014) state that it is important to analyse collected data through statistics to obtain meaningful information. Data coding is the process of analysing text in a qualitative form, labelling the text to form themes/categories (Creswell, 2011). Creswell (2011) states that there are no set guidelines for coding data even though general guidelines exist. Therefore, for this study, thematic analysis, quantifying and categorisation of responses were undertaken to focus mainly on the open-ended items, which were counted, categorised and quantified, and thematically analysed.

The quantified variables were Languages and Age, after the Age were quantified, it is reported upon. The languages were quantified and a word cloud analysis was conducted. The Father and Mother's Occupation were re-coded to 1) produce an ordinal scale and 2) omit blank and unknown data. Finally, the Father and Mother's Occupation data were coded, quantified and categories and themes created and the data were reported as themes and word cloud, which used word counts.

#### 5.2.2.1 Age

The demographic variable age was an open-ended item that respondents were allowed to enter a digital number. Table 5-1 shows how the data relating to the variable age, were categorised and given codes.

Table 5-1: Age Category

| Age Category | Code |
|---|---|
| 18 years | 1 |
| 19 years | 2 |
| 20 years | 3 |
| 21 years | 4 |
| 22+ years | 5 |

The age variable was further categorised to allow for the inferential statistics. Table 5-2 shows results of further age categorisation.

Table 5-2: Age Category

| Age Category | Code |
|---|---|
| < 21 years | 1 |
| 21+ years | 2 |

The age variable is presented in the data frequencies section and charts were used to present the data for the study. Finally, the age variable was used in the inferential statistics and for comparing relationships with other factors used in the study.

#### 5.2.2.2 Home Language

The home language was a closed-ended question, with the option to specify 'Other' home languages. Table 5-3 shows the number of languages indicated in the 'Other' home language category. Furthermore, a word cloud was generated to indicate the 'Other' home languages.

Table 5-3: Other Home language indicated

| Other Home Language | Count |
|---|---|
| Sepedi | 17 |
| Xitsonga | 11 |
| Tshivenda | 9 |
| Siswati | 6 |
| IsiNdebele | 5 |
| Shona | 4 |
| Somali | 1 |

The variable home language 'Other' data was combined with the languages, Sesotho, Tswana, Xhosa, and Zulu to make up African languages used for inferential statistical analysis. Table 5-4 shows how the Home languages were categorised into two groups.

Table 5-4: Home Language Categories

| Home Language | Code |
|---|---|
| Afrikaans/English | 1 |
| African | 2 |

#### 5.2.2.3 Parents Occupation

The parents' occupation data were collected as an open-ended question for both the Father's and Mother's Occupations from the respondents. The data were categorised and assigned codes as shown in Table 5-5. The parents' occupation variable was not statistically significant for any of the inferential statistics. Additionally, a word cloud was conducted to represent prominent data.

Table 5-5: Father/Mother Occupation

| Father/Mother Occupation | Code |
|---|---|
| Professional | 1 |
| Entrepreneur | 2 |
| White Collar | 3 |
| Pink Collar | 4 |
| Blue Collar | 5 |
| Unemployed | 6 |
| Pensioner | 7 |

### 5.2.2.4 IT and Non-IT Groups

The sample obtained in this study was divided into two groups, students pursuing a career in IT and students registered for other careers. The IT and Non-IT groups were based on a closed-ended question requesting students to indicate the programme they were registered for. The question presented a list of programmes and an option named 'Other', in which respondents could type in the programme they were registered for. All programmes specified under the 'Other' option were added to the Non-IT group category as all the IT programmes were listed.

### 5.2.2.5 Career Choice

The Career Choice variable was an open-ended question in which respondents were asked to provide their future career choice. The results were categorised and presented in Table 5-6: Career Choice Categories. The categorised data for the Career Choice variable was not used as it did not provide any statistically significant results.

Table 5-6: Career Choice Categories

| Career Choice | Code |
|---|---|
| Chartered Accountant, Accountant, Attorney, Auditor, Lawyer, Forensic Auditor, Economist, Doctor, Investment Specialist, Psychologist, Pilot, Quantity Surveyor, Bio-kinetics | 1 |
| Manager, Nurse, Lecturer, Teacher, Chief Operations Officer, Assessor, Human Resources, Politics, Tour Guide, Personal Assistant, Receptionist, Bookkeeper, Intern | 2 |
| Aerospace Engineer, Pharmacist, Chemist, Scientist, Architecture, | 3 |
| Software Developer, Programmer, Game Designer, Graphic Designer, UX/UI Designer | 4 |
| Business Intelligence, Business Analyst, Software Engineer, IT Manager, IT Specialist, System Analyst, Machine Learning | 5 |
| Entrepreneur, TV personality, TV Production, Arts Director | 6 |
| Unknown, Unsure, Anything available, blanks (empty records) | 7 |

#### 5.2.2.6 Job Title

The respondents were asked to specify the job title they would like to occupy in the future. The results were categorised and assigned a code as shown in Table 5-7. However, the statistical analysis that included the variable did not produce any statistically significant results.

Table 5-7: Job Title Categories

| Job title | Code |
|---|---|
| Accountant – (Senior, Junior, Assistant), Psychologist, Lawyer, Surveyor, Environmentalist | 1 |
| Teacher, Intern, Supervisor, Bookkeep, Political Analyst, Graduate Support | 2 |
| Microbiologist, Chemist/Pharmacist, | 3 |
| Software Developer, Programmer, Game Designer, Graphic Designer, UX/UI designer | 4 |
| Big Data analyst | 5 |
| Entrepreneur, TV producer/Director | 6 |
| Unknown, Unsure, Anything available, blanks (empty records) | 7 |

### 5.2.3 Data Analysis

The qualitative data for the biographical variables discussed above were coded and counted. The qualitative data were analysed as coded quantitative data in different statistical analyses.

## 5.3 Demographic Profile of Respondents

After the closure of the questionnaire, the results were statistically analysed. The questionnaire was viewed by 1 649 people, with 408 participants completing the questionnaire. While there was a large number of people who viewed the questionnaire only 971 responded to the questions, however, 574 participants did not fully complete the questionnaire that results in a 41% completion rate of the participants. This section presents the demographic data of 405 respondents to the questionnaire through frequency distributions.

The first section of the questionnaire determined the background influence on the students' career decisions. This section discusses the frequency distribution of each demographic variable.

### 5.3.1 Gender

The respondents were requested to indicate their gender (Figure 5-2). The majority of respondents were female (55%, n = 221), while 45% (n=184) were males. The representation of the university was reflected as the university has 55% females and 45% male enrolments. The gender variable results correspond with the NMU statistics of 54% female enrollments (NMU, 2020).

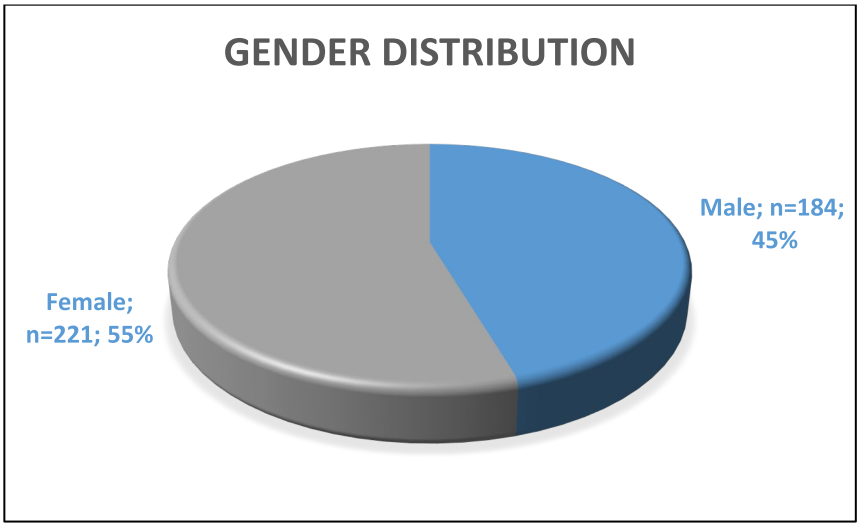


Figure 5-2: Frequency distribution - Gender

### 5.3.2 Race

Respondents were requested to indicate their race and the responses are shown in Figure 5-3. The majority of the respondents were Black (82%; n = 332), followed by Whites at (11%; n = 46), Coloureds at (5%; n = 21) and Indians at 1% (n = 6). The results reflect the race representation at NMU as the majority race is black 75% (NMU, 2020).

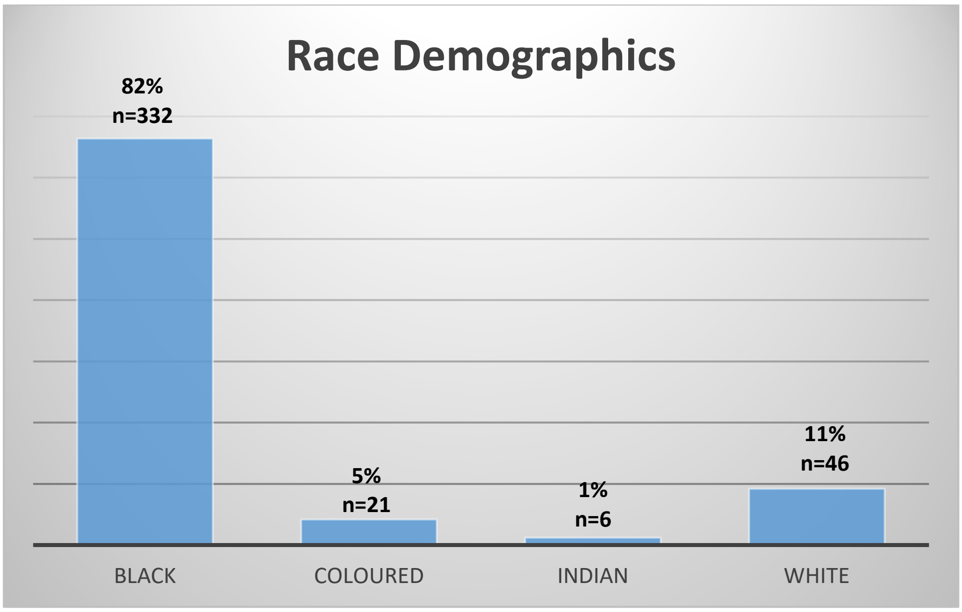


Figure 5-3: Frequency distribution - Race

### 5.3.3 Home Language

As part of the questionnaire, the respondents had to indicate their home language. The majority of the respondents' home language (Figure 5-4) was isiXhosa at 43% (n=173), followed by 17% English (n=70), and other languages at 14% (n=58). IsiZulu follows (8%; n=33) and 7% (n=29) for Afrikaans and 6% (n = 26) for Sesotho. The languages reflect the NMU demographics as 75% of the students are African, therefore speak African languages (NMU, 2020).

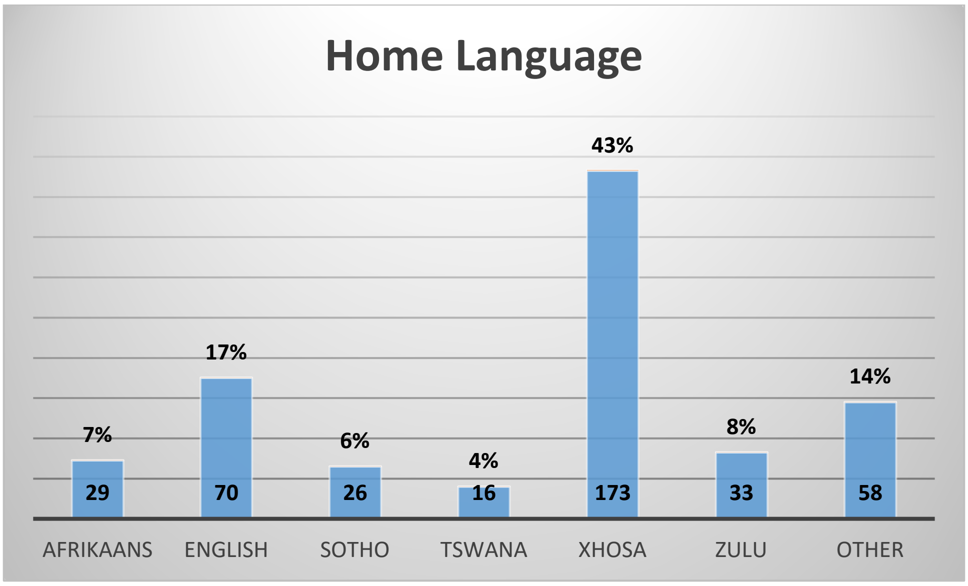


Figure 5-4: Frequency distribution - Home language

Further investigation of the languages indicated ‘Other’ was undertaken using a combination of word count and word cloud presentation as shown in Figure 5-5. The majority of the languages listed in the ‘Other’ category (n = 58), Sepedi (n = 17), Xitsonga (n = 11), Tshivenda (n = 9) and Siswati  (n = 6). Other languages (n = 10) included were isiNdebele, Shona and Somali.


Figure 5-5: Other Languages

### 5.3.4 Disabilities

The participants were requested to indicate whether they had disabilities. The majority of the participants at 99% (n = 399) had no disabilities, and 1% (n = 6) had disabilities. The results reflect the NMU demographics as there are few students with disabilities.

### 5.3.5 Age

Respondents were requested to indicate their age. Most of the respondents (27%, n = 111), were 19 years old, followed by 25% (n=101) 18 years, 16% (n = 66) for 20 years, 11% (n = 44) for 21 years and 20% for 22 years and above (Figure 5-6).

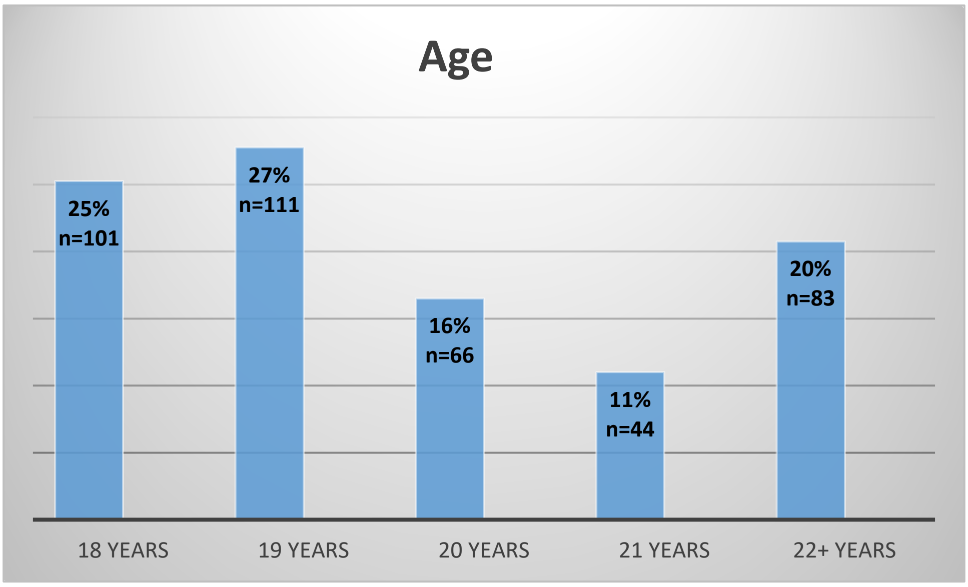


Figure 5-6: Age frequency distribution

### 5.3.6 Father's and Mother's Occupation

The respondents were requested to indicate their father's and mother's occupation, the data were categorised into seven categories as shown in Table 5-8. 32% (n = 85) of the respondents' fathers were unemployed and 37% (n = 120) of respondents' mother were unemployed. Several studies indicate that household or parents income is a key influencer to a child's career choice (Borrego et al., 2018; Hines et al., 2019; Othman & Mohamad, 2019). Therefore, a high number of unemployed parents (mother and father) will impact a student's career.

Table 5-8: Frequency Distribution - Father and Mother Occupation

| Job Category | Father | | Mother | |
|---|---|---|---|---|
| | n | % | n | % |
| Professional | 14 | 5% | 7 | 2% |
| Entrepreneur | 27 | 10% | 18 | 6% |
| White Collar | 62 | 24% | 77 | 24% |
| Pink Collar | 6 | 2% | 29 | 9% |
| Blue Collar | 64 | 24% | 64 | 20% |
| Unemployed | 85 | 32% | 120 | 37% |
| Pensioner | 4 | 2% | 11 | 3% |
| Total | 262 | 100% | 326 | 100% |

Additionally, Figure 5-7 shows the results in a word cloud, indicating that most of the respondent's fathers were unemployed. Respondents that indicated N/A or None, the researcher assumed that the father was not involved in the respondent's life.

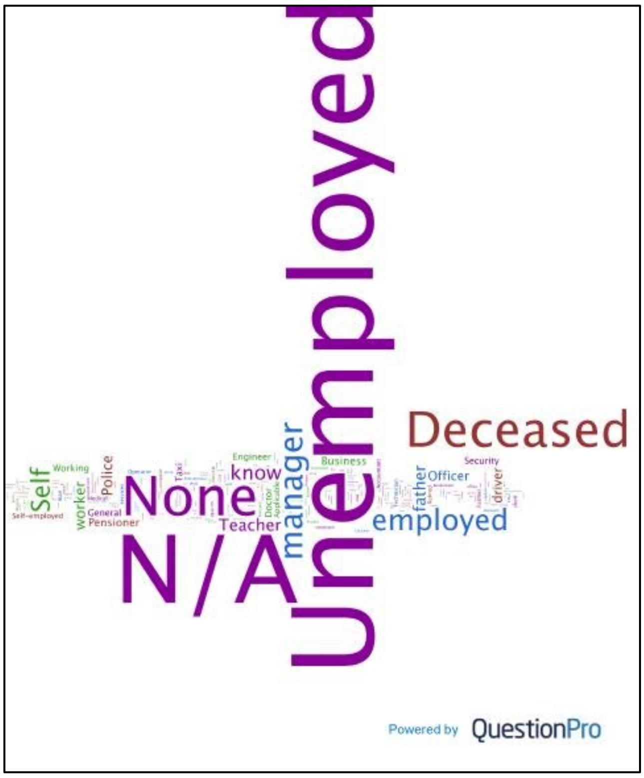


Figure 5-7: Fathers occupation word cloud

The results in Figure 5-8, show some of the key terms used to describe the respondents' mother's occupation, such as unemployed, none, and n/a of which the researcher assumes means no employment. Additionally, occupations categorised as Pink Collar including teachers and nurses were slightly dominant as occupations.

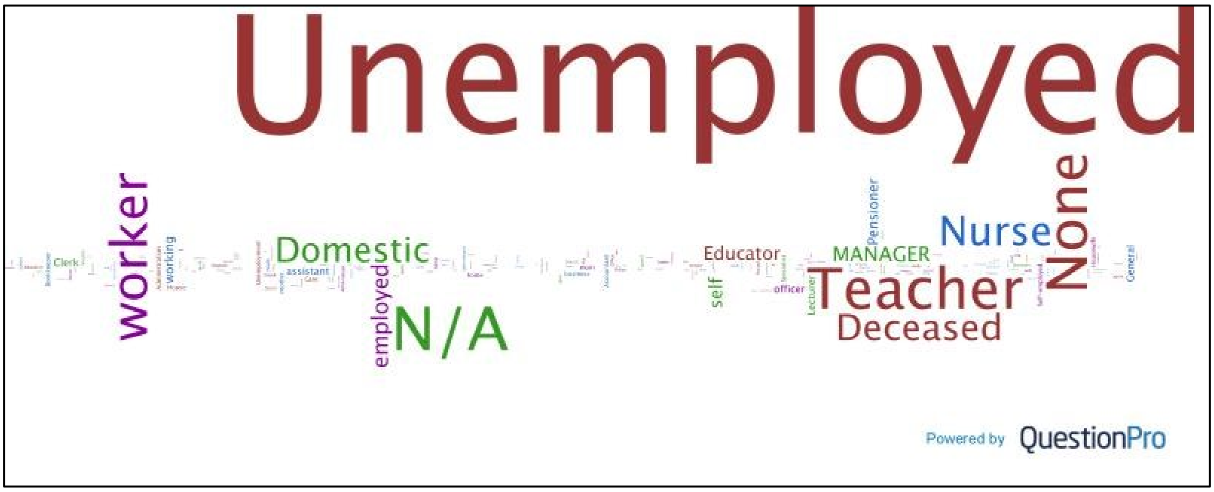


Figure 5-8: Mothers occupation word cloud

### 5.3.7 Father's and Mother's highest qualification

Respondents were requested to indicate the highest qualification of their parents. Most respondents at 35% (n=88) for their father and 34% (n=116) for their mother, had less than a matric certificate (Table 5-9).

Table 5-9: Frequency distribution – Father and Mother Highest Qualification

| Highest Qualification | Father | | Mother | |
|---|---|---|---|---|
| | n | % | n | % |
| Less than Matric | 88 | 35% | 116 | 34% |
| Matric | 68 | 27% | 94 | 27% |
| Higher Certificate | 5 | 2% | 6 | 2% |
| Diploma/Advanced Certificate | 34 | 14% | 51 | 15% |
| Bachelor's Degree/Advance Diploma | 27 | 11% | 45 | 13% |
| Honours Degree/Postgraduate Diploma | 17 | 7% | 21 | 6% |
| Master's Degree | 11 | 4% | 5 | 1% |
| Doctoral Degree | 1 | 0% | 6 | 2% |
| Total | 251 | 100% | 344 | 100% |

Furthermore, Table 5-9 shows that both mothers and fathers at 27% (n = 94; n = 68), respectively have a matric certificate as the highest qualification.

### 5.3.8 Program registered for

The respondents had to indicate the program they were registered for (Table 5-10). The results showed that the respondents were spread evenly across different programs, with the highest program receiving 19% (n = 77) as the Other category, followed by Diploma in Support Services at 16% (n = 65). The BSc and NDip IT (Software Development and NHCert (IT)) all received 11% at (n = 46; n = 46; n = 43) respectively.

Table 5-10: Frequency Distribution: Program registered for

| Program Register for | | |
| --- | --- | --- |
| **Qualification** | **n** | **%** |
| Dip (Information Tech: Support Services) | 65 | 16.0% |
| BSc | 46 | 11.4% |
| Dip (Information Tech: Software Development) | 46 | 11.4% |
| HCert (IT) (User Support Services) | 43 | 10.6% |
| B.Com Accounting Sciences | 31 | 7.7% |
| Dip (Information Tech: Comm Networks) | 27 | 6.7% |
| BIT | 26 | 6.4% |
| B.Com General | 24 | 5.9% |
| B.Com CS & IS | 20 | 4.9% |
| Other | 77 | 19.0% |
| Total | 405 | 100% |

### 5.3.9 IT vs Non-IT Group

The respondents were categorised and divided into two groups, into IT and Non-IT student groups. Table 5-11 showed IT students at 67% (n = 273) and Non-IT students at 33% (n = 132).

Table 5-11: Frequency Distribution – IT and Non-IT Group

| Group | n | % |
| --- | --- | --- |
| IT Group | 273 | 67% |
| Non-IT Group | 132 | 33% |
| Total | 405 | 100% |

### 5.3.10 Background Information

The respondents were required to indicate whether they had IT and other professionals and role models in their families (Table 5-12).

Table 5-12: Frequency Distributions: Background Information (n = 405)

| Questionnaire Item Question | Yes | | No | |
|---|---|---|---|---|
| | n | % | n | % |
| There are professionals (e.g. doctors, accountants, lawyers) in my family | 162 | 40% | 243 | 60% |
| There are IT professionals in my family | 65 | 16% | 340 | 84% |
| I have family working in the IT industry | 71 | 18% | 334 | 82% |
| I have friends working in the IT industry | 120 | 30% | 285 | 70% |
| I have IT role models | 173 | 43% | 232 | 57% |
| I have role models for my chosen career | 226 | 56% | 179 | 44% |

The results as depicted in Table 5-12 showed that 56% (n = 226) of the respondents indicated that they had role models in their chosen career. While 43% (n = 173) indicated having IT role models. However, 84% (n = 340) and 82% (n = 334) indicated not having IT professionals in their family and not having family working in the IT industry respectively.

### 5.3.11 Career Choice

The career choice question was an open-ended question in which respondents had to indicate the career they want to pursue, after completing their studies. The responses were coded as indicated in Table 5-6. As shown in Table 5-13, 48% (n = 194) indicated jobs in the two IT categories while 23% (n = 92) indicated professional jobs, namely, Charted Accountant, Doctors and Lawyers.

Table 5-13: Frequency Distribution – Career Choice

| Job title | n | % |
|---|---|---|
| Charted Accountant, Accountant, Auditor, Lawyer, Forensic Auditor, Economist, Doctor, Investment Specialist, Psychologist, Pilot, Quantity Surveyor, Bio-kinetics | 92 | 23% |
| Manager, Nurse, Lecturer, Teacher, Chief Operations Officer, Assessor, Human Resources, Politics, tour guide, PA, Receptionist, Bookkeeper, Intern | 35 | 9% |
| Aerospace Engineer, Pharmacist, Chemist, Scientist, Architecture, | 33 | 8% |
| Software Developer, Programmer, Game Designer, Graphic Designer, UX/UI Designer | 110 | 27% |
| Business Intelligence, Business Analyst, Software Engineer, IT Manager, IT Specialist, System Analyst, Machine Learning | 84 | 21% |
| Entrepreneur, TV personality, TV Production, Arts Director | 29 | 7% |
| Unknown, Unsure, Anything available, blanks (empty records) | 22 | 5% |
| Total | 405 | 100% |

### 5.3.12 Job Title

Respondents were asked to indicate, what do they think their first job title would be. Thirty-three percent (n = 133) responses indicated IT jobs titles, such as Software Developer, Programmer, etc. as their first job titles. However, twenty-seven percent (n = 111) of respondents did not know what their first job title will be (Table 5-14). Nineteen percent (n = 75), indicated their first job title would be jobs such as Teachers, Interns, Supervisors, etc.

Table 5-14: Frequency Distribution – Job Title

| Job Title | n | % |
|---|---|---|
| Accountant – Senior/Junior, Assistant Psychologist, Lawyer, Surveyor, Environmentalist | 57 | 14% |
| Teacher, Intern, Supervisor, Bookkeep, Political analyst, Graduate support, work | 75 | 19% |
| Microbiologist, Chemist/Pharmacist, | 12 | 3% |
| Software developer, programmer, game designer, graphic designer, UX/UI designer, Big Data analyst | 133 | 33% |
| Entrepreneur, TV producer/Director | 17 | 4% |
| Unknown, unsure, anything available, blanks (empty records) | 111 | 27% |
| Total | 405 | 100% |

## 5.4 Frequency Distribution of each Factor

In this section, the responses received for each item relating to each of the factors are provided. The questionnaire had included items for each factor, using dichotomous items, three-point and five-point Likert scale. For reporting purposes, the responses for: “Strongly Disagree” and “Disagree” were combined to be “Disagree”. “Agree” and “Strongly Agree” were also combined as “Agree”. Similarly, the responses for: “Slightly Confident” and “Fairly Confident” were combined to be “Low Confident”. Additionally, “Quiet Confident” and “Extremely Confident” were combined as “High Confident”.

The following sub-sections will describe the responses to each of the statements included for each factor, identified and included in the conceptual model. The frequency distribution analysis is conducted on the seven factors: Culture, Career Influencers, Learning Experiences, Personal-Attributes, Self-Confidence, Perceptions about the IT industry, Career Awareness and Perceptions about the Chosen Career.

### 5.4.1 Culture

The first section of the questionnaire was the biographical information, followed by the second section Culture, Culture focuses on understanding the influence of culture on a chosen career. Table 5-15 indicates the frequency distributions for each of the questionnaire statements on culture.

Table 5-15: Frequency Distribution – Culture (n = 405)

| Statement | Disagree | | Neutral | | Agree | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| In my culture, people have a clear understanding of professional careers, such as a chartered accountant | 67 | 17% | 134 | 33% | 204 | 50% |
| In my culture, people have a clear understanding of IT careers | 122 | 30% | 145 | 36% | 138 | 34% |
| In my culture, a woman is expected to have a family and children | 116 | 29% | 107 | 26% | 182 | 45% |
| In my culture, having a large family is important | 163 | 40% | 147 | 36% | 95 | 24% |
| In my culture, IT is seen as a career for men and women | 52 | 13% | 103 | 25% | 250 | 62% |
| In my culture, it is important to have a qualification | 37 | 9% | 78 | 19% | 290 | 72% |
| In my culture, it is important that women have a formal qualification | 52 | 13% | 142 | 35% | 211 | 52% |
| In my culture, people encourage children to study towards professional careers, such as a doctor or a chartered accountant | 32 | 8% | 59 | 15% | 314 | 77% |
| In my culture, women are expected to have a full-time job | 67 | 17% | 184 | 45% | 154 | 38% |
| People in my culture are religious | 20 | 5% | 117 | 29% | 268 | 66% |

Seventy-eight percent (n = 314) of the respondents indicated that in their culture, people are encouraged to study towards professional careers, such as doctors or chartered accountants. Seventy-two percent (n = 290) of the respondents indicated that it is important to obtain a qualification in their culture. Sixty-two percent (n = 250) of the respondents indicated that IT is a career for both men and women. A low percentage of 34% (n = 138) agreed that many in their culture have a clear understanding of IT careers. Overall, for the rest of the items, the majority of the respondents agreed with the statements.

### 5.4.2 Career Influencers

The second factor using a 3-point Likert scale investigated the career influencers and to what extent they influenced the respondent's chosen career (Table 5-16).

Table 5-16: Frequency Distributions – Career Choice Influencers (n = 405)

| Influencers | Not at all | | A little | | A lot | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Family | 133 | 33% | 147 | 36% | 125 | 31% |
| Friends | 190 | 47% | 142 | 35% | 73 | 18% |
| Teachers | 162 | 40% | 138 | 34% | 105 | 26% |
| Career guidance advisors/teachers | 152 | 38% | 136 | 34% | 117 | 29% |
| Role models | 154 | 38% | 91 | 22% | 160 | 40% |
| My religious circle | 286 | 71% | 84 | 21% | 35 | 9% |
| The Internet | 58 | 14% | 102 | 25% | 245 | 60% |
| Social media | 136 | 34% | 121 | 30% | 148 | 37% |

Seventy-one percent (n = 286) indicated that religious circles did not have an influence on their career choice. While 60% (n= 245) of the respondents indicated that the use of the Internet had a major or a lot of influence on their career decision. However, Role Models were evenly divided between having a lot of influence 40% (n = 160) and not influenced at all indicated 38% (n = 154) respectively. Similarly, 34% (n = 136) of the respondents indicated they have not been influenced by Social Media, while 37% (n = 148) indicated a lot of influence from Social media.

### 5.4.3 Learning Experiences

The third factor of the questionnaire investigated the learning experiences of students before enrolling for the current studies, to see if they influenced the respondent’s chosen career. Table 5-17 shows the frequency distributions for each statement on learning experiences.

The responses were widespread for items under learning experiences. Seventy-seven percent (n = 310) of the responses indicated that they did not start computer programming whilst at school while 16% (n = 65) started programming at school. Seventy-six percent (n = 309) of the respondents did not do programming on their mobile phones while growing up, however, 13% (n = 52) did some programming on mobile phones. Fifty-two percent (n = 211) agreed that they had an interest in IT during their school years and 48% (n = 193) found IT enjoyable whilst growing up. Half the respondents indicated to have had computers in their secondary school and 45% (n = 181) of respondents indicated to have had a computer at home while growing up.

Table 5-17: Frequency Distributions – Learning Experiences (n = 405)

| Statement | Disagree | | Neutral | | Agree | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| I had access to a computer in my primary school(s) | 196 | 48% | 30 | 7% | 179 | 44% |
| I had access to a computer in my secondary school(s) | 163 | 40% | 40 | 10% | 202 | 50% |
| I used a computer at home when I was growing up | 183 | 45% | 41 | 10% | 181 | 45% |
| I found IT to be enjoyable whilst growing up | 117 | 29% | 95 | 23% | 193 | 48% |
| I received adequate IT training at school, which prepared me for university | 273 | 67% | 40 | 10% | 92 | 23% |
| I was involved in computer projects at school | 266 | 66% | 36 | 9% | 103 | 25% |
| I had an interest in IT during my school years | 137 | 34% | 57 | 14% | 211 | 52% |
| I started computer programming whilst at school | 310 | 77% | 30 | 7% | 65 | 16% |
| I used computers when I was at school | 157 | 39% | 52 | 13% | 196 | 48% |
| I did some programming on my mobile phone (e.g. Tanks or Boats) whilst growing up | 309 | 76% | 44 | 11% | 52 | 13% |

### 5.4.4 Personal-Attributes

The fourth factor measured the respondent's Personal-Attributes, impacting their chosen career. Table 5-18 depicts the frequency distribution results.

Table 5-18: Frequency Distributions – Personal Attributes (n = 405)

| Questionnaire Statement | Disagree | | Neutral | | Agree | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| I expect to do well in my subjects at university | 8 | 2% | 20 | 5% | 377 | 93% |
| I am confident working with computers | 20 | 5% | 97 | 24% | 288 | 71% |
| I take responsibility for my learning | 4 | 1% | 14 | 3% | 387 | 96% |
| I do my work as well as most other people | 18 | 4% | 58 | 14% | 329 | 81% |
| I am a good problem-solver | 10 | 2% | 88 | 22% | 307 | 76% |
| It is easy for me to achieve my goals | 44 | 11% | 164 | 40% | 197 | 49% |
| I work well under pressure | 65 | 16% | 122 | 30% | 218 | 54% |
| I am a confident person | 32 | 8% | 108 | 27% | 265 | 65% |
| I feel I have a number of good qualities | 4 | 1% | 74 | 18% | 327 | 81% |
| On the whole, I am satisfied with myself | 24 | 6% | 69 | 17% | 312 | 77% |

Overall, most respondents agreed with the statements, however, 96% (n = 387) of the respondents highlighted that they take responsibility for their learning. Followed by 93% (n = 377) expecting to do well with their subjects at university. Almost half the respondents at 49% (n = 197) stated it is easy for them to achieve their goals.

### 5.4.5 Self-Confidence

The fifth factor focused on self-confidence, whether self-confidence could influence the student's chosen career. Table 5-19 depicts the frequency distribution results of each question in the factor.

Table 5-19: Frequency Distribution – Self-Confidence

| Questions | No Confidence | | Low Confidence | | High Confidence | |
|---|---|---|---|---|---|---|
| | n | n | n | % | n | % |
| How confident are you to complete all the work that is assigned to you in your modules? | 6 | 1% | 133 | 33% | 266 | 66% |
| How confident are you to understand complicated ideas when they are presented in your modules? | 8 | 2% | 222 | 55% | 175 | 43% |
| How confident are you to learn all of the material presented in your modules? | 5 | 1% | 136 | 34% | 264 | 65% |
| How confident are you to do the difficult work that is assigned in your modules? | 6 | 1% | 164 | 40% | 235 | 58% |
| How confident are you to remember what you have learned in your current modules? | 4 | 1% | 145 | 36% | 256 | 63% |
| How confident are you to complete your diploma/degree programme in the required minimum time? | 7 | 2% | 71 | 18% | 327 | 81% |
| How confident are you to pass all your modules? | 3 | 1% | 77 | 19% | 325 | 80% |

Overall, the responses to the questions showed reasonably High Confidence. Fifty-five percent (n = 222) of respondents indicated having low confidence in understanding complicated ideas when they are presented in their modules. Eight-one percent (n = 327) of the respondents had high confidence that they would complete their programmes in the minimum required time and 80% (n = 325) respondents indicated they will pass all their modules respectively. It is important to note that this factor has been renamed in Section 0 to Academic Confidence.

### 5.4.6 Perceptions about the IT industry

The sixth factor investigated the student's perceptions about the IT industry, to determine whether the perception had any influence on their career decision.

Table 5-20 depicts the distribution frequencies of the perceptions regarding the IT industry.

Table 5-20: Frequency Distribution - Perceptions about the IT industry (n = 405)

| Statement | Disagree | | Neutral | | Agree | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| An IT career has a good image/status | 10 | 3% | 74 | 18% | 321 | 79% |
| An IT career provides a flexible work schedule between work and social life | 24 | 6% | 115 | 28% | 266 | 66% |
| An IT career ensures long term employment | 19 | 5% | 98 | 24% | 288 | 71% |
| IT is regarded as a male profession | 214 | 53% | 93 | 23% | 98 | 24% |
| People working in the IT industry earn good salaries | 7 | 2% | 117 | 29% | 281 | 69% |
| A person with an IT qualification will find work easily | 39 | 10% | 161 | 40% | 205 | 50% |
| A person with an IT qualification can work internationally | 3 | 1% | 50 | 12% | 352 | 87% |
| There is good job security in the IT industry | 15 | 4% | 105 | 26% | 285 | 70% |
| People with an IT qualification are 'geeks' | 161 | 40% | 147 | 36% | 97 | 24% |
| There are many jobs available in the IT industry | 7 | 2% | 118 | 29% | 280 | 69% |
| The IT industry provides many job opportunities for women | 44 | 11% | 180 | 44% | 181 | 45% |
| There are good prospects for developing new skills in the IT industry | 2 | 1% | 60 | 15% | 343 | 84% |
| The IT industry provides the opportunity to become an IT entrepreneur | 7 | 2% | 77 | 19% | 321 | 79% |

Eighty-seven percent (n = 352) of the respondents agreed that a person with an IT qualification can work internationally. Additionally, 85% (n = 343) of the respondents believe that there are good prospects for developing new skills in the IT industry. Salaries were important, as 69% (n = 281) of the respondents agreed that people working in the IT industry earn good salaries. Overall, the respondents largely agreed with the statements, however, 53% (n = 214) disagreed with the statement that IT is regarded as a male profession.

### 5.4.7 Career Awareness

The seventh factor examined career awareness and whether it influences the respondents chosen career. The frequency distribution of career distribution statements is shown in Table 5-21.

Seventy-two percent (n = 290) of the respondents indicated that they knew the job they wanted in the future. Similarly, Seventy-one percent (n = 289) of the students did have an understanding of the career paths available for their chosen qualification respectively. Forty-seven percent (n = 110) of the respondents did not understand the differences between CS, IS, and IT careers. Similarly, Forty-seven percent (n = 187) of the respondents did not have an understanding of Information System careers before enrolling at university.

Table 5-21: Frequency Distribution – Career Awareness (n = 405)

| Statement | Disagree | | Neutral | | Agree | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| I do have an understanding of the career paths available for students with my qualifications | 25 | 7% | 91 | 22% | 289 | 71% |
| I did have an understanding of Information Technology (IT) careers before I enrolled at university | 105 | 26% | 99 | 24% | 201 | 50% |
| I had an understanding of Computer Science (CS) careers before I enrolled at university | 155 | 38% | 116 | 29% | 134 | 33% |
| I did have an understanding of Information Systems (IS) careers before I enrolled at university | 187 | 46% | 114 | 28% | 104 | 26% |
| I understand the differences between IT, CS, and IS careers | 190 | 47% | 110 | 27% | 105 | 26% |
| I know what job I want to do in the future | 43 | 10% | 72 | 18% | 290 | 72% |
| I know which company I want to work for after I graduate | 154 | 38% | 147 | 36% | 104 | 26% |
| I can explain the main job functions for my future job | 71 | 18% | 127 | 31% | 207 | 51% |

### 5.4.8 Perceptions about the Chosen Career

The final factor included statements related to the dependent factor perceptions about the student's chosen career, and Table 5-22 shows the frequency distribution for each item relating to the perceptions about their chosen career.

Overall, the respondents agreed with the statements regarding the perceptions of their chosen careers. Ninety-seven percent (n = 391) of the respondents agreed that they will learn new skills in their chosen career, while Ninety-one percent (n = 361) acknowledged they will have to keep ahead of the change and technologies in their chosen field. Seventy-four percent (n = 299) of respondents agreed they have good prospects for a better than average salary in their chosen career.

Table 5-22: Frequency Distribution: Perceptions about Chosen Career (n = 405)

| Statement | Disagree | | Neutral | | Agree | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| I am happy with my career choice | 17 | 4% | 68 | 17% | 320 | 79% |
| My family respects my career choice | 28 | 7% | 53 | 13% | 324 | 80% |
| My chosen career will be rewarding | 4 | 1% | 54 | 13% | 347 | 86% |
| I would recommend my career choice to others | 10 | 2% | 66 | 16% | 329 | 82% |
| I have to keep ahead of change and new technologies in my chosen career | 5 | 1% | 31 | 8% | 369 | 91% |
| I will learn new skills in my chosen career | 0 | 0% | 14 | 3% | 391 | 97% |
| There are many jobs available in the career I have chosen | 14 | 3% | 84 | 21% | 307 | 76% |
| There are good prospects for a better than average starting salary in the career I have chosen | 5 | 1% | 101 | 25% | 299 | 74% |
| I will have opportunities to work in different kinds of business functions in my chosen career | 12 | 3% | 68 | 17% | 325 | 80% |
| I can become an entrepreneur with my career choice | 14 | 3% | 73 | 18% | 318 | 79% |

## 5.5 Item Analysis

Item and Exploratory Factor Analysis are two statistical methods used to analyse data obtained in a study. Item analysis is used to identify statistical relevant items, while factor analysis is used to determine items that fit together in measuring the same factor.

### 5.5.1 Exploratory Factor Analysis

Exploratory Factor Analysis (EFA) is a multivariate statistical approach that verifies the constructs influencing a set of responses. There are two main objectives of the EFA, namely to determine the number of independent factors influencing a dependent factor and to measure the strength of the relationship between each factor. Eigenvalues and the Scree Plot are two techniques used to determine which items to retain for each factor. The number of factors to extract was determined using two guidelines, namely eigenvalues greater than 1 and the scree plot. The factor loading greater or equal to 0.003 was deemed significant at the $\alpha=0.05$ level for the sample size n = 405. In the following sub-sections, the EFA for each factor will be presented using eigenvalues and scree plots.

#### 5.5.1.1 Factor Analysis – IT Role Models

The EFA for the factor – IT Role Models two-factors, as indicated by the Eigenvalues (Table 5-23) and three-factors, as indicated by the Scree plot (Figure 5-9).

Table 5-23: EFA Eigenvalues – IT Role Models

(n = 405; Minimum significant loading = .300)

| Factor | Eigenvalue | % Total Variance |
|---|---|---|
| 1 | 1.909 | 47.7 |
| 2 | 1.080 | 27.0 |
| 3 | 0.783 | 19.6 |
| 4 | 0.229 | 5.7 |

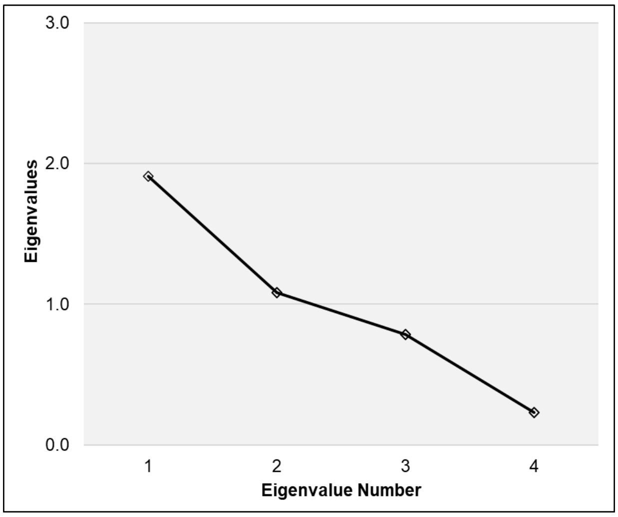


Figure 5-9: Scree Plot-IT Role Models (n = 405)

Internal consistency was not required for this factor as the NMU statistical consultant indicated that the relatively poor total variance of 47% can be ignored (Table 5-23). This factor is not a reflective latent variable, i.e. responses to these items reflect an underlying factor. Therefore the final loading for a one-factor model is indicated in Table 5-24, indicating the three items that loaded. The three items have above the minimum significant loading = .300. Item: *I have an IT role model* not meeting the required minimum significant loading of .300. However, as stated before, the item can be ignored due to the factor not being a reflective latent variable.

Table 5-24: EFA Loadings (1 Factor Model) – IT Role Models

(n = 405; Minimum significant loading = .300)

| Item | Factor 1 |
|---|---|
| There are IT professionals in my family | **.899** |
| I have family working in the IT industry | **.896** |
| I have friends working in the IT industry | **.480** |
| ~~I have IT role models~~ | ~~.260~~ |
| Total % of Variance Explained = 47.7% | |

#### 5.5.1.2 Factor Analysis – Culture

The initial factor loadings of the Eigenvalues resulted in a three-factors loading model, explaining 57.8% of the total variance. Table 5-25 shows the results.

Table 5-25: 1st Loadings EFA Eigenvalues – Culture (n = 405)

| Factor | Eigenvalue | % Total Variance |
|---|---|---|
| 1 | 2.704 | 27.0 |
| 2 | 1.913 | 19.1 |
| 3 | 1.173 | 11.7 |
| 4 | 0.840 | 8.4 |
| 5 | 0.798 | 8.0 |
| 6 | 0.692 | 6.9 |
| 7 | 0.549 | 5.5 |
| 8 | 0.476 | 4.8 |
| 9 | 0.445 | 4.5 |
| 10 | 0.408 | 4.1 |

Item: *In my culture, having a large family is important* did not meet the minimum significance of .300 and was removed and the EFA re-run (Table 5-26).

Table 5-26: EFA 1st Loadings (1 Factor Model) - Culture
(n = 405; Minimum signifcant loading = .300)

| Item | Factor 1 |
|---|---|
| In my culture, it is important that women have a formal qualification | **.759** |
| In my culture, it is important to have a qualification | **.704** |
| In my culture, women are expected to have a full-time job | **.702** |
| People in my culture are religious | **.574** |
| In my culture, people encourage children to study towards professional careers, such as a doctor or a chartered accountant | **.526** |
| In my culture, IT is seen as a career for men and women | **.445** |
| In my culture, people have a clear understanding of professional careers, such as a chartered accountant | **.362** |
| In my culture, people have a clear understanding of IT careers | **.307** |
| In my culture, a woman is expected to have a family and children | **.307** |
| ~~In my culture, having a large family is important~~ | ~~.126~~ |
| Total % of Variance Explained = 27.0% | |

The EFA loadings were run a 2nd time, the result was a two-factor model, which explained 58.7% of the total variance (Table 5-27), while the Scree Plot also showed two factors (Figure 5-10).

Table 5-27: 2nd loadings Eigenvalues – Culture

(n = 405; Minimum significant loading = .300)

| Factor | Eigenvalue | % Total Variance |
|---|---|---|
| 1 | 2.696 | 30.0 |
| 2 | 1.687 | 18.7 |
| 3 | 0.987 | 11.0 |
| 4 | 0.825 | 9.2 |
| 5 | 0.720 | 8.0 |
| 6 | 0.692 | 7.7 |
| 7 | 0.529 | 5.9 |
| 8 | 0.456 | 5.1 |
| 9 | 0.409 | 4.5 |

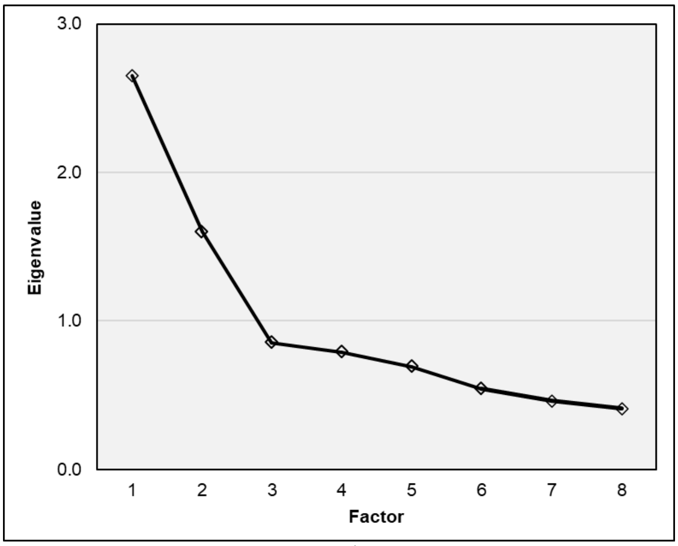


Figure 5-10: 1st loading Scree Plot – Culture (n = 405)

The item: *In my culture, a woman is expected to have a family and children* did not meet the minimum significance of .300 was omitted (Table 5-28) and the model was re-evaluated.

Table 5-28: EFA 2nd Loadings (1 Factor Model) – Culture

(n = 405; Minimum significant loading =.300)

| Item | Factor 1 |
|---|---|
| In my culture, it is important that women have a formal qualification | **.762** |
| In my culture, it is important to have a qualification | **.703** |
| In my culture, women are expected to have a full-time job | **.698** |
| People in my culture are religious | **.563** |
| In my culture, people encourage children to study towards professional careers, such as a doctor or a chartered accountant | **.517** |
| In my culture, IT is seen as a career for men and women | **.463** |
| In my culture, people have a clear understanding of professional careers, such as a chartered accountant | **.388** |
| In my culture, people have a clear understanding of IT careers | **.332** |
| ~~In my culture, a woman is expected to have a family and children~~ | ~~.267~~ |
| Total % of Variance Explained = 30.0% | |

The EFA re-run results indicated two factors by the Eigenvalues, as well as the Scree Plot (Figure 5-11). A one-factor model that explained 33.1% of the total variance was compared (Table 5-30) with the two-factor model (Table 5-31).

Table 5-29: 2nd EFA Eigenvalues – Culture

(n = 405; Minimum significant loading = .300)

| Factor | Eigenvalue | % Total Variance |
|---|---|---|
| 1 | 2.651 | 33.1 |
| 2 | 1.601 | 20.0 |
| 3 | 0.853 | 10.7 |
| 4 | 0.790 | 9.9 |
| 5 | 0.692 | 8.7 |
| 6 | 0.542 | 6.8 |
| 7 | 0.461 | 5.8 |
| 8 | 0.409 | 5.1 |

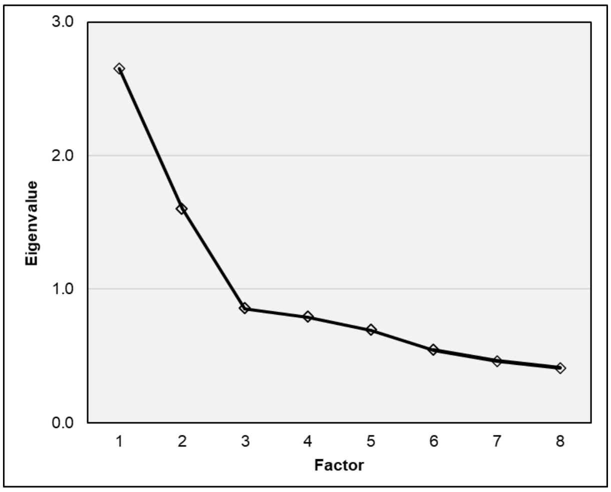


Figure 5-11: Scree Plot – Culture (n=405)

The two factor model (Table 5-29) explained 53.1% of the total variance, while the one factor model explained 33.1% of the total variance (Table 5-30).

Table 5-30: EFA 3rd loadings – Culture

(n = 405; Minimum significant loading = .300)

| Item | Factor 1 |
|---|---|
| C_07 In my culture, it is important that women have a formal qualification | .769 |
| C_06 In my culture, it is important to have a qualification | .704 |
| C_09 In my culture, women are expected to have a full-time job | .693 |
| C_10 People in my culture are religious | .533 |
| C_08 In my culture, people encourage children to study towards professional careers, such as a doctor or a chartered accountant | .499 |
| C_05 In my culture, IT is seen as a career for men and women | .487 |
| C_01 In my culture, people have a clear understanding of professional careers, such as a chartered accountant | .423 |
| C_02 In my culture, people have a clear understanding of IT careers | .367 |
| Total % of Variance Explained = 33.1% | |

Therefore, the two factor model was considered an optimal solution with 53.2% of the total variance explained, which splits the culture factor into two factors (Table 5-29).

Factor 1 was renamed *Culture Expectations* with 5 items and Factor 2 was renamed *Culture Career Understanding* with three items (Table 5-31).

Table 5-31: EFA Final Loadings (2 Factor Model) – Culture

(n = 405; Minimum significant loading .300)

| Item | Factor 1 | Factor 2 |
|---|---|---|
| In my culture, it is important to have a qualification | **.751** | .066 |
| In my culture, it is important that women have a formal qualification | **.737** | .244 |
| In my culture, women are expected to have a full-time job | **.731** | .083 |
| People in my culture are religious | **.638** | -.091 |
| In my culture, people encourage children to study towards professional careers, such as a doctor or a chartered accountant | **.577** | -.045 |
| In my culture, people have a clear understanding of IT careers | -.007 | **.850** |
| In my culture, people have a clear understanding of professional careers, such as a chartered accountant | .081 | **.798** |
| In my culture, IT is seen as a career for men and women | .248 | **.602** |
| Explained variance | 2.45 | 1.80 |
| % of Total variance | 30.6% | 22.5% |
| Total % of Variance Explained = 53.2% | | |

### 5.5.1.3 Factor Analysis – Career Choice Influencers

The EFA evaluation resulted in a two factor model, as shown in Table 5-32, with a total of 57.2% total variance explained. The Scree Plot also indicated two factors, corresponding with the Eigenvalues (Figure 5-12).

Table 5-32: EFA Eigenvalues – Career Choice Influencers

(n = 405; Minimum significant loading = .300)

| Factor | Eigenvalue | % Total Variance |
|---|---|---|
| 1 | 3.177 | 39.7 |
| 2 | 1.397 | 17.5 |
| 3 | 0.833 | 10.4 |
| 4 | 0.734 | 9.2 |
| 5 | 0.618 | 7.7 |
| 6 | 0.507 | 6.3 |
| 7 | 0.408 | 5.1 |
| 8 | 0.325 | 4.1 |

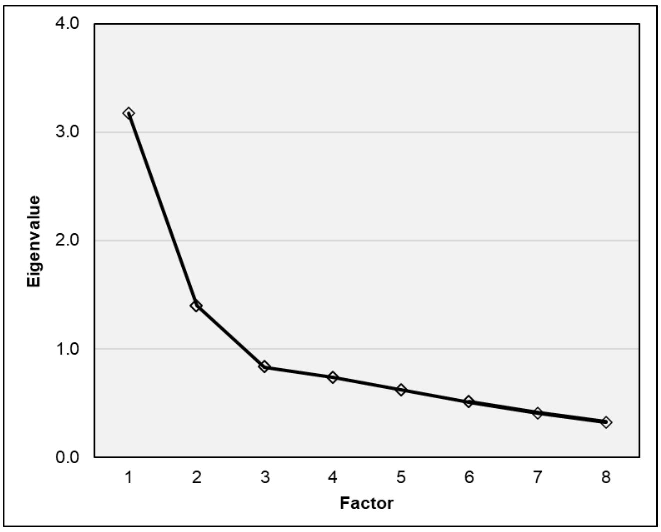


Figure 5-12: Scree Plot – Career Choice Influencers (n = 405)

The two factor loadings (Table 5-33) were compared with a one factor model (Table 5-34). The two factor model explained 57.2% total variance (Table 5-33) compared to the one factor model, which explained 39.7% total variance.

Table 5-33: EFA Loadings (1 Factor Model) – Career Choice Influencers
(n = 405; Minimum significant loading = .300)

| **Item** | **Factor 1** |
|---|---|
| Teachers | **.737** |
| Career guidance advisors/teachers | **.725** |
| Friends | **.724** |
| My religious circle | **.665** |
| Family | **.600** |
| Role models | **.576** |
| Social media | **.495** |
| The Internet | **.451** |
| Total % of Variance Explained = 39.7% | |

Therefore the two factor model was considered optimal (Table 5-34) and factor one was renamed *Career Choice Influencers – Personal* with 6 items and factor two named *Career Choice Influencers – Media* with 2 items. The item: *Role models* was retained in the factor *Career Choice Influencers – Personal*, as it had a higher factor loading of 0.488 in the factor.

Table 5-34: EFA Loadings (2 Factor Model) – Career Choice Influencers
(n = 405; Minimum significant loading = .300)

| **Items** | **Factor 1** | **Factor 2** |
|---|---|---|
| Teachers | **.777** | .098 |
| Career guidance advisors/teachers | **.738** | .150 |
| Family | **.708** | -.068 |
| My religious circle | **.686** | .120 |
| Friends | **.661** | .297 |
| Role models | **.488** | **.312** |
| The Internet | .056 | **.884** |
| Social media | .116 | **.863** |
| Explained variance | 2.81 | 1.76 |
| % of Total variance | 35.1% | 22.0% |
| Total % of Variance Explained = 57.2% | | |

#### 5.5.1.4 Factor Analysis – Learning Experiences

The first EFA evaluation resulted in a three factor model (Table 5-35), while the Scree Plot showed one factor (Figure 5-13). The EFA loadings had a combined total variance explained of 73.9% (Table 5-35).

Table 5-35: 1st Loading EFA Eigenvalues – Learning Experiences

(n = 405; Minimum significant loading = .300)

| Factor | Eigenvalue | % Total Variance |
|---|---|---|
| 1 | 5.146 | 51.5 |
| 2 | 1.239 | 12.4 |
| 3 | 1.000 | 10.0 |
| 4 | 0.714 | 7.1 |
| 5 | 0.425 | 4.2 |
| 6 | 0.397 | 4.0 |
| 7 | 0.366 | 3.7 |
| 8 | 0.289 | 2.9 |
| 9 | 0.219 | 2.2 |
| 10 | 0.205 | 2.1 |

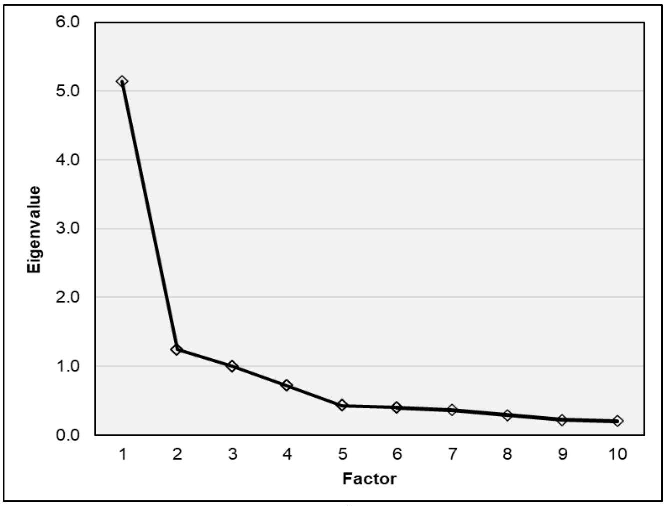

Figure 5-13: 1st Scree Plot – Learning Experiences (n = 405)

The items in a one factor model have a factor loading above the minimum significant requirement loading of .300 (Table 5-36). The item: *I did some programming on my mobile phone (e.g. Tanks or Boats) whilst growing up,* which was removed as it was a relatively weak item and a re-run for the model was performed.

Table 5-36: 1st Loading EFA – Learning Experiences

(n = 405; Minimum significant loading = .300)

| Item | Factor 1 |
|---|---|
| LE_09 I used computers when I was at school | **.856** |
| LE_05 I received adequate IT training at school, which prepared me for university | **.832** |
| LE_06 I was involved in computer projects at school | **.828** |
| LE_02 I had access to a computer in my secondary school(s) | **.807** |
| LE_03 I used a computer at home when I was growing up | **.778** |
| LE_01 I had access to a computer in my primary school(s) | **.722** |
| LE_08 I started computer programming whilst at school | **.717** |
| LE_04 I found IT to be enjoyable whilst growing up | **.633** |
| LE_07 I had an interest in IT during my school years | **.492** |
| LE_10 I did some programming on my mobile phone (e.g. Tanks or Boats) whilst growing up | **.317** |
| Total % of Variance Explained = 51.5% | |

The results of the second EFA evaluation for a one factor model resulted in 56.3% of the total variance explained (Table 5-37). The one factor model had nine items that were above the minimum significant loading of .300.

Table 5-37: 2nd EFA Loading (1 Factor Model) - Learning Experiences
(n = 405; Minimum significant loading = .300)

| Item | Factor 1 |
|---|---|
| I used computers when I was at school | **.863** |
| I received adequate IT training at school, which prepared me for university | **.834** |
| I was involved in computer projects at school | **.827** |
| I had access to a computer in my secondary school(s) | **.817** |
| I used a computer at home when I was growing up | **.782** |
| I had access to a computer in my primary school(s) | **.724** |
| I started computer programming whilst at school | **.706** |
| I found IT to be enjoyable whilst growing up | **.630** |
| I had an interest in IT during my school years | **.488** |
| Total % of Variance Explained = 56.3% | |

The final evaluation of the factor, Learning Experiences indicated one factor (Table 5-38) and the Scree Plot also indicated one factor (Figure 5-14).

Table 5-38: EFA Eigenvalues – Learning Experiences
(n = 405; Minimum significant loading = .300)

| Factor | Eigenvalue | % Total Variance |
|---|---|---|
| 1 | 4.567 | 65.2 |
| 2 | 0.770 | 11.0 |
| 3 | 0.451 | 6.4 |
| 4 | 0.414 | 5.9 |
| 5 | 0.361 | 5.2 |
| 6 | 0.230 | 3.3 |
| 7 | 0.206 | 2.9 |

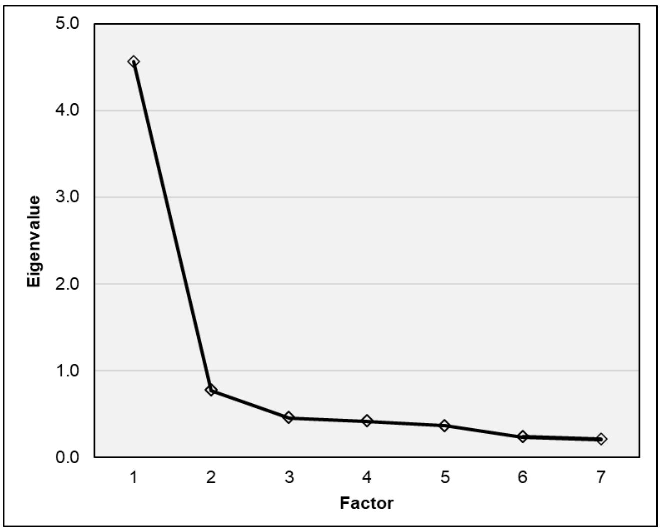

Figure 5-14: Scree Plot – Learning Experiences (n = 405)

Therefore the one factor model was considered optimal and item: *I found IT to be enjoyable whilst growing up* and item: *I had an interest in IT during my school years* were removed to improve internal consistency (Table 5-39).

Table 5-39: EFA Loadings (1 Factor Model) – Learning Experiences

(n = 405; Minimum significant loading = .300)

| Item | Factor 1 |
|---|---|
| I used computers when I was at school | .876 |
| I received adequate IT training at school, which prepared me for university | .853 |
| I had access to a computer in my secondary school(s) | .839 |
| I was involved in computer projects at school | .835 |
| I used a computer at home when I was growing up | .775 |
| I had access to a computer in my primary school(s) | .754 |
| I started computer programming  whilst at school | .707 |
| ~~I found IT to be enjoyable whilst growing up~~ | ~~.630~~ |
| ~~I had an interest in IT during my school years~~ | ~~.488~~ |
| Total % of Variance Explained = 65.2% | |

The one factor loadings resulted in 65.2% of the total variance explained with seven items all above the minimum significant loading of .300 (Table 5-39).

### 5.5.1.5 Factor Analysis – Personal Attributes

The first round of statistical EFA evaluation resulted in two factors as indicated by the Eigenvalues (Table 5-40), while the Scree Plot showed one factor (Figure 5-15). The one factor model explained 37% of the total variance.

Table 5-40: 1st Loading EFA Eigenvalues – Personal Attributes

(n = 405; Minimum Significant Loading = .300)

| Factor | Eigenvalue | % Total Variance |
|---|---|---|
| 1 | 3.696 | 37.0 |
| 2 | 1.401 | 14.0 |
| 3 | 0.930 | 9.3 |
| 4 | 0.719 | 7.2 |
| 5 | 0.662 | 6.6 |
| 6 | 0.635 | 6.3 |
| 7 | 0.590 | 5.9 |
| 8 | 0.505 | 5.0 |
| 9 | 0.463 | 4.6 |
| 10 | 0.399 | 4.0 |

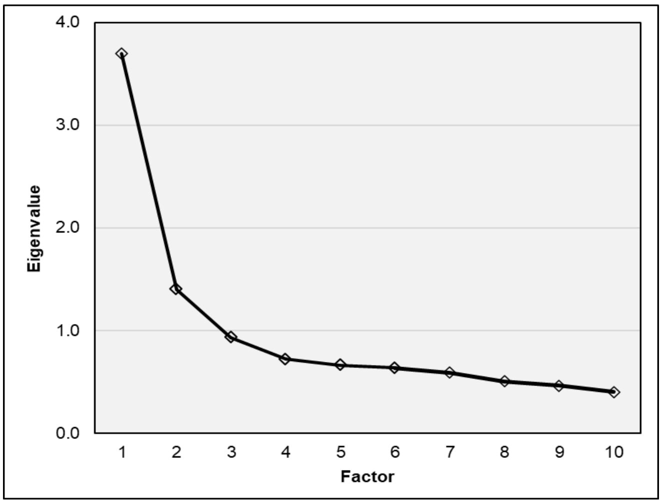


Figure 5-15: 1st Scree Plot – Personal Attributes (n = 405)

The factor loadings for the one factor model showed that all items had minimum significance loadings above .300 (Table 5-41).

Table 5-41: 1st EFA Loadings (1 Factor Model) - Personal Attributes
(n = 405; Minimum significant loading = .300)

| Item | Factor 1 |
|---|---|
| It is easy for me to achieve my goals | **.685** |
| I feel I have a number of good qualities | **.669** |
| I take responsibility for my learning | **.656** |
| I am a good problem-solver | **.639** |
| I am a confident person | **.611** |
| I do my work as well as most other people | **.602** |
| On the whole, I am satisfied with myself | **.592** |
| I expect to do well in my subjects at university | **.559** |
| I work well under pressure | **.540** |
| ~~I am confident working with computers~~ | ~~**.498**~~ |
| Total % of Variance Explained = 37.0% | |

The EFA was re-run on a one factor model and a two factor model. The re-evaluation resulted in a two factor model, which explained 51.0% of the total variance (Table 5-42

Table 5-42: EFA Loadings (2 Factor Model) – Personal Attributes
(n = 405; Minimum significant loading = .300)

| Item | Factor 1 | Factor 2 |
|---|---|---|
| I am a confident person | **.735** | .075 |
| I feel I have a number of good qualities | **.731** | .170 |
| It is easy for me to achieve my goals | **.697** | .235 |
| I work well under pressure | **.635** | .084 |
| On the whole, I am satisfied with myself | **.611** | .194 |
| I am a good problem-solver | **.552** | **.337** |
| I take responsibility for my learning | .218 | **.760** |
| I do my work as well as most other people | .172 | **.732** |
| I am confident working with computers | .043 | **.723** |
| I expect to do well in my subjects at university | .156 | **.684** |
| Explained variance | 2.75 | 2.35 |
| % of Total variance | 27.5% | 23.5% |
| Total % of Variance Explained = 51.0% | | |

The NMU statistician and the researcher found it difficult to name the two factors in the model, as items were too similar across the two factors. Therefore, a decision was taken to use the one factor model as the optimal solution, however, this required improvements of the total variance explained, thus item *I am confident working with computers* was omitted.

After the re-evaluation of the model, the results indicated a two factor model as indicated by the Eigenvalues (Table 5-43).

Table 5-43: EFA Eigenvalues – Personal Attributes
(n = 405; Minimum significant loading = .300 = 405)

| Factor | Eigenvalue | % Total Variance |
|---|---|---|
| 1 | 3.505 | 38.9 |
| 2 | 1.241 | 13.8 |
| 3 | 0.922 | 10.2 |
| 4 | 0.711 | 7.9 |
| 5 | 0.636 | 7.1 |
| 6 | 0.607 | 6.7 |
| 7 | 0.506 | 5.6 |
| 8 | 0.468 | 5.2 |
| 9 | 0.405 | 4.5 |

The one factor model explained 38.9% of the total variance and all nine items met the minimum factor loading of .300 (Table 5-44).

Table 5-44: 3rd Loading EFA Eigenvalues – Personal Attributes
(n = 405; Minimum significant loading = .300)

| Item | Factor 1 |
|---|---|
| It is easy for me to achieve my goals | **.700** |
| I feel I have a number of good qualities | **.695** |
| I am a confident person | **.640** |
| I am a good problem-solver | **.639** |
| I take responsibility for my learning | **.630** |
| On the whole, I am satisfied with myself | **.614** |
| ~~I do my work as well as most other people~~ | ~~**.578**~~ |
| ~~I work well under pressure~~ | ~~**.565**~~ |
| ~~I expect to do well in my subjects at university~~ | ~~**.535**~~ |
| Total % of Variance Explained = 38.9% | |

A further examination was undertaken and the following items: *I do my work as well as most other people*, *I work well under pressure*, and *I expect to do well in my subjects at university* were omitted to improve internal consistency. The results were a One-Factor model indicated by both the Eigenvalues as shown in Table 5-45 and the Scree Plot (Figure 5-16).

Table 5-45: EFA Final Eigenvalues – Personal Attributes

(n = 405; Minimum significant loading = .300)

| Factor | Eigenvalue | % Total Variance |
|---|---|---|
| 1 | 2.768 | 46.1 |
| 2 | 0.854 | 14.2 |
| 3 | 0.791 | 13.2 |
| 4 | 0.627 | 10.5 |
| 5 | 0.490 | 8.2 |
| 6 | 0.470 | 7.8 |

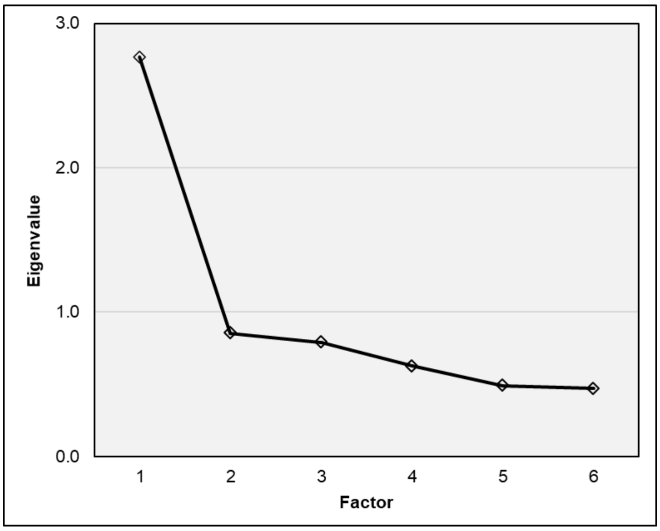


Figure 5-16: Scree Plot – Personal Attributes (n = 405)

The one factor model with six items was considered optimal. The EFA loadings had the total variance explained of 46.1% as shown in Table 5-46. All six items met the minimum significant loading of .300.

Table 5-46: EFA Loadings (1 Factor Model) – Personal Attributes

(n = 405; Minimum significant loading = .300)

| Item | Factor 1 |
|---|---|
| I feel I have a number of good qualities | **.755** |
| It is easy for me to achieve my goals | **.714** |
| I am a confident person | **.706** |
| On the whole, I am satisfied with myself | **.678** |
| I am a good problem-solver | **.654** |
| I take responsibility for my learning | **.550** |
| Total % of Variance Explained = 46.1% | |

### 5.5.1.6 Factor Analysis – Self-Confidence (Academic confidence)

The factor was initially named Self-confidence, as indicated in Figure 4-18, the Hypothesised Conceptual Model. However, the NMU statistician indicated that the items all refer to *Academic Confidence*, hence the factor was renamed *Academic Confidence*. The Eigenvalues Table 5-47 and the Scree Plot (Figure 5-17) both showed one factor. The Eigenvalue of 4.219 explains 60.3% of the total variance.

Table 5-47: EFA Eigenvalues – Self Confidence

(n = 405; Minimum significant loading = .300)

| Factor | Eigenvalue | % Total Variance |
|---|---|---|
| 1 | 4.219 | 60.3 |
| 2 | 0.837 | 12.0 |
| 3 | 0.534 | 7.6 |
| 4 | 0.432 | 6.2 |
| 5 | 0.376 | 5.4 |
| 6 | 0.347 | 5.0 |
| 7 | 0.255 | 3.6 |

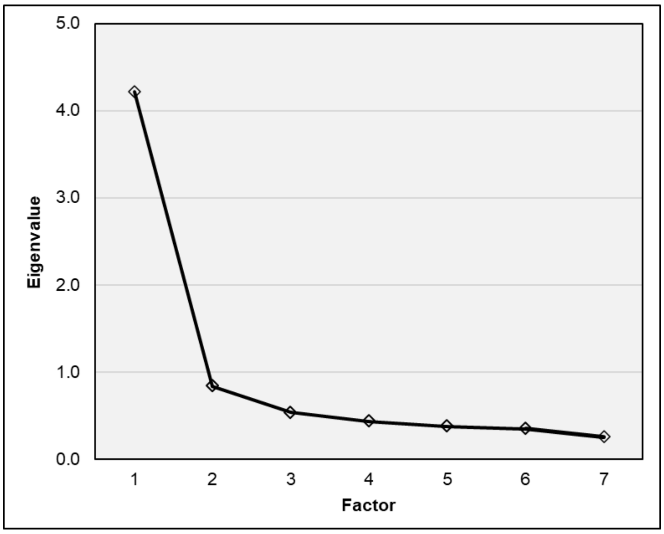


Figure 5-17: Scree Plot - Self-Confidence (n = 405)

Seven items were loaded for the one factor model, as indicated in Table 5-48. The factor loadings were all above minimum significance loading .300 and the total variance explained was 60.3%.

Table 5-48: EFA (1 Factor Model) – Academic Confidence

(n = 405; Minimum significant loading =.300)

| Item | Factor 1 |
|---|---|
| Learn all of the material presented in your modules? | .833 |
| Complete all the work that is assigned to you in your modules? | .813 |
| Do the difficult work that is assigned in your modules? | .797 |
| Understand complicated ideas when they are presented in your modules? | .758 |
| Complete your diploma/degree programme in the required minimum time? | .758 |
| Pass all your modules? | .754 |
| Remember what you have learned in your current modules? | .714 |
| Total % of Variance Explained = 60.3% | |

### 5.5.1.7 Factor Analysis – Perceptions about the IT industry

The Eigenvalues indicated a three factor model as shown in Table 5-49, while the Scree Plot indicated one factor (Figure 5-18).

Table 5-49: 1st Time EFA Eigenvalues – Perceptions about the IT industry (n = 405; Minimum significant loading = .300)

| Factor | Eigenvalue | % Total Variance |
|---|---|---|
| 1 | 4.739 | 36.5 |
| 2 | 1.300 | 10.0 |
| 3 | 1.014 | 7.8 |
| 4 | 0.902 | 6.9 |
| 5 | 0.806 | 6.2 |
| 6 | 0.701 | 5.4 |
| 7 | 0.649 | 5.0 |
| 8 | 0.587 | 4.5 |
| 9 | 0.565 | 4.3 |
| 10 | 0.488 | 3.8 |
| 11 | 0.457 | 3.5 |
| 12 | 0.439 | 3.4 |
| 13 | 0.353 | 2.7 |

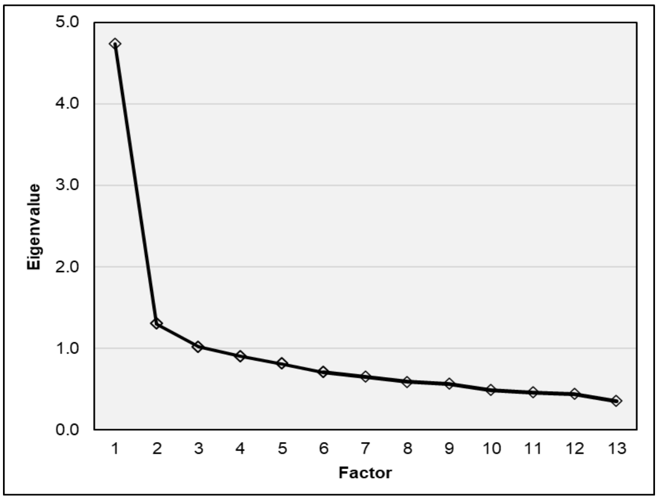


Figure 5-18: 1st Time Scree Plot – Perceptions about the IT industry (n = 405)

The EFA loadings loaded twelve items, however, ten items loaded above the minimum significant loading of .300 with two items below the significant loading value (Table 5-50).

Table 5-50: EFA 1st Loadings (1 Factor Model)- Perceptions about the IT industry (n = 405; Minimum significant loading = .300)

| Item | Factor 1 |
|---|---|
| There is good job security in the IT industry | .738 |
| A person with an IT qualification will find work easily | .719 |
| There are many jobs available in the IT industry | .718 |
| People working in the IT industry earn good salaries | .704 |
| An IT career ensures long term employment | .703 |
| An IT career has a good image/status | .668 |
| There are good prospects for developing new skills in the IT industry | .664 |
| A person with an IT qualification can work internationally | .654 |
| The IT industry provides the opportunity to become an IT entrepreneur | .580 |
| The IT industry provides many job opportunities for women | .475 |
| An IT career provides a flexible work schedule between work and social life | .470 |
| ~~People with an IT qualification are 'geeks'~~ | ~~-.261~~ |
| ~~IT is regarded as a male profession~~ | ~~.071~~ |
| Total % of Variance Explained = 36.5% | |

Therefore, the items: *IT is regarded as a male profession* and *People with an IT qualification are 'geeks'* were omitted and the EFA loadings were re-evaluated (Table 5-50). The results from the EFA re-evaluation explained 42.5% of the total variance (Table 5-51).

Table 5-51: EFA 2nd Loadings (1 Factor Model) – Perceptions about the IT industry (n = 405; Minimum significant loading = .300)

| **Item** | **Factor 1** |
|---|---|
| There is good job security in the IT industry | **.734** |
| There are many jobs available in the IT industry | **.719** |
| A person with an IT qualification will find work easily | **.717** |
| People working in the IT industry earn good salaries | **.707** |
| An IT career ensures long term employment | **.703** |
| An IT career has a good image/status | **.667** |
| There are good prospects for developing new skills in the IT industry | **.667** |
| A person with an IT qualification can work internationally | **.663** |
| The IT industry provides the opportunity to become an IT entrepreneur | **.584** |
| ~~The IT industry provides many job opportunities for women~~ | ~~**.478**~~ |
| ~~An IT career provides a flexible work schedule between work and social life~~ | ~~**.467**~~ |
| Total % of Variance Explained = 42.5% | |

The items: *An IT career provides a flexible work schedule between work and social life* and *The IT industry provides many job opportunities for women* were omitted on face value and advice from the NMU Statistician. The re-evaluated EFA Eigenvalues indicated a one factor model (Table 5-52) as well as the Scree Plot, as depicted in Figure 5-19. The factor explained a total variance of 47.9%.

Table 5-52: EFA Eigenvalues – Perceptions about the IT

industry (n = 405; Minimum significant loading = .300)

| Factor | Eigenvalue | % Total Variance |
|---|---|---|
| 1 | 4.308 | 47.9 |
| 2 | 0.933 | 10.4 |
| 3 | 0.704 | 7.8 |
| 4 | 0.645 | 7.2 |
| 5 | 0.601 | 6.7 |
| 6 | 0.512 | 5.7 |
| 7 | 0.476 | 5.3 |
| 8 | 0.453 | 5.0 |
| 9 | 0.367 | 4.1 |

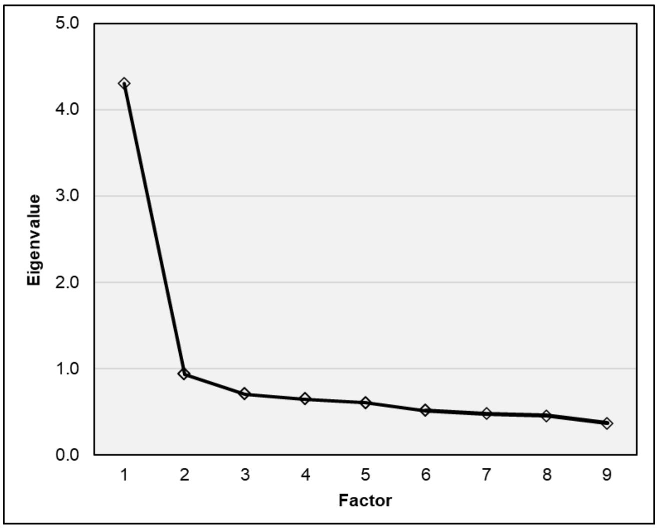

Figure 5-19: Scree Plot – Perceptions about the IT industry (n = 405)

The one factor model had nine items that loaded above the significant minimum loading of .300 (Table 5-53) and explained 47.9% of the total variance of the factor, Perceptions about the IT industry.

Table 5-53: EFA Loadings (1 Factor Model) – Perceptions about the IT industry (n = 405; Minimum significant loading =.300)

| Item | Factor 1 |
|---|---|
| There is good job security in the IT industry | **.750** |
| A person with an IT qualification will find work easily | **.724** |
| There are many jobs available in the IT industry | **.724** |
| People working in the IT industry earn good salaries | **.723** |
| An IT career ensures long term employment | **.703** |
| A person with an IT qualification can work internationally | **.678** |
| An IT career has a good image/status | **.668** |
| There are good prospects for developing new skills in the IT industry | **.662** |
| The IT industry provides the opportunity to become an IT entrepreneur | **.580** |
| Total % of Variance Explained = 47.9% | |

### 5.5.1.8 Factor Analysis – Career Awareness

The EFA Eigenvalues indicated a two factors model as shown in Table 5-54 and the Scree Plot also indicated two factors (Figure 5-20).

Table 5-54: 1st Time EFA Eigenvalues – Career Awareness

(n = 405; Minimum significant loading = .300)

| Factor | Eigenvalue | % Total Variance |
|---|---|---|
| 1 | 3.422 | 42.8 |
| 2 | 1.625 | 20.3 |
| 3 | 0.781 | 9.8 |
| 4 | 0.576 | 7.2 |
| 5 | 0.565 | 7.1 |
| 6 | 0.435 | 5.4 |
| 7 | 0.330 | 4.1 |
| 8 | 0.267 | 3.3 |

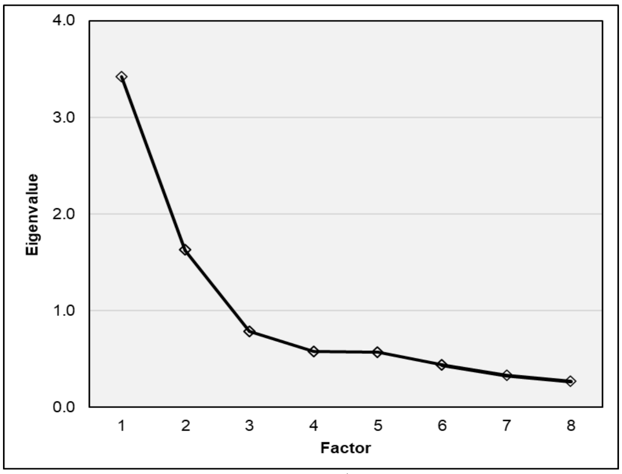


Figure 5-20: 1st Time Scree Plot – Career Awareness (n = 405)

The two factor model explained 63.1% of the total variance, with eight items loaded. In order to improve the validity, items: *I do have an understanding of the career paths available for students with my qualifications* and *I understand the differences between IT, CS, and IS careers* had to be removed from the model (Table 5-55).

Table 5-55: EFA Loading (2 Factor Model) – Career Awareness

(n = 450; Minimum significant loading = .300)

| Item | Factor 1 | Factor 2 |
|---|---|---|
| I had an understanding of Computer Science (CS) careers before I enrolled at university | **.874** | .128 |
| I did have an understanding of Information Systems (IS) careers before I enrolled at university | **.867** | .103 |
| I did have an understanding of Information Technology (IT) careers before I enrolled at university | **.833** | .056 |
| ~~I understand the differences between IT, CS, and IS careers~~ | ~~**.630**~~ | ~~.256~~ |
| I can explain the main job functions for my future job | .112 | **.851** |
| I know what job I want to do in the future | .142 | **.788** |
| I know which company I want to work for after I graduate | .044 | **.731** |
| ~~I do have an understanding of the career paths available for students with my qualifications~~ | ~~**.395**~~ | ~~**.524**~~ |
| Explained variance | 2.80 | 2.25 |
| % of Total variance | 35.0% | 28.1% |
| Total % of Variance Explained = 63.1% | | |

The two factor model was re-evaluated and the Eigenvalues again indicated two factors (Table 5-56) as well as the Scree Plot (Figure 5-21).

Table 5-56: EFA Eigenvalues – Career Awareness

(n = 405; Minimum significant loading = .300)

| Factor | Eigenvalue | % Total Variance |
|---|---|---|
| 1 | 2.725 | 45.4 |
| 2 | 1.590 | 26.5 |
| 3 | 0.625 | 10.4 |
| 4 | 0.457 | 7.6 |
| 5 | 0.335 | 5.6 |
| 6 | 0.268 | 4.5 |

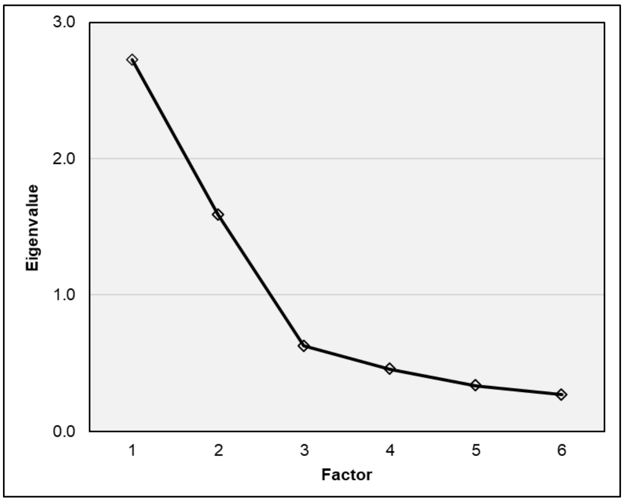

Figure 5-21: Scree Plot – Career Awareness (n = 405)

The two factors combined explained 71.9% total variance (Table 5-57). Each factor has three items that are above the minimum significant loading of .300. Furthermore, the two factors were named: Factor 1 - *Career Awareness – Prior to Studies* and Factor 2 - *Career Awareness - Current*.

Table 5-57: EFA Loadings (2 Factor Model) – Career Awareness

(n = 405; Minimum significant loading = .300)

| Item | Factor 1 | Factor 2 |
|---|---|---|
| I had an understanding of Computer Science (CS) careers before I enrolled at university | **.893** | .138 |
| I did have an understanding of Information Systems (IS) careers before I enrolled at university | **.871** | .108 |
| I did have an understanding of Information Technology (IT) careers before I enrolled at university | **.860** | .061 |
| I can explain the main job functions for my future job | .121 | **.854** |
| I know what job I want to do in the future | .164 | **.797** |
| I know which company I want to work for after I graduate | .044 | **.760** |
| Explained variance | 2.34 | 1.98 |
| % of Total variance | 39.0% | 32.9% |
| Total % of Variance Explained = 71.9% | | |

#### 5.5.1.9 Factor Analysis – Perceptions about Chosen Career

In the first results of the EFA, Eigenvalues showed a two factors model, as depicted in Table 5-58, while the Scree Plot indicated one factor (Figure 5-22).

Table 5-58: 1st Time EFA Eigenvalues – Perceptions about Chosen Career

(n = 405; Minimum significant loading = .300)

| Factor | Eigenvalue | % Total Variance |
|---|---|---|
| 1 | 4.728 | 47.3 |
| 2 | 1.062 | 10.6 |
| 3 | 0.926 | 9.3 |
| 4 | 0.632 | 6.3 |
| 5 | 0.594 | 5.9 |
| 6 | 0.512 | 5.1 |
| 7 | 0.457 | 4.6 |
| 8 | 0.435 | 4.3 |
| 9 | 0.343 | 3.4 |
| 10 | 0.311 | 3.1 |

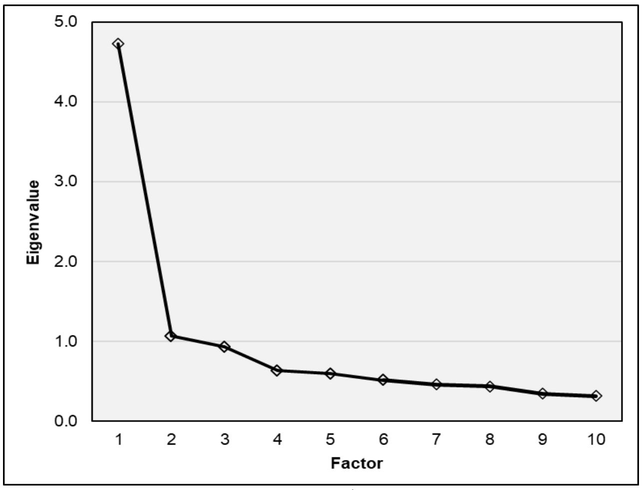


Figure 5-22: 1st Time Scree Plot – Perceptions about Chosen Career (n = 405)

The one factor model (Table 5-59) had ten items loadings above the minimum significant loading value of .300 and the total variance explained was 47.3%, as shown in Table 5-59.

Table 5-59: EFA Loading (1 Factor Model) - Perceptions about Chosen Career
(n = 405; Minimum significant loading = .300)

| Item | Factor 1 |
|---|---|
| My chosen career will be rewarding | .790 |
| There are many jobs available in the career I have chosen | .748 |
| I will learn new skills in my chosen career | .726 |
| I will have opportunities to work in different kinds of business functions in my chosen career | .725 |
| I would recommend my career choice to others | .702 |
| I am happy with my career choice | .698 |
| There are good prospects for a better than average starting salary in the career I have chosen | .691 |
| I have to keep ahead of change and new technologies in my chosen career | .629 |
| I can become an entrepreneur with my career choice | .579 |
| My family respects my career choice | .551 |
| Total % of Variance Explained = 47.3% | |

In order to improve validity, the NMU Statistitian omitted two items: *My family respects my career choice* and *I can become an entrepreneur with my career choice* and the EFA loadings were re-evaluated. The results indicated a one factor model, the only Eigenvalue above 1 was 4.189 (Table 5-60) which was in agreement with the one factor indicated by the Scree Plot (Figure 5-23).

Table 5-60: EFA Eigenvalues – Perceptions about Chosen Career

(n = 405; Minimum significant loading = .300)

| actor | Eigenvalue | % Total Variance |
|---|---|---|
| 1 | 4.189 | 52.4 |
| 2 | 0.931 | 11.6 |
| 3 | 0.760 | 9.5 |
| 4 | 0.525 | 6.6 |
| 5 | 0.488 | 6.1 |
| 6 | 0.446 | 5.6 |
| 7 | 0.348 | 4.4 |
| 8 | 0.312 | 3.9 |

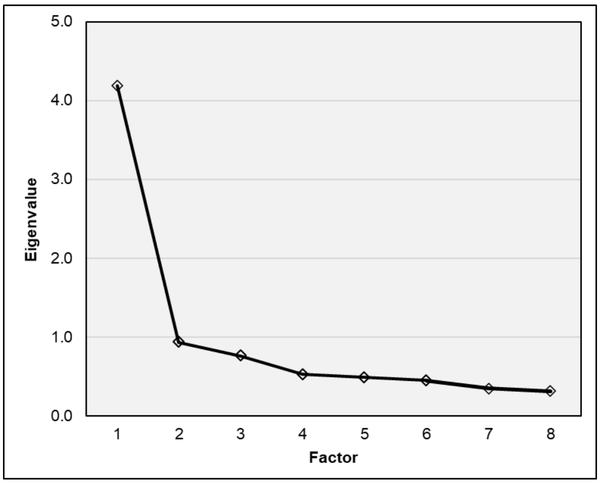


Figure 5-23: Scree Plot – Perceptions about Chosen Career (n = 405)

The one factor model explained 52.4% of the total variance. The one factor model had eight items and all items were above the minimum significant loading of .300 (Table 5-61).

Table 5-61: EFA Loadings (1 Factor Model) – Perceptions about the Chosen Career (n = 405; Minimum significant loading = .300)

| Item | Factor 1 |
|---|---|
| My chosen career will be rewarding | **.789** |
| There are many jobs available in the career I have chosen | **.747** |
| I will learn new skills in my chosen career | **.743** |
| I will have opportunities to work in different kinds of business functions in my chosen career | **.727** |
| I would recommend my career choice to others | **.719** |
| I am happy with my career choice | **.713** |
| There are good prospects for a better than average starting salary in the career I have chosen | **.680** |
| I have to keep ahead of change and new technologies in my chosen career | **.663** |
| Total % of Variance Explained = 52.4% | |

### 5.5.2 Reliability – Cronbach’s Alpha analysis

In order to examine the internal reliability of multiple scale items, the Cronbach alpha coefficient is used (Collis & Hussey, 2014). The coefficient ranges from 0 (no consistency) to 1 (complete consistency). Table 5-62 shows the interpretation intervals that will be used to determine the reliability of the factors that were presented in this study.

Table 5-62: Interpretation intervals for Cronbach’s alpha coefficient

| Rating | Interval |
|---|---|
| Excellent | 0.80 + |
| Good | 0.70 - 0.79 |
| Fair | 0.60 - 0.69 |
| Poor | 0.50 - 0.59 |
| Unacceptable | < 0.50 |

Table 5-63: Cronbach’s alpha coefficients for the factors (n = 405) shows the reliability of each factor for this study. The Cronbach's alpha interpretations in Table 5-63: Cronbach’s alpha coefficients for the factors (n = 405) must be compared with each factor with interpretations intervals.

Table 5-63: Cronbach’s alpha coefficients for the factors (n = 405)

| Factor | Coefficient | Reliability |
|---|---|---|
| Learning Experiences | 0.91 | Excellent |
| Academic-Confidence | 0.89 | Excellent |
| Perceptions about the IT industry | 0.86 | Excellent |
| Career Awareness - Prior to Studies | 0.86 | Excellent |
| Perceptions about Chosen Career | 0.87 | Excellent |
| Culture | 0.70 | Good |
| Career Choice Influencers - Personal | 0.78 | Good |
| Career Choice Influencers - Media | 0.74 | Good |
| Personal Attributes | 0.75 | Good |
| Career Awareness - Current | 0.74 | Good |
| IT Role Models | 0.55 | Poor |

The five factors; *Learning Experiences* (0.90), *Self-Confidence* (0.89), *Perceptions about IT industry* (0.86), *Career Awareness – Prior to Studies* (0.86), and *Perceptions about Chosen Career* (0.87) recorded excellent Cronbach Alpha reliability as the coefficients were above 0.80. Furthermore four factors; namely *Culture* (0.70), *Career Choice Influencers – Personal* (0.78), *Career Choice Influencers – Media* (0.74), *Personal Attributes* (0.75), and *Career Awareness – Current* (0.74) indicated good Cronbach’s Alpha reliability with a coefficient between 0.70 and 0.79

One factor rates poorly on the reliability which was the IT Role Models factor with a coefficient of 0.55. However, Nunally (1978) indicated for new research the IT Role Models rating is acceptable.

### 5.6 Descriptive Statistics for the Factors

This study used descriptive statistics to provide an exploration of the factors concerning the survey responses. Table 5-64: Frequency Distributions for the Factors (n = 405) shows the responses to each factor in terms of the lower, middle and higher responses.

The IT Role Models had dichotomous items represented with Yes/No. The Career Choice Influencers Personal and Media had three items scale Not at all/ A little/A lot. The final factors categories were based on two different 5-Point Likert scales, Strongly Disagree/Disagree/Neutral/Agree/Strongly Agree and Not all Confident/Slightly Confident/Fairly Confident/Quite Confident/Extremely Confident.

Table 5-64: Frequency Distributions for the Factors (n = 405)

| | **Lower 1.00 to 1.39** | | **Middle 1.40 to 1.60** | | **Higher 1.61 to 2.00** | |
|---|---|---|---|---|---|---|
| IT Role Models | 293 | 72% | 66 | 16% | 46 | 12% |
| | **Lower 1.00 to 1.79** | | **Middle 1.80 to 2.20** | | **Higher 2.21 to 3.00** | |
| Career Choice Influencers - Personal | 192 | 47% | 120 | 30% | 93 | 23% |
| Career Choice Influencers - Media | 101 | 25% | 92 | 23% | 212 | 52% |
| | **Lower 1.00 to 2.59** | | **Middle 2.60 to 3.40** | | **Higher 3.41 to 5.00** | |
| Culture | 15 | 4% | 130 | 32% | 260 | 64% |
| Learning Experiences | 206 | 50% | 67 | 17% | 132 | 33% |
| Personal Attributes | 2 | 1% | 53 | 13% | 350 | 86% |
| Academic Confidence | 18 | 5% | 82 | 20% | 305 | 75% |
| Perceptions about the IT industry | 1 | 0% | 59 | 15% | 345 | 85% |
| Career Awareness - Prior to Studies | 125 | 31% | 151 | 37% | 129 | 32% |
| Career Awareness - Current | 55 | 14% | 158 | 39% | 192 | 47% |
| Perceptions about - Chosen Career | 4 | 1% | 35 | 9% | 366 | 90% |

Seventy-two percent of the respondents (n = 293) indicated *IT Role Models* had a low influence on their chosen career decision. The factor *Career Choice Influencers –*

*Personal*, only had 47% (n = 192) responses showing personal influencers have on their chosen careers, contrary to the *Career Choice Influencers – Media* with 52% (n = 212) of the responses indicated that media has a high influence on their chosen careers.

The factors, *Culture* 64% (n = 260), *Personal Attributes* 86% (n = 350), *Academic Confidence* 75% (n = 305), *Perception about the IT industry* 85% (n = 345) and *Perceptions about the Chosen Career* 90% (n = 366) were important factors as they scored high which showed they are key factors influencing career decisions.

## 5.7 Inferential Statistics for the factors

The section discusses the inferential statistics which uses the one-sample t-test and inferential ranking on the factors identified in the study. The section focuses on the relationships between the IT and Non-IT groups. A one-sample t-test, correlation analysis between factors and inferential rankings amongst factors were conducted.

A one-sample t-test is used for various statistical tests, to determine statistical significance (Gravetter & Wallnau, 2009). While correlation analysis offers information about the association between factors by measuring the direction and strength of any existing linear relationship between the factors (Collis & Hussey, 2014). Inferential statistics focuses on making inferences about population parameters based on sample data (Jackson, 2011).

Table 5-65 presents the Cohen's *d* interpretations interval. Coheh's d is used for practical significance in a one-sample t-test and is used to represent the extent of differences between two or more groups (Salkind, 2010).

Table 5-65: Interpretations intervals for Cohen's *d* (Gravetter & Wallnau, 2009)

| Interpretation intervals for Cohen's d | |
|---|---|
| **Significance:** | **Interval** |
| Not | $d < 0.20$ |
| Small | $0.20 \leq d < 0.50$ |
| Medium | $0.50 \leq d < 0.80$ |
| Large | $d \geq .80$ |

### 5.7.1 One-Sample t-tests between IT and Non-IT Groups

Two groups were identified for the study, namely the IT group (Bachelor in CS, Bachelor in Science CS&IS, Bachelor IT, National Diploma: IT, and National Higher Certificate: IT) and Non-IT group (Bachelors in Commerce, Economics, Finance, Accounting, and other courses). Table 5-66 presents the results of the t-test between the IT and Non-IT groups.

Table 5-66: t-test between IT (n = 273) and Non-IT (n = 132) Groups

| Factor | Group | Mean | S.D. | Difference | t | p(d.f.=403) | Cohen's d |
|---|---|---|---|---|---|---|---|
| Total Correct - Job Title/Description | IT | 6.11 | 2.37 | 0.49 | 2.02 | **.045** | **0.21** |
| | Non-IT | 5.62 | 2.16 | | | | **Small** |
| IT Role Models | IT | 1.28 | 0.28 | 0.05 | 1.79 | .074 | n/a |
| | Non-IT | 1.23 | 0.27 | | | | |
| Culture | IT | 3.65 | 0.58 | 0.09 | 1.46 | .144 | n/a |
| | Non-IT | 3.56 | 0.58 | | | | |
| Career Choice Influencers - Personal | IT | 1.84 | 0.55 | 0.10 | 1.75 | .081 | n/a |
| | Non-IT | 1.74 | 0.53 | | | | |
| Career Choice Influencers - Media | IT | 2.36 | 0.65 | 0.34 | 4.65 | **<.0005** | **0.49** |
| | Non-IT | 2.02 | 0.75 | | | | **Small** |
| Learning Experiences | IT | 2.66 | 1.20 | -0.13 | -1.08 | .281 | n/a |
| | Non-IT | 2.79 | 1.11 | | | | |
| Personal Attributes | IT | 4.03 | 0.54 | 0.05 | 0.90 | .370 | n/a |
| | Non-IT | 3.98 | 0.53 | | | | |
| Academic Confidence | IT | 3.91 | 0.73 | 0.13 | 1.69 | .092 | n/a |
| | Non-IT | 3.78 | 0.69 | | | | |
| Perceptions about the IT industry | IT | 4.07 | 0.53 | 0.23 | 4.03 | **<.0005** | **0.43** |
| | Non-IT | 3.83 | 0.58 | | | | **Small** |
| Career Awareness - Prior to Studies | IT | 3.18 | 0.99 | 0.46 | 4.53 | **<.0005** | **0.48** |
| | Non-IT | 2.73 | 0.88 | | | | **Small** |
| Career Awareness - Current | IT | 3.36 | 0.86 | -0.17 | -1.90 | .058 | n/a |
| | Non-IT | 3.53 | 0.81 | | | | |
| Perceptions about Chosen Career | IT | 4.23 | 0.54 | 0.12 | 2.06 | **.040** | **0.22** |
| | Non-IT | 4.11 | 0.58 | | | | **Small** |

A new factor *Total Correct – Job Title/Description* factor was created as the factor was used to determine the respondents' knowledge of job titles and descriptions to check their understanding and awareness of job titles and job descriptions (Table 5-66). The respondents were asked to match jobs with descriptions and the number of correct job titles and descriptions were totalled. This factor can be seen in the questionnaire (Appendix E – Questionnaire).

The Total Correct – Job Title/Description factor results between the IT and non-IT groups showed a non-statistically significant difference between the two groups with a $p$-value of .045, which was below the acceptable value of $p < .05$. Additionally, the Cohen's d ($d$ =.21) value showed a small practical significance. The IT group ($M$ = 6.11) was higher compared to the Non-IT group ($M$ = 5.62), therefore the results indicate that the IT group scored better matching and identifying the job titles and descriptions than the Non-IT group. The *Career Choice Influencers – Media* factor showed a statistically significant difference ($p < .05$) with a small practical significance Cohen's $d$ = .49. This indicates the use of Social Media differed for the two groups.

Regarding the factor, *Perception about the IT Industry*, the IT group had a 4.07 mean compared to the Non-IT mean of 3.83, with a statistically significant $p < .0005$. Additionally, the Cohen's $d$ = .43 indicates a small practical significance. Therefore the results indicate that the IT group had better perceptions about the IT industry compared to the Non-IT.

The factor, *Career Awareness - Prior to Studies*, the IT group ($M$ = 3.18) was more aware of careers before their studies than the Non-IT group ($M$ = 2.73). The comparison further indicates a statistical significance ($p$ <.0005) with a small practical significance (Cohen's $d$ = 0.48). The results indicate that the IT group was more aware of careers compared to the Non-IT group prior to their studies.

The factor, *Perceptions about the Chosen Career* had statistical significance ($p$ = .040) and a small practical significance (Cohen's $d$ = 0.22). The results further showed the IT group had better perceptions about their chosen careers ($M$ = 4.23) compared to the Non-IT group ($M$ = 4.11). Therefore the results indicate that the IT group had better perceptions about their chosen career compared to the Non-IT group.

### 5.7.2 Inferential Ranking – Factors

The factors were ranked, using matched-pair t-test (statistical significance) and Cohen's d (practical significance), such that:

a) The mean of the first factor in Significance Group (Signif. Group) i differs statistically and practically from the mean of the first factor in Signif.Group (i +1); and

b) None of the means of the factors in Signif.Group i differ significantly from the mean of the first factor in that group.

Table 5-67: Classification Intervals for Inferentail Ranking

| Category | Interval |
|---|---|
| Lower | < 2.60 |
| Middle | 2.60 to 3.39 |
| Higher | > 3.39 |

For inferential ranking purposes, the scores for factors which items were not on 5 points Likert scale IT Role Models and Career Choice Influencers were transformed by the NMU Statistician to a 5-point Likert scale. Table 5-67 will be used to interpret and Table 5-68 indicates the results.

Table 5-68 depicts the ranking and significant group of the eleven factors identified in the study. The first factor, *Perceptions about the Chosen Career* ranked first and was the only factor in the first significant group, followed by the factor *Personal Attributes* and *Perceptions about the IT industry*, which were both in the second significant group.

Table 5-68: 95% Confidence Intervals Classifications and Inferential Ranking – Factors (n = 405)

| | Descriptive Statistics | | 95% CI Classification | | | Inferential Ranking | |
|---|---|---|---|---|---|---|---|
| **Factors** | **Mean** | **S.D.** | **Low** | **High** | **Category** | **Rank** | **Signif. Group** |
| Perceptions about Chosen Career | 4.19 | 0.55 | 4.14 | 4.25 | Higher | 1 | 1 |
| Personal Attributes | 4.01 | 0.54 | 3.96 | 4.06 | Higher | 2 | 2 |
| Perceptions about the IT industry | 3.99 | 0.56 | 3.94 | 4.05 | Higher | 2 | 2 |
| Self-Confidence | 3.87 | 0.72 | 3.80 | 3.94 | Higher | 4 | 3 |
| Culture | 3.62 | 0.58 | 3.56 | 3.68 | Higher | 5 | 4 |
| Career Choice Influencers - Media | 3.49 | 1.40 | 3.35 | 3.63 | Middle to Higher | 5 | 4 |
| Career Awareness - Current | 3.42 | 0.85 | 3.33 | 3.50 | Middle to Higher | 7 | 5 |
| Career Awareness - Prior to Studies | 3.04 | 0.97 | 2.94 | 3.13 | Middle | 8 | 6 |
| Learning Experiences | 2.70 | 1.17 | 2.59 | 2.82 | Lower to Middle | 9 | 7 |
| Career Choice Influencers - Personal | 2.62 | 1.08 | 2.51 | 2.73 | Lower to Middle | 9 | 7 |
| IT Role Models | 2.06 | 1.12 | 1.95 | 2.17 | Lower | 11 | 8 |

The third factor, *Academic Confidence* (*Self-Confidence)* ranked fourth while being the only factor ranking third in the third significance group. The fifth factor, *Culture* ranked fifth and the sixth factor, *Career Choice Influencers – Media* ranked fifth and made up the fourth significance group. *Career Awareness – Current* was seventh in ranking and the only factor in the fifth significance group, followed by *Career Awareness – Prior to Studies* ranked number eight and the only factor in the sixth significance group. The factors, *Learning Experiences* and *Career Choice Influencers – Personal* ranked ninth and formed the seventh significance group. Lastly, the eleventh factor was the *IT Role Models* and made up the eighth significance group. The eleven factors identified in this study, thus grouped into eight significant groupings.

## 5.8 Testing the Proposed Conceptual Model

A multivariate analysis assists researchers to create knowledge and improving decision-making by allowing multiple measurements to be simultaneously analysed

(Hair et al., 2006). The following sub-sections focuses on testing the proposed model, using a one-sample t-test, and correlation analysis. The section presents multiple regression analysis results and the hypothesised model. The chapter discusses the Confirmatory Factor Analyses (CFA) and Structural Equation Modelling (SEM). Finally, the chapter presents the revised model as confirmed by the CFA and SEM.

### 5.8.1 Revised Hypothesised Model

In this section, the results from multiple regression analyses and the correlations analysis, discussed in the previous sections, are evaluated. The number of hypotheses developed in Chapter 4 was fifteen, the hypothesised model for the Perceptions about Chosen Career was tested using the statistical analysis methods discussed previously. The results indicated that most of the factors were statistically insignificant. Therefore, factors were removed and the hypothesised model was revised guided by the results from the statistical analysis. Finally, all of the hypotheses proposed in Section 4.8.5.4 were rejected based on the EFA results, except $HA_{12}$ Perceptions about the IT industry, which positively influences Perceptions of chosen careers.

Table 5-69 presents the revised hypotheses which have increased from the original 15 hypotheses to 24 hypotheses. The increase is the result of the statistical analysis that was performed using the EFA, t-test and correlations. The hypotheses will either be accepted or rejected after further testing of the conceptual model using CFA and SEM. Figure 5-24 illustrates how each hypothesis links to the conceptual model.

Table 5-69: Revised Conceptual Model Hypotheses

| Hypothesis | Hypothesis Description |
|---|---|
| $HA_1$ | Career Choice Influencers - Media positively influences Career Choice Influence - Personal |
| $HA_2$ | Career Choice Influence - Media positively influences IT Role Models |
| $HA_3$ | Career Choice Influence - Media positively influences Learning Experiences |
| $HA_4$ | Culture positively influences Career Choice Influencers - Personal |
| $HA_5$ | Culture positively influences Learning Experiences |
| $HA_6$ | IT Role Models positively influences Learning Experiences |
| $HA_7$ | Career Awareness - Current positively Influences Perceptions about Chosen Career |
| $HA_8$ | Career Awareness - Prior to Studies positively influences Job Title/Descriptions Knowledge |
| $HA_9$ | Career Choice Influencers - Media positively Influences Perceptions about the IT industry |
| $HA_{10}$ | Career Choice Influencers - Personal positively influences Career Awareness - Current |
| $HA_{11}$ | Career Choice Influencers - Personal positively influences Job Title/Description Knowledge |
| $HA_{12}$ | Culture positively influences Academic Confidence |
| $HA_{13}$ | Culture positively influences Career Awareness - Current |
| $HA_{14}$ | Culture positively influences Career Awareness - Prior to Studies |
| $HA_{15}$ | Culture positively influences Perceptions about the IT industry |
| $HA_{16}$ | Culture positively influences Personal Attributes |
| $HA_{17}$ | IT Role Models positively influences Job Title/Description Knowledge |
| $HA_{18}$ | Learning Experiences positively influence Career Awareness - Current |
| $HA_{19}$ | IT Role Models positively influences Job Title/Description Knowledge |
| $HA_{20}$ | Learning Experiences positively influence Career Awareness - Prior to Studies |
| $HA_{21}$ | Learning Experiences positively influence Job Title/Description Knowledge |
| $HA_{22}$ | Perceptions about the IT industry positively influence Perceptions about Chosen Career |
| $HA_{23}$ | Personal Attributes positively influence Perceptions about Chosen Career |
| $HA_{24}$ | Academic Confidence positively influence Perceptions about Chosen Career |

Figure 5-24 indicates that the four dependent factors namely, *Career Awareness - Current*, *Personal Attributes*, *Academic Confidence* and *Perceptions about IT Industry*, influence the *Perceptions about Chosen Career*. The model was further tested using the t-test and correlations between the factors.

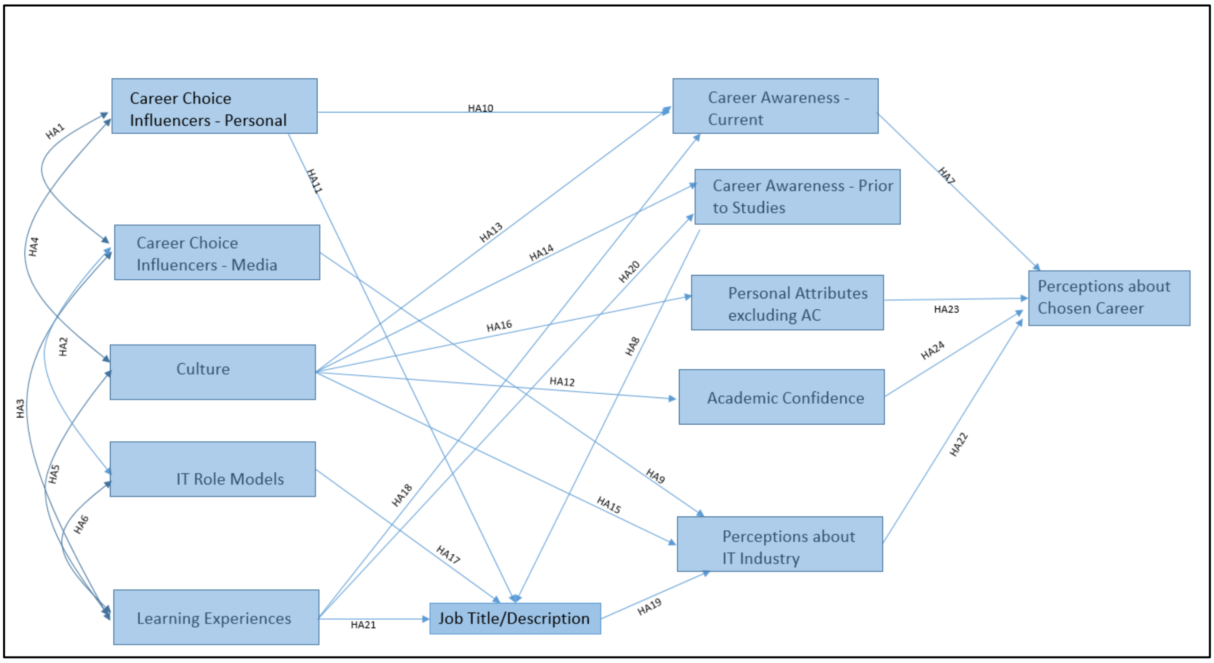

Figure 5-24: Revised Hypothesised Model

### 5.8.2 One-Sample t-tests between the factors

Table 5-70 indicates the results of the t-test analysis using all of the factors of the study. The means were calculated for scores being the average of 5-point Likert scale items, except for IT Role Models (*) and Career Choice Influencers (**) as indicated with an asterisk in Table 5-70. Table 5-70 presents the mean values for the factors, standard deviation (S.D), the low and high confidence levels. Further, the table presents the hypothesis value ($H_1$:µ) which is compared with the actual mean value of the factor. The value of t and degrees of freedom (d.f.=404) are used to determine the p-value, used for the practical significance. Finally, the table presents the Cohen's d value to present statistical significance.

The factors with a statistically significant difference (p < .05) and practically significant difference (Cohen's d > 0.20). The factors that are statistically significant (p < .05) were, *IT Role Models* (Cohen's *d* = 1.20), *Culture* (Cohen's *d* = 1.75), *Personal Attributes* (Cohen's *d* = 1.13), *Perceptions about the IT industry* (Cohen's *d* = 1.06) and *Perceptions about Chosen Career* (Cohen's *d* = 1.43). Furthermore, the *t* values for the factors were; *IT Role Models* (*t* = -24.19), *Culture* (*t* = 35.29), *Personal Attributes*(*t* = 22.77), *Perceptions about the IT Industry* (*t* = 21.36) and *Perceptions about Chosen Career* (*t* = 28.72). Three factors, *Career Choice Influencers – Personal*

(Cohen's *d* = 0.72), *Learning Experiences* (Cohen's *d* = 0.60), and *Academic Confidence* (Cohen's *d* = 0.65) were statistically significant ($p < .05$) and had a medium practical significance.

Table 5-70: One-sample t-test between Factors
(n = 405; d.f. = 404)

| Variable | Mean | S.D. | 95% Lo | 95% Hi | $H_1$:µ | t | p (d.f.=404) | Cohen's d |
|---|---|---|---|---|---|---|---|---|
| IT Role Models* | 1.26 | 0.28 | 1.24 | 1.29 | ≠1.60 | -24.19 | <.0005 | 1.20 Large |
| Culture | 3.62 | 0.58 | 3.56 | 3.68 | ≠2.60 | 35.29 | <.0005 | 1.75 Large |
| Career Choice Influencers - Personal** | 1.81 | 0.54 | 1.76 | 1.86 | ≠2.20 | -14.49 | <.0005 | 0.72 Medium |
| Career Choice Influencers - Media** | 2.25 | 0.70 | 2.18 | 2.31 | ≠2.20 | 1.31 | .190 | n/a |
| Learning Experiences | 2.70 | 1.17 | 2.59 | 2.82 | ≠3.40 | -11.98 | <.0005 | 0.60 Medium |
| Personal Attributes | 4.01 | 0.54 | 3.96 | 4.06 | ≠3.40 | 22.77 | <.0005 | 1.13 Large |
| Academic Confidence | 3.87 | 0.72 | 3.80 | 3.94 | ≠3.40 | 13.10 | <.0005 | 0.65 Medium |
| Perceptions about the IT industry | 3.99 | 0.56 | 3.94 | 4.05 | ≠3.40 | 21.36 | <.0005 | 1.06 Large |
| Career Awareness - Prior to Studies | 3.04 | 0.97 | 2.94 | 3.13 | ≠3.40 | -7.54 | <.0005 | 0.37 Small |
| Career Awareness - Current | 3.42 | 0.85 | 3.33 | 3.50 | ≠3.40 | 0.37 | .712 | n/a |
| Perceptions about Chosen Career | 4.19 | 0.55 | 4.14 | 4.25 | ≠3.40 | 28.72 | <.0005 | 1.43 Large |
| Response items' scale:<br>* 1=Yes, 2=No<br>** 1=Not at all; 2=A little; 3=A lot | | | | | | | | |

*Career Awareness Prior to Studies* factor had a small practical significance as the (Cohen's *d* = 0.37) and $t = -7.54$ further being statistically significant with a *p*-value of <.0005. The *Career Choice Influencers – Media* and *Career Awareness - Current* factors both their *p*-value was greater than the minimum of 0.05 at $p = .190$ and $p = .712$ respectively. The *t* values for *Career Choice Influencers– Media* ($t = 1.31$) and *Career Awareness - Current* ($t = 0.37$), therefore, the two factors *Career Choice Influencers– Media* and *Career Awareness - Current* both were statistically deemed insignificant factors.

### 5.8.3 Correlation between the factors

For the correlation analysis, a correlation coefficient *r* is statistically significant at the 0.05 level for n = 405, if |r| >= .097 and practically significant, regardless of the sample size, if |r|  >= .300. Thus correlations are significant both statistically and practically if |r| >= .300 (Gravetter & Wallnau, 2009). The correlation between the factors is presented in Table 5-71.

Table 5-71 depicts the summarised Pearson's *r* values for the correlation between each factor. Twenty-four of the relationships were both statistically and practically significant as the *r*-value is greater than .300. There was a very strong correlation between *Personal Attributes* and *Academic Confidence* (*r* = .628). Additionally, a very strong correlation was recorded between *Personal Attributes* and *Perceptions about the Chosen Career* (*r* = .491) indicating the importance of personal attributes on students' chosen careers. Lastly, the correlation between *Perceptions about the IT industry* and *Perceptions about Chosen Careers* was a very strong positive correlation (*r* = .452). This implies there is a strong correlation between *Perceptions about the IT industry* and a student's *Perceptions about Chosen Careers.*

The Pearson Correlation analysis indicates positive correlations between *Perceptions about Chosen Career* and four independent factors; *Career Awareness - Current* (*r* = 418), *Perceptions about IT industry* (*r* = .452), *Academic Confidence* (*r* = .401), and *Personal Attributes* (*r* = .491). Therefore,  meaning all the four factors had positive correlations with *Perceptions about the Chosen Career*.

Table 5-71: Pearson Product Moment Correlations – IT Role Models to Perceptions about Chosen Career (n = 405)

| | IT Role Models | Culture | Career Choice Influencers - | Career Choice Influencers - Media | Learning Experiences | Personal Attributes | Academic Confidence | Perceptions about the IT industry | Career Awareness - Prior to Studies | Career Awareness - Current | Perceptions about Chosen Career |
|---|---|---|---|---|---|---|---|---|---|---|---|
| IT Role Models | - | **.184** | **.186** | -.023 | ***.381*** | **.108** | .068 | **.156** | ***.305*** | .080 | **.112** |
| Culture | **.184** | - | **.125** | -.052 | **.185** | **.199** | **.224** | **.210** | **.119** | .083 | **.120** |
| Career Choice Influencers - Personal | **.186** | **.125** | - | **.300** | **.109** | **.181** | **.188** | **.152** | **.111** | **.205** | **.120** |
| Career Choice Influencers - Media | -.023 | -.052 | **.300** | - | **-.187** | .050 | .064 | **.177** | .030 | **.137** | **.165** |
| Learning Experiences | ***.381*** | **.185** | **.109** | **-.187** | - | **.174** | **.141** | .052 | ***.396*** | -.028 | .087 |
| Personal Attributes | **.108** | **.199** | **.181** | .050 | **.174** | - | ***.628*** | ***.311*** | ***.333*** | ***.384*** | ***.491*** |
| Academic Confidence | .068 | **.224** | **.188** | .064 | **.141** | ***.628*** | - | ***.324*** | **.284** | **.290** | ***.401*** |
| Perceptions about the IT industry | **.156** | **.210** | **.152** | **.177** | .052 | ***.311*** | ***.324*** | - | **.220** | **.242** | ***.452*** |
| Career Awareness - Prior to Studies | ***.305*** | **.119** | **.111** | .030 | ***.396*** | ***.333*** | **.284** | **.220** | - | **.248** | **.289** |
| Career Awareness - Current | .080 | .083 | **.205** | **.137** | -.028 | ***.384*** | **.290** | **.242** | **.248** | - | ***.418*** |
| Perceptions about Chosen Career | **.112** | **.120** | **.120** | **.165** | .087 | ***.491*** | ***.401*** | ***.452*** | **.289** | ***.418*** | - |

### 5.8.4 Final Hypotheses and Model

Table 5-72 presents the final hypotheses of the conceptual model, with hypotheses either accepted or rejected based on the t-test and correlations. The CFA and the SEM will be used to confirm the proposed conceptual model.

Table 5-72: Final Hypotheses

| Hypothesis | Hypothesis Description | Pearson Correlation *r* | Correlation Strength | p-value | Hypothesis Accepted or Rejected |
|---|---|---|---|---|---|
| $HA_1$ | Career Choice Influencers - Media positively influences Career Choice Influence - Personal | **0.384** | Strong | 0.005 | Accepted |
| $HA_2$ | Career Choice Influence - Media positively influences IT Role Models | -0.15 | Negative | 0.01 | Rejected |
| $HA_3$ | Career Choice Influence - Media positively influences Learning Experiences | -0.261 | Negative | 0.0005 | Accepted |
| $HA_4$ | Culture positively influences Career Choice Influencers - Personal | **0.2** | Medium | 0.005 | Accepted |
| $HA_5$ | Culture positively influences Learning Experiences | **0.26** | Medium | 0.0005 | Accepted |
| $HA_6$ | IT Role Models positively influences Learning Experiences | **0.342** | Strong | 0.0005 | Accepted |
| $HA_7$ | Career Awareness - Current positively Influences Perceptions about Chosen Career | **0.418** | Strong | 0.0005 | Accepted |
| $HA_8$ | Career Awareness - Prior to Studies positively influences Job Title/Descriptions Knowledge | **-** | No Correlation | 0.092 | Rejected |
| $HA_9$ | Career Choice Influencers - Media positively Influences Perceptions about the IT industry | **0.177** | Medium | 0.001 | Accepted |
| $HA_{10}$ | Career Choice Influencers - Personal positively influences Career Awareness - Current | **0.111** | Medium | 0.013 | Accepted |
| $HA_{11}$ | Career Choice Influencers - Personal positively influences Job Title/Description Knowledge | **-** | No Correlation | 0.0005 | Rejected |
| $HA_{12}$ | Culture positively influences Academic Confidence | **0.224** | Medium | 0.0005 | Accepted |
| $HA_{13}$ | Culture positively influences Career Awareness - Current | 0.083 | Weak | 0.0005 | Accepted |
| $HA_{14}$ | Culture positively influences Career Awareness - Prior to Studies | **0.119** | Medium | 0.0005 | Accepted |
| $HA_{15}$ | Culture positively influences Perceptions about the IT industry | **0.21** | Medium | 0.0005 | Accepted |
| $HA_{16}$ | Culture positively influences Personal Attributes | **0.199** | Medium | 0.0005 | Accepted |

| | | | | | |
|---|---|---|---|---|---|
| $HA_{17}$ | IT Role Models positively influences Job Title/Description Knowledge | **-** | No Correlation | 0.006 | Rejected |
| $HA_{18}$ | Learning Experiences positively influence Career Awareness - Current | 0.028 | Weak | 0.13 | Rejected |
| $HA_{19}$ | Job Title/Description Knowledge positively influences Perceptions about IT industry | **-** | No Correlation | 0.57 | Rejected |
| $HA_{20}$ | Learning Experiences positively influence Career Awareness - Prior to Studies | **0.396** | Strong | 0.0005 | Accepted |
| $HA_{21}$ | Learning Experiences positively influence Job Title/Description Knowledge | **-** | No Correlation | 0.011 | Accepted |
| $HA_{22}$ | Perceptions about the IT industry positively influence Perceptions about Chosen Career | **0.452** | Strong | 0.0005 | Accepted |
| $HA_{23}$ | Personal Attributes positively influence Perceptions about Chosen Career | **0.491** | Strong | 0.0005 | Accepted |
| $HA_{24}$ | Academic Confidence positively influence Perceptions about Chosen Career | **0.401** | Strong | 0.0005 | Accepted |

Figure 5-25 presents the final hypotheses and conceptual model. Additionally, the model illustrates the Pearson's *r* value and *p*-value. The figure further highlights the red line rejected hypotheses versus the blue line accepted hypotheses.

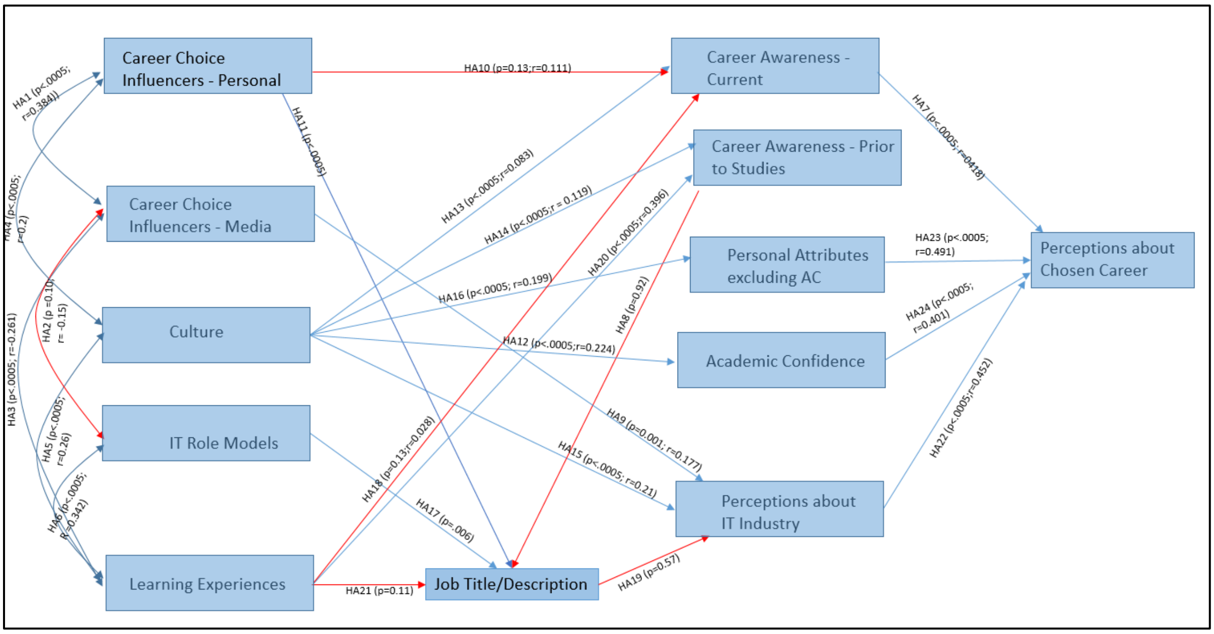


Figure 5-25: Final Model IT Career Choice Model

Six hypotheses were rejected namely $HA_2$, $HA_6$, $HA_{11}$, $HA_{17}$, $HA_{19}$ and $HA_{21}$. The reasons for the hypotheses rejection were the Person *r* results indicating no correlation and the t-test p-value greater than 0.05. Therefore, resulting in the acceptance of 17 hypotheses as indicated by the solid blue line. The final model was confirmed using the CFA and SEM analysis.

### 5.8.5 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) is used to test the degree to which measure factors represent a smaller number of constructs (Hair et al., 2006). Furthermore, Schreiber et al. (2006) indicate the purpose of a CFA analysis is to test the degree to which data fits with the expected structure.

In order to evaluate the conducted CFA, the Goodness-of-Fit target criteria are applicable as presented in Table 5-73. The table specifies the target criteria of numerous items (m) and sample size (n) as well as Chi-square ($\chi^2$), $\chi^2$ per degree of freedom (df), Bentler Comparative Fit Index (CFI), Bentler-Bonnet normed fit index (NFI), Joreksog adjusted Goodness-of-Fit index (AGFI) and the Root Mean Square Error of Approximation (RMSEA) (Hair et al., 2006; Schreiber et al., 2006).

Table 5-73: Goodness-of-Fit Criteria depending on samples size (n) and number of items (m)

| Goodness-of-Fit Criteria depending on samples size (n) and number of items (m) | | | | | | |
|---|---|---|---|---|---|---|
| n.m. Cat. | 1 | 2 | 3 | 4 | 5 | 6 |
| Sample Size | n < 250 | | | 250 < n < 1000 | | |
| No. of items | m ≤ 12 | 12 < m < 30 | m ≥ 30 | m ≤ 12 | 12 < m < 30 | m ≥ 30 |
| $\chi^2$ p | p > .05 | | | | | |
| $\chi^2$/df | ≤ 2 | | | ≤ 3 | | |
| NFI | n.a. | ≥ .95 | ≥ .92 | ≥ .95 | ≥ .92 | ≥ .90 |
| CFI | ≥ .97 | ≥ .95 | ≥ .92 | ≥ .95 | ≥ .92 | ≥ .90 |
| AGFI | ≥ .95 | | | | | |
| RMSEA | ≤ .08 | | | | | |

Using the criteria from Table 5-73, the factors for this study have a sample size (n) of 405 and generally, factors have several items below 30. Therefore the targeted

Chi-square ($\chi^2$) is p > .05 and the target $\chi^2$ per degree of freedom (df) is ≤ 3. The NFI ranges from between ≥ .90 and ≥ .95 similar to the CFI ranging from ≥ .90 and ≥ .95. The target Joreskog adjusted Goodness-of-Fit index (AGFI) is ≥ .95 and the target RMSEA is ≤ .08.

Table 5-74 presents the Confirmatory Factor Analysis results for six factors of the study: *Career Choice Influencers*, *Learning Experiences*, *Career Awareness*, *Personal Attributes*, *Perception about the IT industry* and *Perceptions on Chosen Career*.

The Confirmatory Factor Analysis - 1 (CFA1) results from the independent factors *Career Choice Influencers* and *Learning Experiences* as shown in Table 5-74, are most of the following targets: $\chi^2/df$ (1.42), CFI (0.97), and RMSEA (.032) were achieved. While the following targets for $\chi^2$ p (<.05), NFI (.91), and AGFI (.91) were not met. Therefore independent factors *Career Choice Influencers* and *Learning Experiences* have an acceptable Goodness-of-Fit, the model is fit for prediction.

The Confirmatory Factor Analysis 2 (CFA2) results of the interdependent factors Career Awareness, Personal Attributes, and Perception about the IT industry, have excellent Goodness-of-Fit results (Table 5-74) as all the targets were $\chi^2$ p (.065), $\chi^2/df$ (1.12), NFI (.93), CFI (.99) and RMSEA (.017). However, AGFI (.92) did not meet the target value. Therefore interdependent factors Career Awareness, Personal Attributes, and Perceptions about the IT industry, have an acceptable goodness-of-fit even though the AGFI did not meet its target. However, RMSEA lower than the minimum means the model is fit for prediction.

Table 5-74: CFA Fit Statistics (figures in red denotes acceptable fit)

| | | CFA1 - CCI and LE | | CFA2 - CA PA PIT | | CFA3 - PCC | |
|---|---|---|---|---|---|---|---|
| **Sample size (n); No. of items (m)** | | 405; 27 | | 405; 29 | | 405; 8 | |
| **Absolute/predictive fit** | **Abbr.** | **Target** | **Observed** | **Target** | **Observed** | **Target** | **Observed** |
| Chi-square (Maximum likelihood) | $\chi^2$ | - | 396.97 | - | 359.08 | - | 11.15 |
| | df | - | 280 | - | 320 | - | 13 |
| | **$\chi^2$ p** | ≥ .05 | **< .0005** | ≥ .05 | **.065** | ≥ .05 | **.598** |
| | **$\chi^2$/df** | ≤ 3 | **1.42** | ≤ 3 | **1.12** | ≤ 3 | **0.86** |
| **Comparative Fit Indices** | | | | | | | |
| Bentler-Bonnet normed fit index | **NFI** | ≥ .92 | **.91** | ≥ .92 | **.93** | ≥ .95 | **.99** |
| Bentler comparative fit index | **CFI** | ≥ .92 | **.97** | ≥ .92 | **.99** | ≥ .95 | **1.00** |
| **Other** | | | | | | | |
| Joreskog adjusted GFI | **AGFI** | ≥ .95 | **.91** | ≥ .95 | **.92** | ≥ .95 | **.98** |
| | 95%Lo | ≤ .08 | **.025** | ≤ .08 | **< .0005** | ≤ .08 | **< .0005** |
| Root mean square error of approximation | **RMSEA** | ≤ .08 | **.032** | ≤ .08 | **.017** | ≤ .08 | **< .0005** |
| | 95%Hi | ≤ .08 | **.039** | ≤ .08 | **.026** | ≤ .08 | **.043** |

The Confirmatory Factor Analysis 3 (CFA3) results of dependant factor Perceptions of the Chosen Career have excellent Goodness-of-Fit results (Table 5-74) as all the targets were $\chi^2$ p (.598), $\chi^2$/df (0.86), NFI (.99) CFI(1.00), AGFI (.98) and RMSEA (<.0005). Therefore dependant factor Perceptions of the Chosen Career has an acceptable CFA Goodness-of-Fit meaning the model is fit for prediction.

### 5.8.6 Structural Equation Modelling (SEM) Goodness-of-Fit

The SEM results in Table 5-75 indicate the Goodness-of-Fit. Table 5-75 SEM Fit statistics are within the target range as follows: $\chi^2$/df (1.37) and RMSEA (.033). However, the NFI = .80, $\chi^2$ p <.05, and AGFI = .82 were all outside the required ranges for acceptable Goodness-of-Fit. The RMSEA was lower than the target ≤ 0.8, indicating that the SEM model is fit for predictions.

Table 5-75: SEM Fit Statistics (figures indicated red denote an acceptable fit)

| | | SEM | |
|---|---|---|---|
| **Sample size (n); No. of items (m)** | | 405; 64 | |
| **Absolute/predictive fit** | **Abbr.** | **Target** | **Observed** |
| Chi-square (Maximum likelihood) | $\chi^2$ | - | 2581.32 |
| | df | - | 1884 |
| | **$\chi^2$ p** | ≥ .05 | **< .0005** |
| | **$\chi^2$/df** | ≤ 3 | **1.37** |
| **Comparative Fit Indices** | | | |
| Bentler-Bonnet normed fit index | **NFI** | ≥ .90 | **.80** |
| Bentler comparative fit index | **CFI** | ≥ .90 | **.94** |
| **Other** | | | |
| Joreskog adjusted GFI | **AGFI** | ≥ .95 | **.82** |
| | 95%Lo | ≤ .08 | **.027** |
| Root mean square error of approximation | **RMSEA** | ≤ .08 | **.030** |
| | 95%Hi | ≤ .08 | **.033** |

The SEM Fit statistic and the CFA3-*Perceptions about the Chosen Career* for this study illustrate that the proposed model of factors determining *Perceptions about the Chosen Career* for first-year students is feasible and supported by the results from SEM Goodness-of-Fit analysis.

### 5.8.7 Empirical Model as confirmed by the SEM

Illustrated in Figure 5-26, is the empirical structural equation model for factors influencing first-year students' perceptions of chosen careers. The sub-section uses the final empirical model results from Estimates – SEM1 – Regression *Perceptions about the Chosen Career*, CFA1 – CFA3, and SEM *Perceptions about Chosen Career* Goodness-of-fit.

The SEM results presented (Figure 5-26) an empirical model that indicated that the factor *Academic Confidence* has no causal relationship with *Perceptions about Chosen Career*, therefore, the relationship was removed. The factor *Culture*, a total variance of 53% is explained in the model. Examining the relationships between *Culture* and the other factors:

- Firstly, *Culture* and *Career Awareness – Current*, the squared correlation SRW = .530, while Squared Multiple Correlation (SMC) is 0.315 with a statistically significant relationship ($p$ <.05);
- Secondly, *Culture* and *Personal Attributes* the relationship is statistically significant ($p$ <.05), and SWR (.896) and an SMC of 0.755; and
- Finally, *Culture* and *Career Awareness – Prior to Studies* the relationship has a statistically significant $p$ <.05, with SWR (.393) and SMC (.330); Finally the relationship between *Culture* and *Perceptions about the IT industry* is a statistically significant relationship with a $p$ <.05, SWR (.426) and SMC (.224). The correlation between *Culture* and the four factors is important as *Culture* influences *Academic Confidence*, *Perceptions about the IT industry*, and *Career Awareness* before and during the studies.

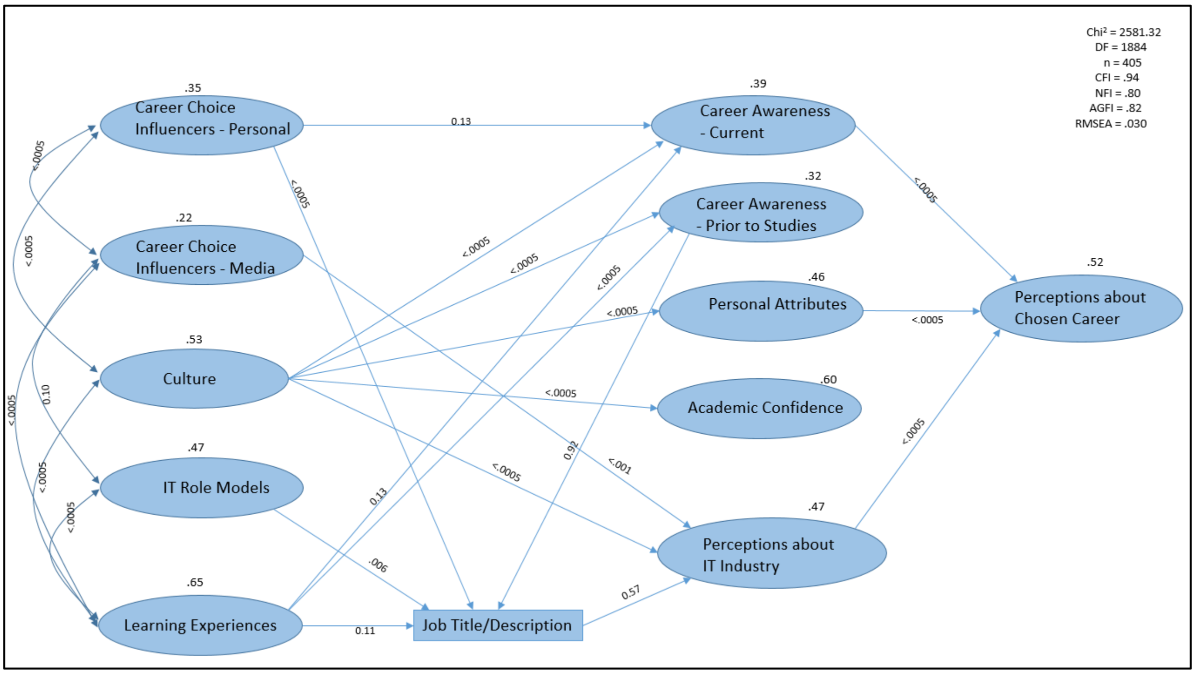


Figure 5-26: Empirical Model for Factors Influencing First-year Students Perceptions of Career Choice

The *Career Awareness – Current* factor has a statistically significant relationship with the *Perceptions about the Chosen Career* factor ($p$ <.05). Additionally, *Career Awareness – Current* has a relationship with the *Culture* factor that is statistically significant ($p$ <.05). However, *Career Awareness – Current* has relationships with *Learning Experiences* and *Career Choice Influencers – Personal*, which are not statistically significant at $p$ = 0.13 for both factors *Learning Experiences* and *Career*

*Choice Influencers – Personal*. The *Career Awareness – Current* factor is responsible for 39% of the total variance explained in the model, therefore *Career Awareness – Current* factor is an important factor that influences students' *Perceptions about their Chosen Careers*.

The *Personal Attributes* factor contributes a 46% total variance explained for the model. The *Personal Attributes* factor has a relationship with *Perceptions of Chosen Career* that is statistically significant ($p$ <.05). Therefore, the *Personal Attributes* factor is a key factor as it influences students' *Perceptions about their Chosen Career*.

*Perceptions about IT Industry* factor explain 52% of the total variance for the model. The *Perceptions about the IT Industry* factor has relationships with three factors, with one relationship not statistically significant ($p$ = 0.57) with *Job Title/Description*. The relationship between *Perceptions about the IT Industry* is important, as *Perceptions about IT Industry* influences students *Perceptions about their Chosen Career* $p$ = <.05, an SWR = .336 and SMC = .458. Therefore, *Perceptions about IT Industry* is an important factor as it is determining factor for perceptions about students' chosen careers.

In summary, the Empirical SEM model for *Perceptions about Career Choice* has shown that three factors namely *Career Awareness – Current*, *Personal Attributes* and *Perceptions about the IT industry* directly influences students perceptions about students' chosen careers. The SEM model illustrated that factor *Culture* is an important factor as it influences *Career Awareness – Current*, *Personal Attributes* and *Perceptions about the IT industry* which directly influences students perceptions about students' chosen careers. Finally, factors *Learning Experiences*, *Career Choice Influencers – Personal*, *Career Choice Influencers – Media* and *Job Title/Description* are important factors as they influence *Career Awareness – Current*, *Personal Attributes* and *Perceptions about the IT industry* directly influences students *Perceptions about Chosen Careers*.

## 5.9 Relationships between Demographic Variables and Factors

Statistical analysis was performed to determine whether any significant relationships were observed between demographic data and factors that influence the student's perceptions of chosen careers. An analysis of variance was to explore the relationships between the demographics and factors.

### 5.9.1 MANOVA and ANOVA Results

A multivariate analysis was conducted on all the factors and the results are presented in Table 5-76.

Table 5-76: MANOVA Statistics – Dependent Variables Total Correct – Job Title/Description to Perceptions about Chosen Career

| Effect | F | D.F. | p |
|---|---|---|---|
| Gender | 3.37 | 12; 390 | <.0005 |
| Age Category | 2.91 | 12; 390 | .001 |
| Home Language | 14.88 | 12; 390 | <.0005 |

The MANOVA results verify the demographic variable: Gender and Home language ($p$ <.05), are statistically significant across all dependent factors. Additionally, the demographic variable Age Category ($p$ = .001), indicating that the factor is statistically significant.

Statistical analysis was performed to determine if there were any significant relationships between the respondents' demographics and chosen career factors. An analysis of variance (ANOVA) is an exploration of statistical relationships between the variables and response to the factors in a study.

### 5.9.2 ANOVA Job Title/Descriptions

A univariate ANOVA analysis was conducted on the dependent factor Job Title/Description, the results are depicted in Table 5-77.

Table 5-77: Univariate ANOVA Statistics – Correct Job Title/Description

| Effect | F-value | D.F. | p | Cohen's d |
|---|---|---|---|---|
| Gender | 6.71 | 1; 401 | .010 | 0.27 |
| Age Category | 1.21 | 1; 401 | .273 | n/a |

| | | | | |
|---|---|---|---|---|
| Home Language | 29.20 | 1; 401 | <.0005 | 0.61 |

The results of the ANOVA analysis found Gender and Home language to be statistically significant, with *p* = .010 and *p* = <.0005 respectively. Both effects Gender and Home language are statistically significant and practically significant as the Cohen's *d* = .027 and Cohen's *d* = .061 respectively.

Table 5-78: Post-hoc Results – Correct Job Title/Description

| Effect | Level 1 | Level 2 | $M_1$ | $M_2$ | t-test p | Cohen's d |
|---|---|---|---|---|---|---|
| Gender | Male | Female | 5.61 | 6.24 | .010 | 0.27 |
| Home Language | Afrikaans/English | African | 6.98 | 5.62 | .000 | 0.61 |

The post-hoc results (Table 5-78), confirmed the differences between the genders for the respondents. Female respondents were more correct in matching Job Title/Descriptions ($M_2$: 6.24) compared to the males ($M_1$: 5.61). Furthermore, the post-hoc results show that there are statistical differences in languages. Students who spoke Afrikaans and English languages combined yielded more positive results ($M_1$: 6.98) compared to the students speaking African languages ($M_2$: 5.62).

The results show the differences in understanding of the job title/descriptions amongst genders and respondents speaking different languages. Furthermore, the results show a limited understanding of Job Title and Descriptions amongst respondents speaking African languages.

### 5.9.3 ANOVA IT Role Models

An ANOVA analysis was conducted for the factor, IT Role Models represented in Table 5-79.

Table 5-79: Univariate ANOVA Results – IT Role Models

| Effect | F-value | D.F. | p | Cohen's d |
|---|---|---|---|---|
| Gender | 0.02 | 1; 401 | .903 | n/a |
| Age Category | 7.05 | 1; 401 | .008 | 0.14 |
| Home Language | 42.75 | 1; 401 | <.0005 | 0.70 |

The results for Home language are statistically significant as the (*p* <.0005) and practically significant with a Cohen's d value of 0.70. Table 5-80 indicates the post hoc results.

Table 5-80: Post-hoc Results – IT Role Models

| Effect | Level 1 | Level 2 | $M_1$ | $M_2$ | t-test p | Cohen's d |
|---|---|---|---|---|---|---|
| Age Category | <21 years | 21+ years | 1.25 | 1.29 | .008 | 0.14 |
| Home Language | Afrikaans/English | African | 1.41 | 1.22 | .000 | 0.70 |

The post-hoc results (Table 5-80) confirm the differences between respondents whose home language is one of the African languages ($M_1$ = 1.22) compared to those with a home language Afrikaans/English ($M_2$ = 1.41). This indicates a marginal difference in the way IT Role Models were perceived by respondents having an Afrikaans/English home language versus those having an African home language.

### 5.9.4 ANOVA Culture

Table 5-81 shows the ANOVA analysis for the factor, Culture.

Table 5-81: Univariate ANOVA Results - Culture

| Effect | F-value | D.F. | p | Cohen's d |
|---|---|---|---|---|
| Gender | 3.56 | 1; 401 | .060 | n/a |
| Age Category | 0.20 | 1; 401 | .658 | n/a |
| Home Language | 8.62 | 1; 401 | .004 | 0.36 |

The results show that Home language is statistically and practically significant ($p$ = .004) and Cohen's d = 0.36. Therefore this depicts a difference in mean values for the Home language. Table 5-82 is the post-hoc results of the Home language.

Table 5-82: Post-hoc Results - Culture

| Effect | Level 1 | Level 2 | $M_1$ | $M_2$ | t-test p | Cohen's d |
|---|---|---|---|---|---|---|
| Home Language | Afrikaans/English | African | 3.77 | 3.57 | .004 | 0.36 |

The post-hoc results in Table 5-82 affirm the differences between respondents Home languages. Respondents having the Home language of Afrikaans/English, their culture was more influential ($M_2$ = 3.77) compared to respondents with an African Home language ($M_1$ = 3.57). The results indicate that Culture has a greater influence on respondents with an Afrikaans/English Home language than the African Home language.

### 5.9.5 ANOVA Career Choice Influencers – Personal

Table 5-83 presents the ANOVA for Career Choice Influencers – Personal.

Table 5-83: Univariate ANOVA Results – Career Choice Influencers - Personal

| Effect | F-value | D.F. | p | Cohen's d |
|---|---|---|---|---|
| Gender | 0.35 | 1; 401 | .557 | n/a |
| Age Category | 0.04 | 1; 401 | .838 | n/a |
| Home Language | 8.11 | 1; 401 | .005 | 0.33 |

The results indicated that Home language to be statistically significant with a $p$ = .005 and practically significant (Cohen's $d$ = 0.33) as indicated in the table. A post-hoc result in Table 5-84 is represented for Career Choice Influencers – Personal.

Table 5-84: Post-hoc Career Choice Influencers - Personal

| Effect | Level 1 | Level 2 | $M_1$ | $M_2$ | t-test p | Cohen's d |
|---|---|---|---|---|---|---|
| Home Language | Afrikaans/English | African | 1.67 | 1.85 | .005 | 0.33 |

The results in Table 5-84 indicated a difference between the respondents, with the respondents of Home Langauge that is African having a mean ($M_2$ = 1.85) compared to the mean ($M_1$ = 1.67) for the Afrikaans/English Home language respondents. Therefore this difference indicates that Career Choice Influencers – Personal has a higher influence for respondents with an African Home language compared to the Afrikaans/English Home language.

### 5.9.6 ANOVA Career Choice Influencers – Media

An ANOVA analysis was undertaken to examine relationships between Career Choice Influencers – Media versus demographics data, Table 5-85 presents the results.

Table 5-85: Univariate ANOVA Results – Career Choice Influencers - Media

| Effect | F-value | D.F. | p | Cohen's d |
|---|---|---|---|---|
| Gender | 15.32 | 1; 401 | <.0005 | 0.39 |
| Age Category | 0.31 | 1; 401 | .577 | n/a |
| Home Language | 21.72 | 1; 401 | <.0005 | 0.56 |

The results presented in the Table 5-85 show that Gender and Home language to be statistically significant with both having a $p$ <.05. Table 5-86 depicts the post-hoc results further examining the Career Choice Influencers – Media factor.

Table 5-86: Post-hoc Results – Career Choice Influencers - Media

| Effect | Level 1 | Level 2 | $M_1$ | $M_2$ | t-test p | Cohen's d |
|---|---|---|---|---|---|---|
| Gender | Male | Female | 2.10 | 2.37 | .000 | 0.39 |
| Home Language | Afrikaans/English | African | 1.96 | 2.34 | .000 | 0.56 |

Firstly, the post-hoc results from Table 5-86 indicated that the Gender differences between Males ($M_1$ = 2.10) and Females ($M_2$ = 2.37). Regarding Career Choice Influencers – Media, the results show female respondents perceive Career Choice Influencers - Media more than male respondents. It can therefore be concluded that Social Media, is an important source of information for female students.

Secondly an observable difference between African ($M_2$ = 2.34) Home languages versus Afrikaans/English ($M_1$ = 1.96) Home languages. The results confirm that Career Choice Influencers – Media is perceived higher by respondents whose home languages are African ($M_2$ = 2.34) compared to those with Afrikaans/English ($M_1$ = 1.96) home languages. Media has a greater influence on career choices for African languages respondents.

### 5.9.7 ANOVA Learning Experiences

Learning Experiences were statistically analysed using the ANOVA with demographics, and Table 5-87 presents the results.

Table 5-87: Univariate ANOVA Results – Learning Experiences

| Effect | F-value | D.F. | p | Cohen's d |
|---|---|---|---|---|
| Gender | 0.11 | 1; 401 | .738 | n/a |
| Age Category | 9.68 | 1; 401 | .002 | 0.52 |
| Home Language | 109.35 | 1; 401 | <.0005 | 1.30 |

The ANOVA results showed Age category to be statistically and practically significant ($p$ = .002; Cohen's $d$ = 0.52). Additionally, home language was statistically and practically significant with a $p$ < .0005 and Cohen's $d$ = 1.30. Table 5-88 displays the post-hoc results for Learning Experiences.

Table 5-88: Post-hoc Results – Learning Experiences

| Effect | Level 1 | Level 2 | $M_1$ | $M_2$ | t-test p | Cohen's d |
|---|---|---|---|---|---|---|
| Age Category | <21 years | 21+ years | 2.89 | 2.30 | .002 | 0.52 |
| Home Language | Afrikaans/English | African | 3.71 | 2.38 | .000 | 1.30 |

The post-hoc results in Table 5-88 confirmed that different age categories have differences in Learning Experiences as those aged under 21 ($M_1$ = 2.89) compared to those 21 years and above ($M_2$ = 2.30). The results indicate that respondents under the age of 21 perceive Learning Experiences higher than those respondents 21 years and above. The Learning Experience includes using and experiencing computers at home and school, before choosing a career. Therefore, respondents under 21 years indicated the Learning experiences as important influencers.

The post-hoc results also showed differences between the home languages of the respondents. Respondents with an African ($M_2$ = 2.38) home language had lower mean scores compared with respondents of Afrikaans/English ($M_1$ = 3.72) home language. Subsequently, the results show Learning Experiences are perceived higher by respondents from Afrikaans/English ($M_1$ = 3.72) home language versus respondents of African home language ($M_2$ = 2.38).

### 5.9.8 ANOVA Career Awareness Prior to Studies

Career Awareness - Prior to Studies factor was interrogated using the ANOVA test with demographic data, Table 5-89 includes the results.

Table 5-89: Univariate ANOVA Results – Career Awareness – Prior to Studies

| Effect | F-value | D.F. | p | Cohen's d |
|---|---|---|---|---|
| Gender | 9.51 | 1; 401 | .002 | 0.31 |
| Age Category | 0.00 | 1; 401 | .950 | n/a |
| Home Language | 12.40 | 1; 401 | <.0005 | 0.41 |

The results show that Gender is statistically and practically significant (p = 0.002; Cohen's *d* = 0.31). Additionally, home language is statistically and practically significant with a *p* <.05 and a Cohen's *d* = 0.41. Therefore the Career Awareness Prior to Studies was further interrogated and Table 5-90 presents the post-hoc results.

Table 5-90: Post-hoc Results – Career Awareness – Prior to Studies

| Effect | Level 1 | Level 2 | $M_1$ | $M_2$ | t-test p | Cohen's d |
|---|---|---|---|---|---|---|
| Gender | Male | Female | 2.87 | 3.17 | .002 | 0.31 |
| Home Language | Afrikaans/English | African | 3.33 | 2.94 | .000 | 0.41 |

The post-hoc results in Table 5-90 revealed gender differences amongst the respondents, with males ($M_1$ = 2.87) compare to females with a mean ($M_2$ = 3.17). The results indicate that female respondents view *Career Awareness Prior to Studies* higher than male respondents. Therefore, females have a higher career awareness at the school level.

Furthermore, the post-hoc results specify differences amongst home languages as African home languages have a mean ($M_1$ = 2.94) versus the mean ($M_2$ = 3.33) Afrikaans/English home languages. The results indicate that respondents of Afrikaans/English home languages perceive *Career Awareness Prior to Studies* higher than those of African home languages.

### 5.9.9 ANOVA Career Awareness - Current

Table 5-91 presents the results of the ANOVA analysis for the *Career Awareness – Current* factor.

Table 5-91: Univariate ANOVA Results – Career Awareness - Current

| Effect | F-value | D.F. | p | Cohen's d |
|---|---|---|---|---|
| Gender | 1.38 | 1; 401 | .242 | n/a |
| Age Category | 6.75 | 1; 401 | .010 | 0.36 |
| Home Language | 5.12 | 1; 401 | .024 | 0.33 |

The ANOVA results show both age category ($p$ = 0.010) and home language ($p$ = 0.024) as statistically significant. Furthermore, both age category Cohen's $d$ = 0.36 and home language Cohen's $d$ = 0.33, indicating both variables are practically significant. *Career Awareness – Current* was further analysed with post-hoc results presented in Table 5-92.

Table 5-92: Post-hoc Results – Career Awareness -Current

| Effect | Level 1 | Level 2 | $M_1$ | $M_2$ | t-test p | Cohen's d |
|---|---|---|---|---|---|---|
| Age Category | <21 years | 21+ years | 3.32 | 3.62 | .010 | 0.36 |
| Home Language | Afrikaans/English | African | 3.21 | 3.48 | .024 | 0.33 |

Initially, the post-hoc results in Table 5-92 indicate differences in perceptions of *Career Awareness - Current* in age categories as respondents 21 years and above have a mean ($M_2$ = 3.62) compared to respondents under 21 years ($M_1$ = 3.32). The results indicate respondents under 21 years currently have a lower perception of careers than respondents who are 21 and younger. Thus, first-year students are less aware of future careers than older first-year students.

Finally, there were differences in the means for some languages, as Afrikaans/English Home languages ($M_1$ = 3.21) compared to the African home languages mean ($M_2$ = 3.48). The results indicate that the respondents of African home languages currently were more career concerned than respondents with Afrikaans/English home languages.

### 5.9.10 ANOVA Perceptions about Chosen Career

Table 5-93 shows the ANOVA results of the factor, *Perceptions about Chosen Career*.

Table 5-93: Univariate ANOVA Results – Perceptions about Chosen Career

| Effect | F-value | D.F. | p | Cohen's d |
|---|---|---|---|---|
| Gender | 5.53 | 1; 401 | .019 | 0.27 |
| Age Category | 3.52 | 1; 401 | .061 | n/a |
| Home Language | 0.89 | 1; 401 | .345 | n/a |

The ANOVA results show gender as both statistically and practically significant with a $p$ = 0.19 and a Cohen's $d$ = 0.27. Therefore the *Perceptions about Chosen Career* factor was further interrogated and the post-hoc results were presented in Table 5-94.

Table 5-94: Post-hoc Results – Perceptions about Chosen Career

| Effect | Level 1 | Level 2 | $M_1$ | $M_2$ | t-test p | Cohen's d |
|---|---|---|---|---|---|---|
| Gender | Male | Female | 4.11 | 4.26 | .019 | 0.27 |

The post-hoc results found gender differences amongst males ($M_1$ = 4.11) and females ($M_2$ = 4.26) regarding *Perceptions about Chosen Career*. The results indicate that female respondents have higher *Perceptions about Chosen Careers* compared to male respondents.

## 5.10 Conclusions

Chapter Five addressed $RO_{4:}$ Empirically evaluate the conceptual model of the factors influencing first-year students' career decisions. In doing so, the chapter explored the data analysis and presentation of the data. First, the chapter explores the data collected from the questionnaire by cleaning, transforming and quantifying the qualitative data for further analysis. The data is further analysed using frequency distributions analysis focusing on the demographic information factors and the results are reported using tables, graphs, and word counts.

Secondly, in addressing the main research objective the chapter responds first to $RQ_{4.1:}$ What factors did the empirical study highlight as influencing students, IT career decisions? In response to the research question, frequency distributions and item analysis was performed using the following statistics; Frequency distributions were conducted on all factors, highlighting agreements, and disagreements for each question. There was agreement on factors Culture, Academic Confidence and Perceptions about the IT Industry. However, there is disagreement on Role Models and Job Title and Description factors.

Exploratory Factor Analysis (EFA) was undertaken to keep items and factors that were best for the model. Eigenvalues and Scree plots were used as part of the EFA and the Cronbach Alpha for reliability. Various one factor and two factor models were established for the factors based on the EFA. Adjustments were undertaken on two different factors from the conceptual model namely; *Career Choice Influencers* (Media and Personal) and *Career Awareness* (Current and Prior to Study). The *Self-Confidence* factor name was changed to *Academic Confidence*. The EFA results presented the items and factors that were used to revise the Hypothesised Model from Chapter Four and Table 5-95 presents the summary of the EFA with Cronbach's Alpha results.

Table 5-95: Summary of the EFA results

| Factors and Items | Factor loading | Cronbach's Alpha | Eigen value | Variance Explained |
|---|---|---|---|---|
| **IT Role Models** | | 0.55 | 1.909 | 47.7 |
| There are IT professionals in my family | .899 | | | |
| I have family working in the IT industry | .896 | | | |
| I have friends working in the IT industry | .480 | | | |
| I have IT role models | .260 | | | |
| **Learning Experiences** | | 0.91 | 4.567 | 65.2 |
| I used computers when I was at school | .876 | | | |
| I received adequate IT training at school, which prepared me for university | .853 | | | |
| I had access to a computer in my secondary school(s) | .839 | | | |
| I was involved in computer projects at school | .835 | | | |
| I used a computer at home when I was growing up | .775 | | | |
| I had access to a computer in my primary school(s) | .754 | | | |
| I started computer programming  whilst at school | .707 | | | |
| **Personal Attributes** | | 0.75 | 2.768 | 46.1 |
| I feel I have a number of good qualities | .755 | | | |
| It is easy for me to achieve my goals | .714 | | | |
| I am a confident person | .706 | | | |
| On the whole, I am satisfied with myself | .678 | | | |
| I am a good problem-solver | .654 | | | |
| I take responsibility for my learning | .550 | | | |
| **Academic Confidence** | | 0.89 | 4.219 | 60.3 |
| Learn all of the material presented in your modules? | .833 | | | |
| Complete all the work that is assigned to you in your modules? | .813 | | | |
| Do the difficult work that is assigned in your modules? | .7’s97 | | | |
| Understand complicated ideas when they are presented in your modules? | .758 | | | |
| Complete your diploma/degree programme in the required minimum time? | .758 | | | |
| Pass all your modules? | .754 | | | |
| Remember what you have learned in your current modules? | .714 | | | |
| **Perceptions about the IT industry** | | 0.86 | 4.308 | 47.9 |
| There is good job security in the IT industry | .750 | | | |
| A person with an IT qualification will find work easily | .724 | | | |
| There are many jobs available in the IT industry | .724 | | | |
| People working in the IT industry earn good salaries | .723 | | | |
| An IT career ensures  long term employment | .703 | | | |

| | | | | |
|---|---|---|---|---|
| A person with an IT qualification can work internationally | .678 | | | |
| An IT career has a good image/status | .668 | | | |
| There are good prospects for developing new skills in the IT industry | .662 | | | |
| The IT industry provides the opportunity to become an IT entrepreneur | .580 | | | |
| **Perceptions about Chosen Career** | | 0.87 | 4.189 | 52.4 |
| My chosen career will be rewarding | .789 | | | |
| There are many jobs available in the career I have chosen | .747 | | | |
| I will learn new skills in my chosen career | .743 | | | |
| I will have opportunities to work in different kinds of business functions in my chosen career | .727 | | | |
| I would recommend my career choice to others | .719 | | | |
| I am happy with my career choice | .713 | | | |
| There are good prospects for a better than average starting salary in the career I have chosen | .680 | | | |
| I have to keep ahead of change and new technologies in my chosen career | .663 | | | |
| **Career Awareness** | | | 4.315 | 71.9 |
| **Career Awareness - Prior to Studies** | | 0.86 | | |
| I had an understanding of Computer Science (CS) careers before I enrolled at university | .893 | | | |
| I did have an understanding of Information Systems (IS) careers before I enrolled at university | .871 | | | |
| I did have an understanding of Information Technology (IT) careers before I enrolled at university | .860 | | | |
| **Career Awareness - Current** | | 0.74 | | |
| I can explain the main job functions for my future job | .854 | | | |
| I know what job I want to do in the future | .797 | | | |
| I know which company I want to work for after I graduate | .760 | | | |
| **Culture** | | 0.7 | 4.252 | 53.2 |
| In my culture, it is important to have a qualification | .751 | | | |
| In my culture, it is important that women have a formal qualification | .737 | | | |
| In my culture, women are expected to have a full-time job | .731 | | | |
| People in my culture are religious | .638 | | | |
| In my culture, people encourage children to study towards professional careers, such as a doctor or a chartered accountant | .577 | | | |
| In my culture, people have a clear understanding of IT careers | .850 | | | |

| | | | | |
|---|---|---|---|---|
| In my culture, people have a clear understanding of professional careers, such as a chartered accountant | .798 | | | |
| In my culture, IT is seen as a career for men and women | .602 | | | |
| **Career Choice Influencers** | | | 4.574 | 57.2 |
| **Career Choice Influencers - Personal** | | 0.78 | | |
| Teachers | .777 | | | |
| Career guidance advisors/teachers | .738 | | | |
| Family | .708 | | | |
| My religious circle | .686 | | | |
| Friends | .661 | | | |
| Role models | .488 | | | |
| **Career Choice Influencers - Media** | | 0.74 | | |
| The Internet | .884 | | | |
| Social media | .863 | | | |

Finally in addressing $RQ_{4.1}$ the Cronbach's Alpha analysis results indicated the reliability of the factors which was very good for most factors except for Role Models rating as poor. The chapter then, addressed $RQ_{4.2:}$ What factors influence the career decisions of the IT students, compared to Non-IT students? To answer the question inferential statistics were performed using the t-test to determine the relationships between the demographic factors. Some relationships were noteworthy as they were statistically and practically significant between the factors namely; Job Title and Descriptions, *Career Choice Influencers – Media*, *Perceptions about the IT Industry*, *Career Awareness – Prior to Studies* and *Perceptions about the Chosen Career* and groups (IT and Non-IT) data.

Finally, the chapter addressed $RQ_{4.3:}$ What factors influence first-year students' IT career choice? To address the question the chapter performed Correlation Analysis, Confirmatory Factor Analysis (CFA), and Structural Equation Model (SEM). The conceptual model to be tested for fitness in measuring Perceptions of Chosen Careers using correlations to determine which factors correlated and hypotheses were revised. The model was further tested using the CFA and SEM to determine which factors statistically influence *Perceptions about the Chosen Career*. The CFA and SEM resulted in the conclusion of whether the model was good for fit and the results were positive and a final model was presented with hypotheses that were accepted.

The relationships between the demographic variables and the factors were conducted through MANOVA and ANOVA testing. The results showed that the different genders, home languages and ages had significant findings on the independent factors. The clear differences between factors age (under 21 years and 21 years and above), gender (male and female) and home languages (African and Afrikaans/English). In conclusion, the chapter responded to the $RO_{4:}$ Empirically evaluate the conceptual model of the factors influencing first-year students' career decisions by addressing $RQ_{4.1}$ – $RQ_{4.3}$. The final empirical model is presented in Figure 5-27.

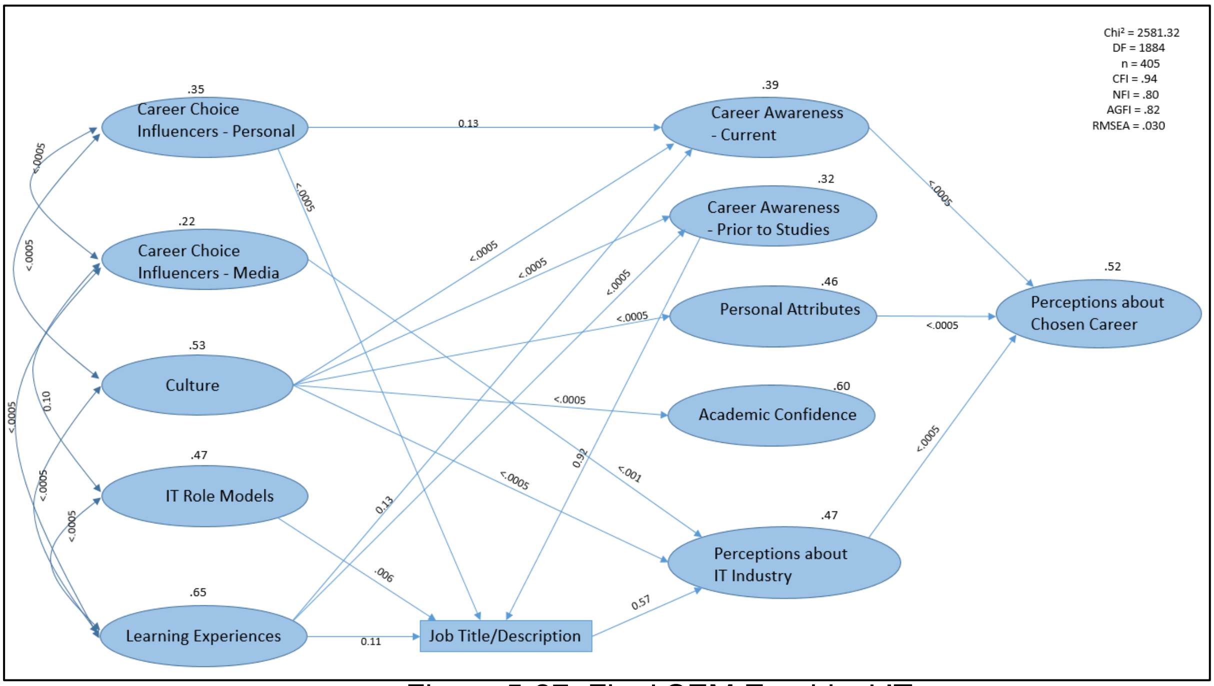


Figure 5-27: Final SEM Empirical IT Career Choice Model

The next chapter, Chapter Six will focus on the interpretation of the results by examining the results of the model and linking them with literature and summarising findings. Chapter Six will aim to address $RO_5$: Identify strategies that can be used to address the factors influencing first-year students' career decisions.

# Chapter 6: Conclusions, Recommendations and Future Research

## 6.1 Introduction

The number of scholars choosing IT careers is declining and there is limited awareness amongst IT career teachers and parents. Various factors influence students' career decisions, such as self-efficacy, parents and role models. The study started by presenting the problem statement, which is the global issue of increased demand for IT professionals. The study focused on the underlying reason for the increased demand which is the limited number of IT professionals produced by Higher Education Institutions globally, as well as in South Africa. The study investigated the factors that influence first-year students in choosing IT careers. The main objective of the study was to identify the factors that influence first-year students in choosing IT careers.

The study defined Higher Education, listed the challenges HEIs face globally and focused on the location of the study, NMU. The study compared NMU with other higher education institutions, particularly regarding student's enrolments as NMU ranks as an above-average university in South Africa. Further NMU was ranked 4$^{th}$ in South African universities by The World University Rankings (The World University Rankings, 2021). The study then identified theories that are used for decision-making and factors that influence career decisions. The results were used to develop a conceptual model that was presented at the Southern African Computer Lecturers' Association SACLA'20 conference (Twani et al., 2020).

The conceptual model was statistically tested using inferential statistics; namely, One-Sample t-test, EFA, Correlations, CFA and SEM. The study provides a new model for future studies on the factors influencing first-year students' career decisions. The study can be used as a guide for investigating specific influences on career decisions, such as culture, parents, learning experience etc. The results were used for making specific recommendations.

The conclusions and recommendations of this study are presented in this chapter. Chapter Six addresses the research objectives namely: $RQ_{5.1}$: How can the IT Career Choice Model be used to inform strategies to create IT Career awareness? and $RQ_{5.2}$: What strategies can be used to address the factors influencing the decision of students to pursue IT careers? In addressing $RQ_{5.1}$ Chapter Six presents the summary of the research study, by synthesising the results, from the preceding Chapter Five. In addressing $RQ_{5.2}$, the chapter focuses on the limitations and contributions of the research study and proposes strategies to create IT career awareness amongst scholars.

Finally, Chapter Six answers the $RQ_M$: What factors influence first-year students' to decide to pursue a career in IT? and addresses the $RO_M$: Identify the factors influencing first-year students career decision to pursue an IT career. Figure 6-1 presents the overview of Chapter Six.


Figure 6-1: Chapter Layout

## 6.2 Summary of the study findings

Chapter One to Chapter Five addressed the supporting research questions ($RQ_1$ – $RQ_5$) and supporting research objectives ($RO_1$ to $RO_5$). Chapter Six answered the $RQ_M$ and addressed $RO_M$, and these are further elaborated on in this chapter.

Chapter One presented insights into the background of the study, focusing on the factors that influence career decisions and theories used in decision making. The context of the study at NMU was outlined and the problem statement, research questions and research objectives of the study were. Finally, the chapter outlined the research significance, the research philosophy, design and methodology, which includes the data collection process and the data analysis.

### 6.2.1 $RQ_1$: Summary of Findings

Chapter Two provided an extensive literature study that detailed the context of the research study, Higher education and the challenges faced in Higher Education. The chapter focuses on Higher education in South Africa and at NMU, furthermore, the chapter compared NMU to other universities in South Africa. The chapter addresses $RQ_{1.1:}$ What is the environment of Higher Education in South Africa? The chapter addressed the questions by focusing on the history and universal challenges in HE. Furthermore, the chapter focused on challenges in HEIs in South Africa and compared NMU against the different HEIs, which indicated that NMU is an above-average ranking university.

$RQ_{1.2:}$ What IT Curricula are available at Higher Education? addressing the Computing curricula, the chapter compares three IT curricula namely IS, IT and CS applied at NMU by using international curricula standards by the ACM. Chapter Two differentiated between CS, IS, and IT by showing the important outcomes for each curriculum. The chapter finally, discussed different career paths derived from the computing curricula (CS, IS, and IT).

$RQ_{1.3}$: What IT Careers are available in Industry? In addressing the question, a landscape of the different IT career paths was discussed from the ACM Curricula. The

ACM Curricula further noted that IT graduates need technical and non-technical skills to fill the demand of IT professionals. Finally, the chapter presented a summary of the top ten jobs that are in demand with the rise of the 4IR (Table 6-1). The jobs or careers are presently in demand and into the future (CC2020, 2020; Schofield & Dwolatzky, 2019). Therefore, HEIs and the IT industry need to train but also advocate the skills and careers in demand to the future IT professionals.

Table 6-1: 4IR Top Ten jobs

| **Top 10 4IR IT jobs** |
|---|
| Information Security |
| DevOps |
| Artificial Intelligence/Blockchain |
| Internet of things Specialist |
| System/Business Analyst |
| Programming/Software Dev/Mobile and Web Developer |
| Database designer and administrator |
| Network analyst/administrator/engineers |
| Data analyst/scientist |
| ICT Project Management |
| Help desk and desktop support |

$RQ_{1.1}$, $RQ_{1.2}$ and $RQ_{1.3}$ are answered with their findings highlighted in the chapter therefore, Chapter Two addresses $RO_{1:}$ Investigate Higher Education in South Africa and current IT Careers.

### 6.2.2 RQ$_2$: Summary of Findings

Chapter Three provided the study's second in-depth literature review conducted to answer $RQ_{2.1}$ and $RQ_{2.1}$. The chapter discussed the process undertaken for the SLR and synthesised the literature. The chapter addressed $RQ_{2.1}$, by synthesis, the SLR results on theories and the decision-making theories, namely: SCCT, TRA and CRT. The chapter investigated the related work on each of the theories. Further, the chapter addressed $RQ_{2.1}$, by synthesising, the SLR findings on the factors influencing career decision making. Seven factors/constructs were identified, namely; Background Information, Socialisers, Learning Experiences, Self-Efficacy, Career Perception and Expectations and Career Awareness leading to a Choice of an IT Career.

The chapter used the theories' constructs/factors to build a conceptual model for an IT Career Choice. Therefore, by presenting a conceptual model and $RQ_{2.3:}$ Which factors must be included in a conceptual model to understand the career decisions of first-year students?

### 6.2.3 $RQ_3$: Summary of Findings

Chapter Four introduced the research onion for addressing $RQ_{3.1}$ – $RQ_{3.2}$ in discussing the research philosophy, approach, strategies, choices, time horizons and data collections and analysis techniques and procedures. $RQ_{3.1:}$ What research design can be used for the study? The chapter focused on the strategy applied, which were surveys. Additionally, in discussing research choices the chapter focused on mixed methods and justified their application in the study. The chapter examined the data collection method as it is mixed quantitative and qualitative and the data analysis methods that were used in this study.

In addressing $RQ_{3.2:}$ What research instruments can be used for data collection? The chapter presented the questionnaire as the tool to collect data and the procedures used to test the data collection instrument, to ensure the reliability and validity of the instrument. The chapter details how a pilot study was administered and how the issues were addressed in the study. Finally, the chapter discussed the ethics approval for the study.

### 6.2.4 $RQ_4$: Summary of Findings

Chapter Five presented the empirical results of the model proposed in Chapter Three, thereby addressing the research questions; $RQ_{4.1:}$ What factors did the empirical study highlight as influencing students, IT career decisions? In Chapter Five, the results from the statistical analysis, and the EFA were demonstrated to determine the relevant factors. The EFA and correlation analysis indicated four factors namely: Career Awareness, Personal Attributes, Academic Confidence and Perceptions about the IT Industry, as positively influencing decisions on first-year students' chosen careers.

$RQ_{4.2}$: What factors influence the career decisions of the IT students, compared to those of Non-IT students? In addressing the questions, the chapter used a One-Sample t-test to determine the differences between the groups and identified five factors where the IT and Non-IT groups differ. The results indicated a statistical significance between the groups as the IT group means were higher compared to the Non-IT group for the factors: *Job Title/Descriptions*, *Career Choice Influencers – Media*, *Perceptions about IT industry*, *Career Awareness* and *Perceptions about the Chosen Career*. Additionally, statistical differences were indicated amongst the demographic variables, age, home language and gender. The study indicated home language and gender differences were statistically significant for *Career Choice Influencers*, *Learning Experiences* and *IT Role Models*. The demographic variable age was statistically significant for *Career Awareness* and *Learning Experiences*.

$RQ_{4.3}$: What factors influence first-year students' IT career choice? In addressing the research question, the chapter presented a Confirmatory Factor Analysis and Structural Equation Modelling to determine factors that influence IT career choices. The CFA and SEM results indicated three factors directly influence the chosen career decision, namely: *Career Awareness – Current*, *Personal Attributes*, and *Perceptions about the IT Industry*, excluding *Academic Confidence*. Therefore the results addressed $RO_4$: Empirically evaluate the conceptual model of the factors influencing first-year students' career decisions.

## 6.3 Summary of the Conceptual Model findings

The research findings for the study are discussed based on the final factors identified, which are presented in Chapter 5. The findings are discussed to identify the relationships between the two groups, IT and Non-IT, using the one-sample t-test. The results indicated a statistical and small practical difference between the IT and Non-IT groups on the factors, *Job Title/Description*, *Career Choice Influencers – Media*, *Perceptions about the IT Industry*, *Career Awareness – Prior to Studies* and *Perceptions about Chosen Career*.

The relationships between the demographic variables and the factors were conducted by MANOVA and ANOVA testing. The MANOVA results showed that different demographic variables, namely; Gender, Age Category and Home language influence the factors namely; *Job Title/Description*, *IT Role Models*, *Culture*, *Career Choice Influencer – Personal*, *Career Choice Influencers – Media*, *Learning Experience*, *Career Awareness – Prior to Studies*, *Career Awareness – Current* and *Perceptions about Chosen Career*.

### 6.3.1 IT Role Models

IT Role modes are helpful to influence and support learning new skills which can lead to career choices (Finzel & Deininger, 2018). In support, Buschor et al. (2014) state that role models are important for students as a source of influence. The study findings were indifferent as to the results partially confirmed literature sources.

The Cronbach's alpha coefficient (0.55) indicated that the factor *IT Role Model* had poor reliability, in support, the EFA findings indicated the factor explained only 47.7% of the total variance. The t-test results ($p < .0005$; Cohen's $d = 1.20$) showed the significance of the factor. The descriptive statistics indicated that 72% of respondents identified *IT Role Models* as not important for their career choice. Hence on the SEM results, the factor influences *Job Title/Descriptions*, which influenced *Career Awareness* and indirectly influences *Perceptions about the IT Industry*.

However, the ANOVA analysis indicated that the factor *IT Role Models*, such as IT professionals, engineers, etc. influenced students from different home languages on their career decision. The findings indicate that amongst the speakers of African languages ($M = 1.22$), *IT Role Models* had less influence on the first-year students' career choice compared to Afrikaans/English ($M = 1.44$) speakers. This is supported by Mein et al. (2018) as they indicate that students with role models in the field tend to pursue similar careers as their role models. Additionally, Chachashvili-Bolotin et al. (2016) argue that parental education has more influence on students' career choices. Perhaps parents education could be the reason why *IT Role Models* have a higher influence amongst Afrikaans/English students' career decisions.

### 6.3.2 Culture

*Culture* is defined as customs and habits that characterise a certain society or nation. Additionally, culture includes the way people in society dress, the language they speak, family lives, work patterns and leisure pursuits (Itulua-Abumere, 2013). Zimmermann (2017) summarises culture as the beliefs, values and material objects that constitute people's way of life. Gathungu and Mwangi (2014) indicate that *Culture* influences career choices.

The EFA results indicated that *Culture* explained 53.2% total variance in a two factor model. The factors were named *Culture Expectations* with 5 items and *Culture Career Understanding* with three items, however, throughout the study, culture was considered as a single factor through the recommendation of the NMU Statistician. *Culture* indirectly influences *Perceptions about Chosen Careers* as it influences *Career Awareness (Current* and *Prior to Studies*), *Personal-Attributes*, *Academic Confidence* and *Perceptions about IT Industry*. The descriptive statistics indicated that 64% agreed culture is important for their career choice decision.

The ANOVA results indicated differences between students from different home languages as the *Culture* of African speaking students ($M = 3.57$) scored less than Afrikaans/English speaking students ($M = 3.77$). On the contrary, Chinyamurindi et al. (2021) concluded that ethnic expectations were perceived by the respondents as having low levels of influence when making career decisions. In their study, investigating the influence of culture on career decisions, Calitz et al. (2020) indicated that South African ethnic groups had differences in the role that culture influences a career choice. Therefore, the results of this study are similar, as *Culture* amongst the Afrikaans/English speakers compared to African languages speakers differs statistically ($p < .004$; Cohen's $d = 0.36$) as indicated in Table 5-82.

### 6.3.3 Career Choice Influencers

Parents play an important role in influencing their children's career decisions in societies (Sharif et al., 2019). Wang et al. (2015) concur that parents play a role in advising their children to register for computer courses. The C*areer Choice Influencers* were split into two variables, media and personal. The personal variables were; mother, father, etc. Media as an influencer included social networks and the Internet.

In the study's statistical findings, 33% (n = 133) of the respondents indicated that family had not influenced their career choice. The family influence was their mother and father. The findings are contrary to the literature, as Chinyamurindi et al. (2021) state that parents are influencers in career decision-making, specifically while scholars are at high school. Mein et al. (2018) support the findings that parents do influence their children's career decisions. Another reason that explains the family influence is the parents' level of education. Mein et al. (2018) state that in families where a father is an engineer, students were later influenced to become engineers. However, the findings of this study, indicated that some respondents' parents were deceased, while others indicated none or N/A for parents. A disturbing finding of the study was that 35% (n = 143) of the respondents did not indicate that they had a father and 19% (n = 79) did not indicate that they had a mother. This could mean the parents did not play an active role in their lives and explains the low influence of family on the career decisions of their children.

Forty-seven percent (n = 192) of the respondents indicated that personal influencers were not important for their career choice. Further, the factor *Career choice influencers – Personal* differed amongst the home languages of African (M = 1.85) and Afrikaans/English (M = 1.65). Sharif et al. (2019) argue that in the Eastern Culture, the most powerful influence is making a difference in society and therefore parents pressure their children to choose a particular career. That could explain the difference that African language speakers are more pressured to make a difference in their communities hence there is higher influence. Contrary to that, Wang et al. (2015) state that household income could be the pressure that may be used as an influencer which would explain the higher mean for the African language speakers.

The descriptive statistics indicated that 52% (n = 212) of respondents agreed that *Career Choice Influencers - Media* are key for their career choice decision. A further examination of the *Career Choice influencers – Media* differences amongst gender and languages, a difference between Females (M = 2.37) and males (M = 2.10). In agreement, Lee et al. (2019) confirmed that media was important for students in their studies and was a determinant for students' career decisions. However, they did not find statistical differences for media between males and females influencing their career decision. In support, Matthew et al., (2018) found that media was an influencer, contrary to this study, as differences were found as females used media more to assist with career choice. Additionally, the study found that African ($M = 2.34$) students were more influenced by media than Afrikaans/English ($M = 1.96$) speaking students.

The Pearson *r* correlation findings indicated that *Career Choice Influencers - Personal* had positive correlations ($r > .300$) with most of the factors namely; *IT Role Models*, *Learning Experiences*, *Personal Attributes*. Additionally, *Career Choice Influencers Media* had correlations with *Personal Attributes* and *Perceptions about the Chosen Career*. The results of the CFA and SEM indicate that career choice influencers affect career choices, which several other studies support (Chinyamurindi et al., 2021; Mein et al., 2018; Wang et al., 2015).

### 6.3.4 Learning Experiences

Learning experience or prior experience includes experiences with computers in the school or the home environment (Balakrishnan & Low, 2016). In support, Downes and Looker (2011) argue that prior computer experience is important, therefore it is important to integrate home and school computing use by building abilities and learning experience as part of the scholar's core experiences. Balakrishnan and Low (2016) state that learning experiences influence students to choose a career in STEM fields.

The descriptive statistics indicated that 50% (n = 206) of the respondents did not agree that *Learning Experiences* are important for their chosen career. The *Learning Experience* items had more than 70% of the respondents disagreeing with statements such as; *I received adequate IT training at school, which prepared me for university*, *I was involved in computer projects at school*, *I started computer programming whilst at school* and *I did some programming on my mobile while growing up*.

Furthermore, the results indicated a statistical and practical significant difference in *Learning Experiences* for different age categories and languages. The findings indicated students under 21 years (M = 2.89) had relied more on learning experiences compared to those 21 years and older (M = 2.30). The results are in agreement with Nugent et al. (2015). They found that learning experiences differ based on younger or older ages. The study findings further indicated a difference between Afrikaans/English speakers (M = 3.71), compared to African (M = 2.38) language speakers in the perception of learning experiences. The results indicate ethnic groups could be the reason for differences in the different language groups, regarding learning experiences. On the contrary, Wang et al. (2015) indicated differences when comparing learning experiences of different genders.

The EFA results indicated that *Learning Experiences* explained 65.2% of the total variances. The t-test indicated that Learning Experiences were both statistically and practically significant ($p$ < .005; Cohen's $d$ = 0.60). However, the descriptive results showed that for 51% (n = 206) of the respondents, learning experiences did not influence their career decision.

The *Learning Experiences* factor had a strong correlation with *Career Awareness – Prior to Studies* ($r$ >.300), therefore, also an indirect influence on the factor *Perceptions about the Chosen Career*. This is supported by Alshahrani et al. (2018) as they state that for students who studied computing at school, the learning experience was significant in influencing students' decision to choose a career. Several studies indicate learning experiences as important in career choices (Cohen & Parsotam, 2010; Nugent et al., 2015). Careers choices are made by students who are academically well prepared from high school, rather than specific preparation for a chosen career (Dick & Rallis, 1991). Therefore, indicating learning experiences as an important factor.

### 6.3.5 Personal Attributes

Personal Attributes or self-efficacy is concerned with an individual's judgement of his/her abilities in working with computers, being a good problem solver and being confident (Alshahrani et al., 2018). Mayer and Oosthuizen (2020) add that problem-solving skills are highly important for future career success. Self-efficacy is a factor that affects students' decisions and could be influenced by basic education in South Africa (Alexander & Twinomurinzi, 2012). Furthermore, positive personal attributes can be encouraged by families and educators by encouraging problem-solving, working with computers etc. (Wang et al., 2015).

The findings of the study indicated that most items for the factor *Personal Attributes* were above 86% (n = 350), illustrating that the students have a positive view about the personal attributes for their chosen career. The Personal Attributes factor had 80% and above of the respondents, strongly agreeing with the items; *I expect to do well in my subjects*, *I take responsibility for my learning, I do my work as well as most other people* and *I feel I have a number of good qualities*. In support, the EFA results indicated the factor explained 46.1% of the total variance. For the factor, there were no other statistically significant findings for personal attributes, when compared to other variables. However, several studies highlight a difference in the level of confidence between genders or academic groups (Alexander et al., 2012; Alshahrani et al., 2018; Matthew et al., 2018; Wang et al., 2015).

The correlation analysis results showed the importance of the factor *Personal Attributes* as it had a strong positive correlation ($r > .300$) with *Academic Confidence*, *Perceptions about the IT Industry*, *Career Awareness – Prior to Studies*, and *Career Awareness – Current*. Additionally, the *Personal Attributes* factor directly influences the *Perceptions about the Chosen Career* as the Pearson Correlation ($r = .491$) strongly indicates. Matthew et al. (2018) found that personal attributes such as interest have been found important on students' perceptions and decision to choose a career.

### 6.3.6 Academic Confidence

The *Academic Confidence* factor is similar to the *Personal Attributes* factor, however, it focuses on the confidence of doing well academically. The *Academic Confidence* factor name was changed from *Self-Confidence*, as the factor focused on academic confidence. It accommodated students showing confidence in completing modules, understanding complicated models and having the confidence of completing their degree in the allotted time.

The descriptive statistics indicated that 65% (n = 262) and above of the respondents had extreme confidence in namely; *completing all the work assigned in their modules*, *I will learn and remember all materials presented for my modules*, and *I will complete and pass my modules*. Overall, the results of the descriptive statistics indicated a positive response from the students, as 75% (n = 305) of respondents have extreme confidence in *doing well and will pass their chosen career choice*. The EFA findings indicated 60.3% explained total variance by the *Academic Confidence* factor which strongly supports the importance of academic confidence amongst students. In support, several studies indicate academic confidence as important for students when choosing careers (Appianing & Van Eck, 2015).

*Academic Confidence* has a strong positive correlation with *Perceptions about the IT industry*. Additionally, the Pearson's correlation results ($r$ = .401), concurred as they indicate *Academic Confidence* strongly influences the *Perceptions about the Chosen Career*. Lewis and Anderson (2011) support the results as they state that students consider how they will do when deciding to major in CS.

### 6.3.7 Career Awareness

Lyon et al. (2021) state that it is important to build awareness among novice students regarding IT courses so that students know what to expect from courses and are able and prepared to handle the course. EFA results for *Career Awareness* was split into two factors, *Career Awareness – Prior to Studies* and *Career Awareness – Current*. The factor explained 71.9% of the total variance. Additionally, the descriptive statistics for the *Career Awareness – Prior to Studies* indicated that 37% (n = 151) and *Career Awareness – Current* 39% (n = 158) of respondents neither agreed nor disagreed regarding the influence of career awareness before choosing their studies (Qazi et al., 2020). A further examination of the *Careers Awareness – Prior to Studies factor*, indicated statistical and small practical ($p$ < .0005; Cohen's $d$ = 0.48) differences between the IT group (M = 3.18) and the Non-IT group (M = 2.73). These study results are similar to Wang et al. (2015) as they found that the IT group has a deeper understanding of different careers when compared to the Non-IT.

The *Career Awareness – Current* descriptive statistics indicated that 47% (n = 192) of the respondents had an awareness of careers during their studies compared to career awareness before enrolling for the studies. Additionally, more than 71% (n = 289) of respondents indicated items, such as *I have an understanding of career paths for my qualification*, and *I know what job I want to do*. The results indicated that first-year students thought they had a good understanding of careers upon registering.

In support, Twani et al. (2020) in their results showed that IT students had a good understanding of job titles. Further, the descriptive statistics indicated 46% (n = 188) and above of the respondents *did not understand Information Systems as a career* and *did not understand the differences between the different computing streams* (IS, CS and IT). The findings were similar to Calitz et al. (2011) in their study. They found that students lacked in-depth knowledge and awareness of careers. In support, Esterhuyse et al. (2019) in their study, found that students generally are not aware of IT career paths.

Additionally, the t-test results indicated statistical and practical significance for the variables age and home language. The differences in respondents 21 years and over (M = 3.32), showed a higher current understanding of careers compared to those under 21 years (M = 3.36). African language speakers (M = 3.48) had a higher current understanding of career versus Afrikaans/English speakers (M = 3.21). The factor, *Job Title/Descriptions* findings indicated the respondent's gender made a difference in understanding job titles, with females (M = 6.24) compared to males (M = 5.61), which is similar to home languages, as African languages (M = 5.62) compared to Afrikaans/English (M = 6.98). Several studies compare gender and different academic groups, not age and language or ethnicity (Govender & Khumalo, 2014; Wang et al., 2015). However, Govender and Khumalo (2014) indicate that children from disadvantaged schools have limited career awareness, which contradicts the findings of this study as African language speakers have a deeper understanding.

The *Career Awareness – Prior to Studies* factor did not have strong correlations with other factors. The *Career Awareness – Current* factor, however, had a positive correlation on *Perceptions about Chosen Career*, with a Pearson Correlation of *r* =

.418. In support of this study's results, Wang et al. (2015) found similar findings as they state that career awareness is increased through exposure and encouragement from influencers, which provides influence toward computing careers.

### 6.3.8 Perceptions about the IT industry

Alexander and Twinomurinzi, (2012) found that perceptions and outcomes expectations outweigh the self-efficacy in importance. Additionally, stereotypes leading to perceptions may have an impact on career decision making (Buschor et al., 2014). In support, Cohen and Parsotam (2010) state that perceptions must take into account the misperceptions that students may have of IT careers.

The frequency descriptions results indicated that 85% (n = 345) of the respondents had positive perceptions about the IT industry. The Perceptions about the IT industry factor had 79% (n = 318) of the respondents indicating for the following items; *an IT career has a good image*, *IT career ensures long term employment*, *a person with an IT qualification can work internationally*, *there are good prospects for new skills in the IT industry*, *IT industry provides the opportunity to become an entrepreneur* and *there is good job security in the IT industry*, as positive. Additionally, the EFA results indicate that *Perceptions about the IT industry* factor explained 47.9% of the total variance.

The t-test for the factor *Perceptions about the IT industry* indicated a statistically ($p < .0005$) and a small practical significance (Cohen's $d = 0.43$) between the IT group ($M = 4.07$) and the Non-IT group ($M = 3.83$). The results indicate a greater understanding of perceptions of the IT industry of the IT group compared to the Non-IT group. However, Appianing and Van Eck (2018) study did not find statistical differences or similarities when comparing IT groups versus Non-IT majors. Additionally, the factor *Perceptions about the IT industry* strongly correlated with *Perceptions about Chosen Career* as the Pearson Correlation being $r = .452$.

### 6.3.9 Perception about Chosen Career

Developing skills at HE will increase the employability of students (Dubey et al., 2021). The descriptive statistics results indicated that 85% (n = 345) of the students responded positively to the statements; *I am happy with my chosen career*, *my chosen career is rewarding* and *I have to keep ahead of change and new technologies in my chosen career*. Overall, 95% (n = 366) of the respondents indicated a positive response regarding their chosen career. In support, the EFA results explained 52.4% of the total variance. Furthermore, the factor showed excellent reliability, with a Cronbach's Alpha value $\alpha$ = .87. Gender differences were found for the factor *Perceptions about Chosen Careers.* This is statistically ($p$ < .005) and practically large and significant (Cohen's $d$ = 1.43). Female (M = 4.26) respondents had higher perceptions about their chosen career compared to males (M = 4.11). Similar results were indicated by Grigg et al. (2018). They showed that gender affects career choices.

There are statistically and practically significant ($p$ = .019; Cohen's $d$ = 0.36) differences between the IT group (M = 4.23) and the Non-IT group (M = 4.11) regarding career perceptions. The results indicated higher perceptions of the chosen career amongst the respondents. Contrary to this study's results, Appianing and Van Eck's (2015) results indicated no statistical differences amongst different academic majors groupings. It is difficult to explain what could be the reason for the differences, an in-depth investigation could provide additional explanations.

The Pearson Correlations ($r$ > .300) indicated four factors that strongly influence the *Perceptions about Chosen Careers,* namely; *Academic Confidence*, *Perceptions about the IT Industry*, *Career Awareness – Prior to Studies* and *Career Awareness – Current*. The CFA and SEM results confirmed *Career Awareness – Current*, *Personal Attributes* and *Perceptions about IT industry* as good predictors of influences that affect perceptions of chosen career. Furthermore, the CFA and SEM results confirmed *Culture*, *Career Choice Influencer* and *Learning Experiences* as indirect predictors of career choice perceptions.

### 6.4 IT Career Choice Model Recommendations

University CS, IS and IT departments need to understand the factors that influence students' career choices in order to improve the declining number of IT professionals in the country. There is the great influence of the fourth industrial revolution and sustainability, especially in the IT field. CS, IS and IT departments need to produce the needed IT skills required in industry. University Departments need to take cognisance of the career choices that face scholars. This section focuses on the recommendations that can be applied by all stakeholders including Universities, departments, industry, schools, parents, scholars and teachers.

### 6.4.1 IT Role Models

IT Career workshops and practical engagement with scholars, such as role models providing talks at schools are proposed. Peers and friends who are from the same background and experienced similar challenges influence scholars' career decisions. Chronicling the life stories of role models provides a platform for inspiration and a basis for an intervention that can be used (Chinyamurindi et al., 2021). Therefore, departments can use senior students or alumni within departments who can be role models for scholars.

Efforts to promote career exploration should be undertaken, specifically explaining different IT careers. In addition, using role models, such as testimonial speeches from peers regarding IT careers and explaining choices of academic majors can be useful. Finally, developing information gathering and fun exercises such as visually appealing computer activities that provide occupational exposure are recommended (Lent et al., 2017). Departments can host sessions where role models give speeches, not only to motivate but to keep in contact with scholars and parents until scholars make their career choice.

### 6.4.2 Culture

Females tend to choose more communication and human interaction careers, while males showed a preference for more technical courses. This is important to reach out to more females by capitalising on females' higher level of communication and interpersonal skills, which fulfil their interests (Babin et al., 2010). Efforts should be made by different stakeholders including parents, teachers, universities to change the culture regarding women as important in society. The change will allow more women to enrol for IT careers.

### 6.4.3 Career Choice Influencers

Scholars, parents and teachers must be supplied with quality information regarding CS, IS and IT courses. Computer Applications Training (CAT) and IT must be promoted at school. Additionally, the creation of a mobile application to facilitate information flow between students, teachers, parents and industry must be developed (Breytenbach et al., 2011). Departments should create applications for scholars, showing them the different computer career paths. Media influences the IT career choices of scholars therefore, departments should use different media including (social media) to advertise information on Computing programmes.

Career counselling interventions should consider the empowerment of scholars to understand different careers. Career professionals should educate parents and teachers about the vital role they play in the scholar's future career decisions (Chinyamurindi et al., 2021). Departments should start by educating teachers, career counsellors and parents about the different IT careers and streams.

The lack of knowledge about IT held by family and friends can be a reason for students not to choose IT. Students who were not familiar with CS, IS and IT programmes before entering university can be deterred from choosing IT. Additionally, the lack of access to information about IT courses is one of the reasons for students not choosing IT. Therefore it was noted that there was a lack in the number of publications about careers in IT (Govender & Khumalo, 2014). Departments should have roadshows to visit schools with information on different IT career paths.

### 6.4.4 Learning Experiences

In this study, 52 respondents had programming experience using mobile phones. The study indicated that previous programming experience can be a strong indicator for choosing careers in IT. Programming experience through home-based training or extra-curricular activities at school is important. Schools should engage scholars with programming experiences and computer experiences at an early age. An ongoing initiative of teaching programming through mobile applications examples such as Tanks and Boats apps which teach programming basics to scholars are instruments that can be adopted in schools as part of the curriculum and can increase learning experiences.

Studying science and maths at school and further involvement in after school activities positively correlates with the level of interest to enrol in STEM fields at university (Chachashvili-Bolotin et al., 2016). Additionally, Govender and Khumalo (2014) indicated that computer experience before tertiary education is important. University departments can have code jams and invite schools, as they build interest and self-efficacy amongst scholars and also introduce students to programming languages and platforms. This benefits students as it creates opportunities for them to learn skills and later choose IT careers.

The study indicated that  Media has a high ability to be influential in career decisions especially in females' career choices. Therefore, departments must use Social Media to reach more females and to choose IT careers and target African home language speakers as well as to inform them about career opportunities in the IT field.

### 6.4.5 Personal Attributes and Academic Confidence

Students' personal attributes and academic confidence is influenced by their ability and learning experiences. Therefore, their ability in school subjects such as maths, programming and problem-solving are relevant for the personal attributes, which influence academic confidence. Academic confidence is being able to complete tasks and pass all modules on time and this plays a role in making a career choice. Therefore, teachers, families including fathers and mothers should be encouraged to help their children maintain and promote their positive view of school subjects, as this builds personal attributes and academic confidence.

### 6.4.6 Career Awareness

The study indicated African males have a lack of awareness of IT careers, therefore, academic departments should target males at the school level and make them more aware of IT career opportunities. Additionally, schools in disadvantaged communities should be targeted, addressing the African language speakers to make them aware of

IT career opportunities. Elias and Brian (2015) indicate that such programmes promote tertiary preparation and have an important impact on the likelihood of the racially disadvantaged students applying and enrolling in greater numbers. In support, Chinyamurindi et al., (2021) argue that HEIs can take an active role in assisting high schools through community engagement, to visit local schools to impart information related to careers.

Emphasis should be placed on the distinction between a business-oriented IT career, which requires communication and interpersonal skills and traditional computer science and engineering, which require strong maths and science skills (Babin et al., 2010). It is important for departments as custodians of computing qualifications, to distinctly show the different career paths to scholars, parents and teachers.

### 6.4.7 Perceptions about the IT industry

A focus on career perceptions and outcomes should be made when recruiting students (Alexander & Twinomurinzi, 2012). Therefore, a call for continued partnerships with employers of IT graduates should be made to look for creative ways to facilitate entry into the IT industry. Campaigns at schools where speakers from industry add more credence to the message and presentation since it comes directly from those in the industry. Earning potential should be discussed and addressed, citing factual statistics and job security. IT can be a stepping stone to other business careers, therefore it is important to use those who have made a similar journey as speakers (Babin et al., 2010). This means departments and companies should facilitate open sessions and invite schools including teachers, students and career guides to inform them of IT careers that will change negative perceptions about IT.

## 6.5 Research Contributions

The study makes several contributions to the first-year students' career decisions at NMU. These contributions can be applied to the IT industry, schools and universities in South Africa. The research contributions will be discussed in two categories namely theoretical and practical.

### 6.5.1 Theoretical Contributions

This research proposed a conceptual model for IT Career Choice, which identified factors that influence students' career choice. The research added knowledge to the decision-making field by proposing the conceptual model which used several decision-making theories. The conceptual model was tested using EFA to determine the factors that statistically can be included in the IT Career decision model. The conceptual model was confirmed using CFA and SEM to prove which factors must be part of the final IT Career decision model.

The author performed an SLR, to identify theories and factors that influence career decisions. Additionally, the study made theoretical contributions to the decision-making field, as the study used three theories; SCCT, TRA and CRT in understanding the phenomena. The study was guided by the theories in determining the factors and building the theoretical conceptual model (Figure 6-2).

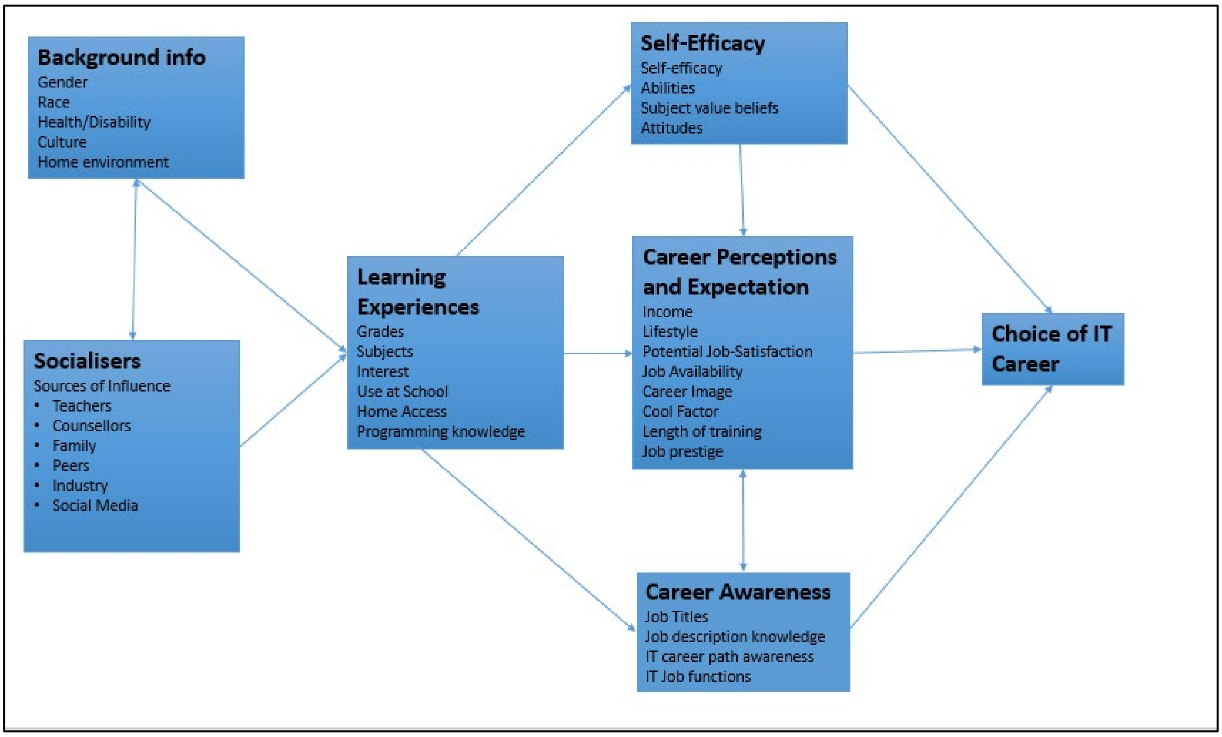


Figure 6-2: Original Theoretical Model

The conceptual model was tested using Exploratory Factor Analysis and Correlations to determine which factors were relevant to first-year career choice decisions. The results identified four factors as determinants for career choice. The use of the EFA was sufficient for presenting the conceptual model as rigorous.

Noteworthy EFA results indicated *Career Choice Influencers* factor has two factors, *Personal* (family, teachers and friends) and *Media* (Social Media and Internet). The culture was a new factor containing 2 factors with 8 items combined. However, *Culture* was considered as one factor as factor 2 had only 2 items. The *Career Awareness* factor has 2 factors, namely *Career Awareness - Prior to Studies* and *Career Awareness - Current* both combined with 6 items, split into 3 items each (Figure 6-3).

However, the conceptual model was further tested and confirmed using CFA and SEM statistical analysis to confirm the factors that are determinants or influence career choice decisions. Figure 6-4 presents the final Empirical Model of the IT Career Choice confirmed by the CFA and SEM results.

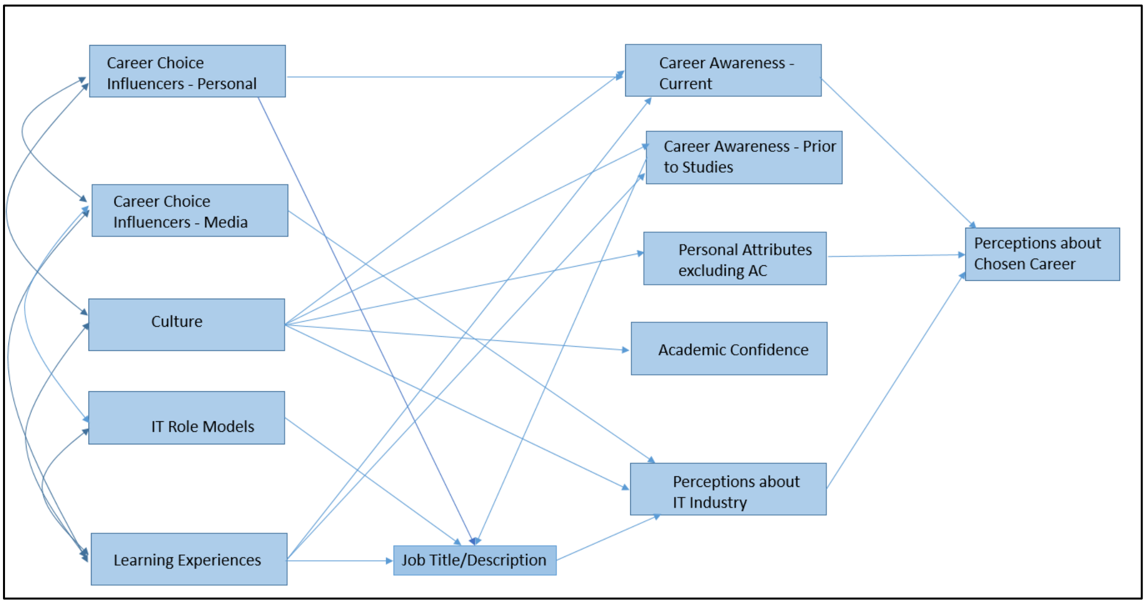


Figure 6-3: Empirical Model for IT Career Choice

The main theoretical contribution of this study is presented as a theoretical model for IT Career Choice (Figure 6-4), confirmed statistically using CFA and SEM. The theoretical model provides contributions as incremental insights by advancing knowledge in the field of decision-making. Decision-making is a field that has been consistently and repeatedly studied over the years (Corley & Gioia, 2016). Therefore, this study contributes incrementally by adding to the existing knowledge in the field.

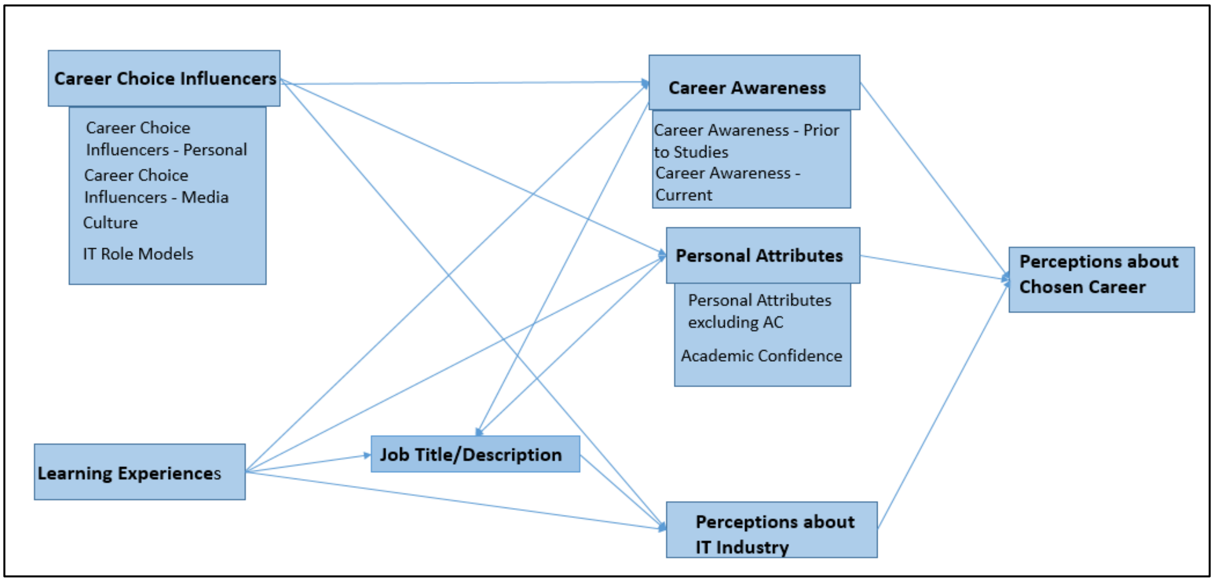


Figure 6-5: IT Career Choice Theoretical Model

In considering the *Career Choice Influencer* factor, the theoretical model has four factors within which are considered by most decision-making models/theories. However, the theoretical model highlights the *Culture* factor as important for career choice influencers, therefore, extending the knowledge on the known career choice influencers such as personal (mother, father, friends) media and role models.

The theoretical model has added new factors such as *Career Awareness*, *Job Title/Descriptions* and *Perceptions about the IT industry* when compared to the SCCT model by Brown (2002). The newly added factors *Career Awareness* and *Perceptions about the IT* industry are factors that influence first-year career decisions. While the factor Job Title description influences *Perceptions about the IT industry*.

Further contributions of the theoretical model are observed on factor *Career Awareness*, the factor consisted of two factors which the empirical model indicated that each factor influences students' career decisions. Therefore, adding knowledge of different understandings, by students before studies and during their studies at university. Finally, as career choices had been made by the students, the study through the model adds knowledge on the perceptions that the students have on their chosen career. The perceptions on chosen career knowledge can be extended and used to improve and advise other studies.

### 6.5.2 Practical Contributions

The study made practical contributions by proposing strategies for a structured and different approach to encouraging students to choose IT careers. The different recommendations proposed to IT departments included activities for recruiting prospective students such as the usage of Social Media, introducing role models and having roadshows for IT Careers across all schools especially the previously disadvantaged schools.

Recommendations for the IT industry in collaboration with universities include the introduction of IT role models that scholars can associate with, code-jams, inviting schools to visit their organisations to build interest in IT careers and the use of mobile computing applications such Tanks and Boats to teach programming.

A set of recommendations for teachers, and career counsellors highlighting first the awareness of different career paths of IT courses, changing stereotypes and perceptions of students that IT is male dominated and recommended.

Finally, recommendations for career choice influencers to positively help their children to maintain positive attitudes towards their school subjects, such as mathematics, computers and programming, which increases personal attributes and academic confidence in completing their studies should be made.

## 6.6 Limitations and Future Research

This research study used mixed methods using closed and open questions in a questionnaire. The participants did not give much detail regarding the open-ended questions, therefore an in-depth study on the questions should be explored. Interviews are the best way in getting an in-depth understanding of the factors that form career choices (Dick & Rallis, 1991). A recommendation would be future research that uses mixed methods both questionnaires and interviews as the interviews will explain the "why" of the decision-making in more detail to support the quantitative findings.

While the study does collect racial and ethnic, parental jobs and education data from the respondents, it failed to collect socio-economic data. Socio-economic factors are significant factors in understanding career decisions to pursue the STEM field (Borrego et al., 2018; Carrico et al., 2019). Future research would benefit from direct economic data to better understand factors that influence students career decisions.

While the study surveyed students from different departments and faculties, the study focused on one public university in the country and data were gathered at one point in time. Therefore, the study is limited in the generalisation of the findings but provides important background for further research in different research contexts.

### 6.7 Summary

The main objective of this chapter was addressing the $RQ_M$: What factors influence first-year students to decide to pursue a career in IT? and the $RO_M$: Identify the factors influencing first-year students career decision to pursue an IT career. To address the main research question and the objective, the deliverables of each objective of the study were as follows;

- Investigate Higher Education in South Africa and current IT Careers.
- Develop a conceptual model of the factors influencing career decisions of first-year students.
- Develop a data collection instrument that can be used to evaluate the conceptual model of the factors influencing career decisions of first-year students.
- Empirically evaluate the conceptual model of the factors influencing first-year students' career decisions.
- Identify strategies that can be used to address the factors influencing first-year students' decisions.

The study concluded from the CFA and SEM findings that three factors were found to have a significant positive effect on the chosen careers namely; *Career Awareness - Current*, *Personal Attributes* and *Perceptions about the IT industry*. However, factors

*Career Choice Influencers – Personal*, *Culture*, and *Learning Experiences* indirectly influence chosen careers.

In conclusion, the results were analysed and presented. Finally, the findings of the IT Career Choice Model, contributions, the limitations of the study and future considerations were discussed. Finally, the recommendations of the IT Career Choice Model were discussed and if the recommendations are implemented, the HEIs will be able to attract more students to enrol for IT careers.

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# Appendix A – Participants Consent

NELSON MANDELA
UNIVERSITY

Appendix 2

Participant consent

Dear End-user computing students

Computer Science (CS) and Information Systems (IS) graduates are experiencing a high employment demand from the Information Technology (IT) job market. Current predictions relating to the IT job market are that demand will increase by 12% through to 2024, according to the United States Bureau of Labour Statistics (Davis, 2019). In South Africa, Kirlidog and Coetzee (2018) concur that there is an acute shortage of skilled workers in the IT sector. Research shows the shortage of IT skills is not unique to SA, as many researchers have highlighted that the shortage of IT skills is a global problem (Brown, 2019). In understanding the enrolment trends at Higher Education Institutions (HEIs) in IT, researchers in the field state that several factors influence students' IT career choice decisions (Arcidiacono, Hotz & Kang, 2012; Becerra-fernandez & Clemmons, 2010). As first-year students, you have made a career choice to enter the IT profession. We would like to understand the factors that influenced your career decision.

We would appreciate your participation.

Your participation in this study is completely voluntary. There are no foreseeable risks associated with this project. However, if you feel uncomfortable answering any questions, you can withdraw from the survey at any point. It is very important for us to learn your opinions. You must be 18 or older to participate. Your participation implies consent. Your survey responses will be strictly confidential and data from this research will be reported only in the aggregate. Your information will be coded and will remain confidential. If you have questions at any time about the survey or the procedures, you may contact Professor Andre Calitz at andre.calitz@mandela.ac.za.

This study is the basis for Mr M. Twani's Master's degree.

# Appendix B – Informed Consent

NELSON MANDELA
UNIVERSITY

INFORMATION AND INFORMED CONSENT FORM (Questionnaire)

| RESEARCHER'S DETAILS | |
|---|---|
| Title of the research project | Factors Influencing First-Year Students' Career Decisions to Pursue an IT Career |
| Reference number | |
| Principal investigator | Malibongwe Twani |
| Address | Nelson Mandela University, South Campus, Embizweni Building, 2nd Floor, 0238 |
| Postal Code | 6031 |
| Contact telephone number (private numbers not advisable) | 041 504 2982 |
| Email Address | mtwani@mandela.ac.za |

| A. DECLARATION BY OR ON BEHALF OF PARTICIPANT | | Initial |
|---|---|---|
| I, the participant and the undersigned | (full names) | |

| A.1 HEREBY CONFIRM AS FOLLOWS: | | Initial |
|---|---|---|
| I, the participant, was invited to participate in the above-mentioned research project | | |
| that is being undertaken by | (name of researcher) | |
| from | (affiliation e.g. department/school/faculty) | |
| of the Nelson Mandela University. | | |

| THE FOLLOWING ASPECTS HAVE BEEN EXPLAINED TO ME, THE PARTICIPANT: | | | | | Initial |
|---|---|---|---|---|---|
| 2.1 | Aim: | This study aims to understand factors influencing first-year students' career decisions in choosing IT. On identifying the factors through a lens of a theoretical model the study provides strategies that can be used to address the factors. | | | |
| 2.2 | Procedures: | I will partake in a questionnaire and be asked questions on factors that influence students decide to pursue careers in Information Technology field.<br><br>I understand that the information I provide may be re-used by the researcher for purposes other than the thesis (e.g. journal papers or conference papers).<br>I am 18 years old or older. | | | |
| 2.3 | Confidentiality: | My identity will not be revealed in any discussion, description or scientific publications by the investigators. | | | |
| 2.4 | Voluntary participation: | My participation is voluntary | YES | NO | |

| 3. THE INFORMATION ABOVE WAS EXPLAINED TO ME/THE PARTICIPANT BY: | **Initial** |
|---|---|
| (name of relevant person) | |
| I was given the opportunity to ask questions and all these questions were answered satisfactorily. | |

| | | |
|---|---|---|
| **4.** | No pressure was exerted on me to consent to participation and I understand that I may withdraw at any stage without penalisation. | |

| | | |
|---|---|---|
| **5.** | Participation in this study will not result in any additional cost to myself. | |

| **A.2 I HEREBY VOLUNTARILY CONSENT TO PARTICIPATE IN THE ABOVE-MENTIONED PROJECT:** | | |
|---|---|---|
| Signed/confirmed at | on | 20 |
| Signature or right thumb print of participant | | |

| **B. STATEMENT BY OR ON BEHALF OF INVESTIGATOR(S)** | | |
|---|---|---|
| I, | (name of interviewer) | declare that: |
| 1. | I have explained the information given in this document to | (name of patient/participant) |
| | and / or his / her representative | (name of representative) |
| 2. | He / she was encouraged and given ample time to ask me any questions; | |
| Signed/confirmed at | on | 20 |
| Signature of interviewer | | |

# Appendix C – Oral Information

Appendix 3

NELSON MANDELA
UNIVERSITY

• PO Box 77000 • Nelson Mandela Metropolitan University
• Port Elizabeth • 6031 • South Africa • www.nmmu.ac.za

**Department of Computing Sciences**
Tel. + 27 (0)41504232327 Fax. +27 (0)504 2831

27 July 2021

Ref:
Contact person: Prof Andre Calitz

Dear participant

Computer Science (CS) and Information Systems (IS) graduates are experiencing a high employment demand from the Information Technology (IT) job market. Current predictions relating to the IT job market are that demand will increase by 12% through to 2024, according to the United States Bureau of Labour Statistics (Davis, 2019). In South Africa, Kirlidog and Coetzee (2018) concur that there is an acute shortage of skilled workers in the IT sector. Research shows the shortage of IT skills is not unique to SA, as many researchers have highlighted that the shortage of IT skills is a global problem (Brown, 2019). In understanding the enrolment trends at Higher Education Institutions (HEIs) in IT, researchers in the field state that several factors influence students' IT career choice decisions (Arcidiacono, Hotz & Kang, 2012; Becerra-fernandez & Clemmons, 2010). As first-year students, you have made a career choice to enter the IT profession. We would like to understand the factors that influenced your career decision.

You are being asked to participate in this research study. We will provide you with the necessary information to assist you to understand the study and explain what would be expected of you. These guidelines would include the risks, benefits, and your rights as a study subject. Please feel free to ask the researcher to clarify anything that is not clear to you.

Your participation in the online survey implies that you agree to participate in the survey.

You have the right to query concerns regarding the study at any time. Telephone numbers of the researcher are provided. Please feel free to call these numbers.

You must be aware of the fact that the ethical integrity of the study has been approved by the Research Ethics Committee (Human) of the Nelson Mandela University.

If you participate, you have the right to withdraw at any given time during the study without penalty or loss of benefits.

Your identity will at all times remain confidential. The results of the research study may be presented at scientific conferences or in specialist publications.

Appendix 3

NELSON MANDELA UNIVERSITY

Yours sincerely

Mr Malibongwe Twani
MSc Computer Science and Information Systems
Department of Computing Sciences
Nelson Mandela University

## Appendix D – Letter to Gate Keepers

NELSON MANDELA
UNIVERSITY

**Appendix 6**

Deputy Vice-Chancellor: 18 October 2020.
Research, Innovation &
Internationalisation
Dr Thandi Mgwebi
**Ref: Request for permission to survey first year Nelson Mandela University students**

Dear Dr Mgwebi

Please could you grant permission for a research study to be conducted, which involves Nelson Mandela University first-year students who will be enrolled for End-user computing in 2021. This research is the basis for my Master's dissertation. The main research problem is as follows: Several factors influence first-year students' decision in pursuing studies, however, the factors influencing first-year students in NMU to pursuing IT careers are not known to the Department of Computing Sciences at NMU.

Computer Science (CS) and Information Systems (IS) graduates are experiencing a high employment demand from the Information Technology (IT) job market. Current predictions relating to the IT job market are that demand will increase by 12% through to 2024, according to the United States Bureau of Labour Statistics (Davis, 2019). In South Africa, Kirlidog and Coetzee (2018) concur that there is an acute shortage of skilled workers in the IT sector. Research shows the shortage of IT skills is not unique to SA, as many researchers have highlighted that the shortage of IT skills is a global problem (Brown, 2019). The objective of this study is to determine the factors that influence first-year students' decision to pursue an IT career. The results will inform strategies to attract students to study IT.

An online questionnaire will be distributed to first-year students in the End-user computing module.

Participation in this research will completely be voluntary and no one will be obliged to take part.

Yours sincerely

**Malibongwe Twani**

MSc Computer Science and Information Systems
Department of Computing Sciences

Nelson Mandela University

# Appendix E – Questionnaire

## First Year Survey 2021

Dear student
Your career choice is influenced by many factors. First year students generally have selected to study a specific programme in order to pursue a specific career. Students also choose subjects such as Information Technology (IT), Computer Science (CS) and Information Systems (IS) to pursue a career in the IT industry.

You are invited to participate in our first year career choice survey. It will take approximately 15 minutes to complete the questionnaire. Your participation is essential in this study and is completely voluntary. There are no foreseeable risks associated with this project. However, if you feel uncomfortable answering any questions, you can withdraw from the survey at any point. It is very important for us to learn your opinions.

Your survey responses will be strictly confidential and data from this research will be reported only in the aggregate. Your information will be coded and will remain confidential. If you have questions at any time about the survey or the procedures, you may contact Mr Malibongwe Twani at the email address: Malibongwe.Twani@Mandela.ac.za.

Thank you very much for your time and support. Please start with the survey now by clicking on the Next button below.

* Please indicate your gender

- ◯ Female
- ◯ Male
- ◯ Other

* How old are you?

* Please indicate your race:

- ◯ Asian
- ◯ Black
- ◯ Coloured
- ◯ Indian
- ◯ White

* Please indicate your home language:

- ☐ Afrikaans
- ☐ English
- ☐ Sotho
- ☐ Tswana
- ☐ Xhosa
- ☐ Zulu
- ☐ Other

* Do you have any disabilities?

- ◯ Yes
- ◯ No

* Indicate your father's occupation:

____________________

* Indicate your mother's occupation:

____________________

* Indicate your father's highest qualification

- ◯ Less than Matric
- ◯ National Certificate (Matric)
- ◯ Higher Certificate
- ◯ Diploma/Advanced Certificate
- ◯ Bachelor's Degree/Advance Diploma
- ◯ Honours Degree/Postgraduate Diploma
- ◯ Master's Degree
- ◯ Doctoral Degree
- ◯ I don't know

---

*

Indicate your mother's highest qualification

- ◯ Less than Matric
- ◯ National Certificate (Matric)
- ◯ Higher Certificate
- ◯ Diploma/Advanced Certificate
- ◯ Bachelor's Degree/Advance Diploma
- ◯ Honours Degree/Postgraduate Diploma
- ◯ Master's Degree
- ◯ Doctoral Degree
- ◯ I don't know

* Please indicate your agreement with the following background information statements:

| | No | Yes |
|---|---|---|
| There are professionals (e.g. doctors, accountants, lawyers) in my family | ◯ | ◯ |
| There are IT professionals in my family | ◯ | ◯ |
| I have family working in the IT industry | ◯ | ◯ |
| I have friends working in the IT industry | ◯ | ◯ |
| I have IT role models | ◯ | ◯ |
| I have role models for my chosen career | ◯ | ◯ |

* Culture

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| In my culture, people have a clear understanding of professional careers, such as a chartered accountant | ◯ | ◯ | ◯ | ◯ | ◯ |
| In my culture, people have a clear understanding of IT careers | ◯ | ◯ | ◯ | ◯ | ◯ |
| In my culture, a woman is expected to have a family and children | ◯ | ◯ | ◯ | ◯ | ◯ |
| In my culture, having a large family is important | ◯ | ◯ | ◯ | ◯ | ◯ |
| In my culture, IT is seen as a career for men and women | ◯ | ◯ | ◯ | ◯ | ◯ |
| In my culture, it is important to have a qualification | ◯ | ◯ | ◯ | ◯ | ◯ |
| In my culture, it is important that women have a formal qualification | ◯ | ◯ | ◯ | ◯ | ◯ |
| In my culture, people encourage children to study towards professional careers, such as a doctor or a chartered accountant | ◯ | ◯ | ◯ | ◯ | ◯ |
| In my culture, women are expected to have a full-time job | ◯ | ◯ | ◯ | ◯ | ◯ |
| People in my culture are religious | ◯ | ◯ | ◯ | ◯ | ◯ |

* Career choice Influencers

Please indicate to what extent did the following influence your career choice:

| | Not at all | A little | A lot |
|---|---|---|---|
| Family | ○ | ○ | ○ |
| Friends | ○ | ○ | ○ |
| Teachers | ○ | ○ | ○ |
| Career guidance advisors/teachers | ○ | ○ | ○ |
| Role models | ○ | ○ | ○ |
| My religious circle | ○ | ○ | ○ |
| The Internet | ○ | ○ | ○ |
| Social media | ○ | ○ | ○ |

* Learning Experiences

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| I had access to a computer in my primary school(s) | ○ | ○ | ○ | ○ | ○ |
| I had access to a computer in my secondary school(s) | ○ | ○ | ○ | ○ | ○ |
| I used a computer at home when I was growing up | ○ | ○ | ○ | ○ | ○ |
| I found IT to be enjoyable whilst growing up | ○ | ○ | ○ | ○ | ○ |
| I received adequate IT training at school, which prepared me for university | ○ | ○ | ○ | ○ | ○ |
| I was involved in computer projects at school | ○ | ○ | ○ | ○ | ○ |
| I had an interest in IT during my school years | ○ | ○ | ○ | ○ | ○ |
| I started computer programming whilst at school | ○ | ○ | ○ | ○ | ○ |
| I used computers when I was at school | ○ | ○ | ○ | ○ | ○ |
| I did some programming on my mobile phone (e.g. Tanks or Boats) whilst growing up | ○ | ○ | ○ | ○ | ○ |

* Which programme are you registered for?

- BCom CS & IS
- BCom Accounting Sciences
- BCom General
- BSc
- BIT
- Dip (Information Tech: Comm Networks)
- Dip (Information Tech: Support Services)
- Dip (Information Tech: Software Development)
- HCert (IT) (User Support Services)
- Other

* Select the first year modules you are enrolled for?

- [ ] Computer Fundamental for Scientists (WRSC111)
- [ ] Computer Fundamentals (WRFV101, WRFV102)
- [ ] Information Technology Skills 1 (ITS1011)
- [ ] Information Systems 1 (WIH1011)
- [ ] Introduction to Information Technology (IITF101)
- [ ] Programming Fundamentals (WRAV101, WRAV102)
- [ ] Development Software (ONT1030, SDS1010)
- [ ] Computer Science for Engineers(MSEV101, MSEV102)
- [ ] Operating System Fundamentals (IOSF101)
- [ ] Other

* Personal Attributes

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| I expect to do well in my subjects at university | | | | | |
| I am confident working with computers | | | | | |
| I take responsibility for my learning | | | | | |
| I do my work as well as most other people | | | | | |
| I am a good problem-solver | | | | | |
| It is easy for me to achieve my goals | | | | | |
| I work well under pressure | | | | | |
| I am a confident person | | | | | |
| I feel I have a number of good qualities | | | | | |
| On the whole, I am satisfied with myself | | | | | |

* Self-confidence: How confident are you that you will be able to:

| | Not at all confident | Slightly confident | Fairly confident | Quite Confident | Extremely confident |
|---|---|---|---|---|---|
| Complete all the work that is assigned to you in your modules? | | | | | |
| Understand complicated ideas when they are presented in your modules? | | | | | |
| Learn all of the material presented in your modules? | | | | | |
| Do the difficult work that is assigned in your modules? | | | | | |
| Remember what you have learned in your current modules? | | | | | |
| Complete your diploma/degree programme in the required minimum time? | | | | | |
| Pass all your modules? | | | | | |

* Perceptions about the IT industry

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| An IT career has a good image/status | ○ | ○ | ○ | ○ | ○ |
| An IT career provides a flexible work schedule between work and social life | ○ | ○ | ○ | ○ | ○ |
| An IT career ensures long term employment | ○ | ○ | ○ | ○ | ○ |
| IT is regarded as a male profession | ○ | ○ | ○ | ○ | ○ |
| People working in the IT industry earn good salaries | ○ | ○ | ○ | ○ | ○ |
| A person with an IT qualification will find work easily | ○ | ○ | ○ | ○ | ○ |
| A person with an IT qualification can work internationally | ○ | ○ | ○ | ○ | ○ |
| There is good job security in the IT industry | ○ | ○ | ○ | ○ | ○ |
| People with an IT qualification are 'geeks' | ○ | ○ | ○ | ○ | ○ |
| There are many jobs available in the IT industry | ○ | ○ | ○ | ○ | ○ |
| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
| The IT industry provides many job opportunities for women | ○ | ○ | ○ | ○ | ○ |
| There are good prospects for developing new skills in the IT industry | ○ | ○ | ○ | ○ | ○ |
| The IT industry provides the opportunity to become an IT entrepreneur | ○ | ○ | ○ | ○ | ○ |

* Career Awareness

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| I do have an understanding of the career paths available for students with my qualifications | ○ | ○ | ○ | ○ | ○ |
| I did have an understanding of Information Technology (IT) careers before I enrolled at university | ○ | ○ | ○ | ○ | ○ |
| I had an understanding of Computer Science (CS) careers before I enrolled at university | ○ | ○ | ○ | ○ | ○ |
| I did have an understanding of Information Systems (IS) careers before I enrolled at university | ○ | ○ | ○ | ○ | ○ |
| I understand the differences between IT, CS and IS careers | ○ | ○ | ○ | ○ | ○ |
| I know what job I want to do in the future | ○ | ○ | ○ | ○ | ○ |
| I know which company I want to work for after I graduate | ○ | ○ | ○ | ○ | ○ |
| I can explain the main job functions for my future job | ○ | ○ | ○ | ○ | ○ |

* Perceptions about your chosen career

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| I am happy with my career choice | ○ | ○ | ○ | ○ | ○ |
| My family respects my career choice | ○ | ○ | ○ | ○ | ○ |
| My chosen career will be rewarding | ○ | ○ | ○ | ○ | ○ |
| I would recommend my career choice to others | ○ | ○ | ○ | ○ | ○ |
| I have to keep ahead of change and new technologies in my chosen career | ○ | ○ | ○ | ○ | ○ |
| I will learn new skills in my chosen career | ○ | ○ | ○ | ○ | ○ |
| There are many jobs available in the career I have chosen | ○ | ○ | ○ | ○ | ○ |
| There are good prospects for a better than average starting salary in the career I have chosen | ○ | ○ | ○ | ○ | ○ |
| I will have opportunities to work in different kinds of business functions in my chosen career | ○ | ○ | ○ | ○ | ○ |
| I can become an entrepreneur with my career choice | ○ | ○ | ○ | ○ | ○ |

* What career do you want to pursue, after completing your studies?

What do you think your first job title be?

* Which job title would you associate with each job description?

| | Software Developer/programmer | Data scientist | Business Analyst | Database Administrator | Accountant | Sales and Marketing representative | Information Security Specialist | Help desk and support consultant | Network Engineer | Auditor |
|---|---|---|---|---|---|---|---|---|---|---|
| A person responsible for handling LAN/WAN, network hardware, software and installations | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| A person working with Big data, applying statistical techniques to analyse, model and interpret the results to create actionable plans for companies | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| A person responsible for maintaining the databases and ensuring data availability in a business | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| A person who solves business problems by analysing and designing IT systems in the organisation | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| A professional person who reviews the financial statements and accounting principles of a business | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| A person who manages sales and promotional activities to increase the sales or the use of a product or service in a business and ultimately market share | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| A person who manages the data, information, systems, network and cloud security in an organisation | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| A person providing IT customer support and troubleshoot daily user IT queries | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| A person responsible for designing, writing code and testing new programmes | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| A person who manages the daily financial transactions and information in a business | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

# Appendix F – REC-H Approval

NELSON MANDELA
UNIVERSITY

PO Box 77000, Nelson Mandela University, Port Elizabeth, 6031, South Africa mandela.ac.za

Chairperson: Research Ethics Committee (Human)
Tel: +27 (0)41 504 2347
sharlene.govender@mandela.ac.za

**NHREC registration nr: REC-042508-025**

**Ref: [H20-SCI-CSS-008] / Approval]**

16 March 2021

Prof A Calitz
Faculty: Science

Dear Prof Calitz

**FACTORS INFLUENCING FIRST-YEAR STUDENTS' DECISION TO PURSUE A CAREER IN IT**

PRP: Prof A Calitz
PI: Mr M Twani

Your above-entitled application served at the Research Ethics Committee (Human) (*24 February 2021*) for approval. The study is classified as a medium risk study. The ethics clearance reference number is **H20-SCI-CSS-008** and approval is subject to the following conditions:

1. The immediate completion and return of the attached acknowledgement to Imtiaz.Khan@mandela.ac.za, the date of receipt of such returned acknowledgement determining the final date of approval for the study where after data collection may commence.
2. Approval for data collection is for 1 calendar year from date of receipt of above mentioned acknowledgement.
3. The submission of an annual progress report by the PRP on the data collection activities of the study (form RECH-004 available on Research Ethics Committee (Human) portal) by 15 November this year for studies approved/extended in the period October of the previous year up to and including September of this year, or 15 November next year for studies approved/extended after September this year.
4. In the event of a requirement to extend the period of data collection (i.e. for a period in excess of 1 calendar year from date of approval), completion of an extension request is required (form RECH-005 available on Research Ethics Committee (Human) portal)
5. In the event of any changes made to the study (excluding extension of the study), completion of an amendments form is required (form RECH-006 available on Research Ethics Committee (Human) portal).
6. Immediate submission (and possible discontinuation of the study in the case of serious events) of the relevant report to RECH (form RECH-007 available on Research Ethics Committee (Human) portal) in the event of any unanticipated problems, serious incidents or adverse events observed during the course of the study.
7. Immediate submission of a Study Termination Report to RECH (form RECH-008 available on Research Ethics Committee (Human) portal) upon expected or unexpected closure/termination of study.
8. Immediate submission of a Study Exception Report of RECH (form RECH-009 available on Research Ethics Committee (Human) portal) in the event of any study deviations, violations and/or exceptions.
9. Acknowledgement that the study could be subjected to passive and/or active monitoring without prior notice at the discretion of Research Ethics Committee (Human).

Please quote the ethics clearance reference number in all correspondence and enquiries related to the study. For speedy processing of email queries (to be directed to Imtiaz.Khan@mandela.ac.za), it is recommended that the ethics clearance reference number together with an indication of the query appear in the subject line of the email.

We wish you well with the study.

Yours sincerely

Dr S Govender
**Chairperson: Research Ethics Committee (Human)**

Cc: Department of Research Development
Faculty Manager: Science

*Appendix 1: Acknowledgement of conditions for ethical approval*

# Appendix G – Turnitin Similarity Report

turnitin

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NELSON MANDELA UNIVERSITY

## DECLARATION BY CANDIDATE

**NAME:** Twani Malibongwe

**STUDENT NUMBER:** 20331983

**QUALIFICATION:** MSc Computer Science

**TITLE OF PROJECT:** Factors Influencing First-Year Students career decisions to pursue an IT Career

**DECLARATION**:

In accordance with Rule G5.11.4, I hereby declare that the above-mentioned treatise/ dissertation/ thesis is my own work and that it has not previously been submitted for assessment to another University or for another qualification.

**SIGNATURE:** M. Twani

**DATE:** 13/08/2021