UNIVERSITY OF KWAZULU-NATAL

Exploring factors influencing the choice of ICT education among matric students in selective rural high schools in Zululand

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DECLARATION

I,_____ Pamela Pakama do hereby declare that this research report is a my own original work which has not been submitted for examination at any other University or College.

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ABSTRACT

The study investigates factors influencing ICT career choice among matric students in selected high schools in Zululand, South Africa. In doing so, the Social Cognitive Career Theory, Unified Theory of Technology Acceptance, Keller's ARCS motivational model, and the Cognitive Load Theory were found to converge on common and relevant constructs for the study. These are used in the research's survey questionnaire and they are: career motivation; social influence; career relevance; self-efficacy; confidence; cognitive load; and career choice. These constructs were then used in designing structured survey statements on a Likert scale used in the survey administered to 190 participants. Of the 203 targeted sample participants, a total of 190 questionnaires were received in good order for analysis, giving a response rate of 93.6%.

The research found that most matric students in the survey had limited understanding of ICT careers but it also acknowledges that an ICT career choice is strategic and relevant. This is deduced from the response to the invitation to consider ICT as a career choice which was met with 89% positive response. Research, however, highlights the gap in implementation of ICT in South African schools with their limited training of teachers or students and capacity building of the instructional stakeholders, and with teachers, who also require be oriented and made familiar and proficient with ICT subjects before sharing their knowledge with students. The conceptual integration approach designed in the study, and adopted from the theoretical models mentioned above, reveals further that social influence plays a role.

Descriptive analysis further showed students responding with moderation but positively to the influence of all factors in their choice of ICT. These results are corroborated by findings from the Pearson's and Spearman's rank correlation coefficient, an independent samples t-test, and a Mann-Whitney U test; all of which led to the rejection of the null hypothesis; concluding that all factors investigated in this study positively influence ICT career choice. However, contrasting results were found in the main model where self-efficacy, cognitive processing ability and confidence were found to be insignificant in explaining variances in ICT career choice and social influence, career motivation and career relevance were found to explain ICT career choice significantly. The survey findings further reveal that in the exploration of enablers and barriers to students' career choice, the availability of role models, exposure to the field and career advice are facilitators while low income, lack of prestige and poor environments are barriers.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

APU	Azusa Pacific University
ARCS	Attention Relevance Confidence and Satisfaction
CAT	Computer Applications Technology
CL	Cognitive Load
CLCF	Cognitive Load Casual Factors
ECD	Early Childhood Development
EU	European Union
FCD	Facilitating Conditions-Direct
FCS	Facilitating Conditions–Support
FIR	Fourth Industrial Revolution
GDP	Gross Domestic Product
ICT	Information and Communication Technology
JSCE	Junior Secondary Certificate Examination
JCSE	Joint Communications Support Element
KZN	KwaZulu-Natal
NEIMS	National Education Infrastructure Management System
OECD	Organisation for Economic Cooperation and Development
PC	Personal Computer
SA	South Africa
SCCT	Social Cognitive Career Theory
SET	Science, Engineering and Technology
UKZN	University of KwaZulu-Natal
USA	United States of America
USAASA	Universal Service and Access Agency of South Africa
UTAUT	Unified Theory of Technology Acceptance

CHAPTER ONE: INTRODUCTION

1.1 Introduction

Information and communication technologies (ICTs) are now widely understood to be an enabler of economic development (Joan, 2008; Skinner, 2013), and therefore, the role of information and communication technology (ICT) has increased rapidly in recent years in all economic sectors (Kori *et al.*, 2015).

According to Schofield (2018) the South African ICT Industry faces a serious ICT skills shortage and there is huge concern about this shortfall. This has become a major challenge for the government in achieving a sustainable growth rate in GDP, to create jobs and to reduce neediness by 2014 (Joan, 2008). As a result of the ICT skills shortage, businesses continually struggle to find qualified and properly trained Information and Communication Technology staff. This puts South Africa in a predicament as it has then to rely on other countries for ICT skills. According to Schofield (2018), ICT companies like the IQ Group in South Africa, bring in programmers from India so as to meet project deadlines and to mentor indigenous recruits. Calitz, Greyling, and Cullen (2014) further remind us that businesses in South Africa are compelled to outsource and offshore ICT skills provided from countries like India and China. Additionally, the Joint Communications Support Element (JCSE) ICT Skills Survey has deduced that the number of companies seeking to recruit skills abroad doubled between 2014 and 2016 (BusinessTech, 2016).

Despite its inclusion into Brazil, Russia, India, China, and South Africa (BRICS), with countries like China and India that have ICT skills in abundance, South Africa is ranked poorly for its ICT skills, dragged down in particular by the quality of its education system, and in particular in its maths and science education (Gillward, Mothobi and Rademan, 2018).In addition to these challenges, South Africa, when compared to other BRICS nations, is still faced with higher usage costs, weak ICT literacy, and low Personal Computer (PC) ownership (Schofield, 2018). Additionally, research has shown that South Africa also sees itself lagging behind its African comparators namely: Kenya, Nigeria, and Egypt (Schofield, 2016). The South African economy has been placed third in Africa behind the latter two nations who are paying greater attention to the impact of technology on economic growth and social development (Schofield, 2016). Having said that, South Africa's ICT is on a positive growth trajectory but there are concerns that government's approach to ICT is fragmented and that the national ICT policy has not been implemented firmly. There are also worries

over government's poor management of procurement (Media, Information and Communication Technologies Sector Education and Training Authority (MICTSETA), 2015).

To curb these ICT skills challenges, broad support for the development of IT skills in schools, universities, colleges and universities of technology, is empowering the youth and enabling them to gain IT skills and competences and eventually to become economically relevant (Hamid, 2014).However, despite the tremendous successes attached to these interventions, South Africa is still unable to address the burning desire for the country to achieve good education and the relevant tutelage in schools. The future of South Africa is bleak without this (Schofield, 2012).

Given the increasing level of ICT skills shortage in the Republic of South Africa and as previous studies show that the root cause of ICT skills shortage starts in matric (Deloitte, 2014) the current study intends to explore the IT education career choice factors in selected High schools in Zululand.

1.2 Background of the Study

It was predicted that by 2010 the manufacturing sector alone, which happens to be a vital sector for economic growth, would experience a shortage of over 14000 ICT specialists (Schofield, 2018). By 2019, South Africa had about 500 000 ICT employees, but the skills shortage still existed (Malinga, 2019). In 2019, South African employers had to recruit 37% of its labour force with ICT skills from other countries (Malinga, 2019). The shortfall is further exacerbated by the rate of Information and communication technology graduations which now is showing a down-ward trend (Plaatjies & Mitrovic, 2014). In 2014 Hamid (2014) estimated that South Africa needed between 30 000 to 70 000 skilled IT workers in order to compete internationally. The lack of ICT skills is deemed to have a negative effect on our economic growth. The 2016 ICT Skills Survey found this deficit so significant that the percentage of corporates recruiting abroad has more than doubled, from only 12% in 2014 to 26% in 2016 (BusinessTech, 2016). In contrast, graduate unemployment is rising in South Africa coupled with overall unemployment rate. The overall rate of unemployment for this education group increased from 5.4% during 1995 to 7% in 2012 (Oluwajodu, Blaauw, Greyling, & Kleynhans, 2015).

An increasing intake of Information technology students could curb the increasing rate of unemployment. On the other hand, a decrease in in-take can affect the country's development. Some studies have shown that there is relatively low intake in ICT. A study

conducted by Padayachee (2017) reveals that the uptake of ICT in schools is relatively low in South Africa. In the schools under study, the usage of ICT was found to be 41% as contextual tools, 29% for sharing ideas and information, 26% as experiential tools and 18% as reflective dialogue tools (Padayachee, 2017:36). The limitation of ICT learning in schools was found to be attributable to poor ICT infrastructure installations in several schools, which is exacerbated by the lack of clear, integrative provincial strategies that ensure equality in resource distribution (Meyer & Gent, 2016:1; Padayachee, 2017:36). Another study conducted in 2014 states that fewer than one percent (1%) of matric students take IT as a subject because it is perceived as being too technical or requiring high-level mathematics skills (Hamid, 2014). Additionally, the Information Systems, Electronic and Telecommunications Technologies (ISETT)Seta noted that less than 8% of secondary school students are opting to study ICT related courses and qualification (Calitz, Evert, & Cullen, 2015).

Furthermore, researchers have discovered that students' choice of ICT careers is low. Enrolment figures have been in decline within higher education institutions and the industry experienced a major crisis in ICT skills (Calitz et al., 2015). Koppi (2008) cited in (Calitz *et al.,* 2015) ascribed the shortfall in proficient employees to some factors such as the relationship between the industry and educational institutions, especially secondary schools and to the wrong perception of ICT careers and profession. Secondary education scholars are not familiar with ICT qualifications or job titles available due to the fact that there is little or no relationship existing between the industry and educational institutions (Calitz *et al.*, 2015). Students generally have a misunderstanding of ICT industry and job descriptions and students' insularity can be associated with the limited acquaintance with the ICT degree programme. Carter (2006) cited in Calitz, Greyling and Cullen (2013) makes the point that SA schools do not engage the services of full-time career or guidance counsellors. Consequently, teachers and parents have little or zero knowledge of the ICT careers available. Even though there are currently more than 290 different vacant posts available in the ICT sphere, students do not get adequate career advice and mentoring (Calitz, 2010). Additionally, Havenga & Mentz (12009) as well as Koorsse *et al.*,(2010) note that the low interest in IT at the secondary school level field of study was reported by IT educators, the Department of Education, ICT co-ordinators of subject and academia. Finally, career alternatives for students are influenced to a significant extent by role models; however, the number of role models in the South African ICT industry is minimal. For this study, the researcher will undertake the study in Zululand. The reason behind the choice of the location

is based on the fact that Kwa-Zulu Natal is one of the provinces with a substantial number of universities and Universities of Technology that specialise in Computer studies. It has four institutions of higher learning which are; Durban University of Technology, University of Zululand, University of KwaZulu Natal, and Mangosuthu University of Technology. Zululand has a substantial number of schools offering a Certified Accounting Technician (CAT) qualification in KwaZulu Natal (KZN,) yet they face infrastructure challenges which means that many fail to obtain access to personal computers or internet connectivity, which places them at a disadvantage when compared to their peers. This study aims to better understand the ICT career choice influences among matric students.

1.3 Statement of the Research Problem

Even though careers in the ICT sector are in abundance, students do not get adequate career advice and mentoring (Calitz, 2010). The career choices students make determines the future workforce of the country. South Africa keeps experiencing a high rate of unemployment, and ultimately, a shortage of ICT skills (Schofield, 2018). Furthermore, South Africa (SA) is still faced with a low investment in crucial basic education which creates a pool of young individuals interested in and capable of being employed in ICT (JSCE, 2018).The 2016 SA Science, Technology & Innovation indicators report found a stagnant number of passes in matric for key subjects and in the levels of pass rates in Science, Engineering and Technology (SET) enrolments in higher education institutions (National Advisory Council on Innovation, 2017; JSCE, 2018). Due to low selection of ICT at matric level as depicted by studies by Hamid (2014), Calitz *et al.*,(2015) and JSCE (2018), a shortage of human resources that can be trained for ICT jobs is materialising. The situation becomes worse for rural students who are not exposed to any great extent to ICT platforms and careers.

Furthermore, ICT jobs are regarded as the fourth most difficult for which to secure a candidate (Mawson, 2011) cited in (De Villiers *et al.*, 2012). The inability of the education sector to produce these skilled resources is the reason for this challenge (De Villiers *et al.*, 2012). One factor which contributes to the failure of the Department of Education to produce ICT resources is due to the fact that the student enrolments into ICT degree programmes have significantly dropped since 2001 (Calitz *et al.*, 2014). In contrast to this ICT jobs are purported to be the highest paying in the industry. This is while the ICT industry is the potential field for employment, however, students with a preference for ICT are still reluctant to pursue ICT degree programmes at universities due to the belief that it is difficult (Calitz *et*

al., 2013). The stereotyping interferes with their choice of school subjects and their occupational choices.

Recent empirical studies have uncovered a complex interaction of factors that affect students' choice of career, which ultimately affect the numbers of students who choose to pursue ICT-related subjects at school. The exploration of contextual and empirical literature shows a number of factors influencing career choice, but in the context of SA, it has not yet been established how these factors interplay to result in low uptake of ICT subjects. As a result, this study seeks to explore existing relationships between factors and to establish how such relationships affect students' choice of an ICT career.

1.4 Research questions

Scholars such as Chi, Glaser & Rees (2012), Smith (2015) and Reddan (2015) have suggested that personal factors such as self-efficacy and cognitive processing affect students' career choice by impacting on students' confidence levels. In addition, works by Kirschner, Paas, & Kirschner (2011), Shumba and Naong (2012) as well as Nyamwange (2016) indicate that through the interaction of career relevance and career motivation among students', the influence of social factors on career choice is established.

This study aimed to answer the primary research question as follows:

- How do the contributing factors influence students' choice of ICT education for an ICT career?

In line with the theoretical constructs guiding the research process, learning cognitive factors are subjected for evaluation for the survey and are outlined as sub-research questions as below:

- What is the relationship between students' confidence and its influencing factors – self-efficacy and cognitive load?
- What is the relationship between social influence and its influencing factors – career motivation and career relevance?
- How does students' confidence and social factors influence their ICT career education choice?

1.5 Research Objectives

In the light of persistent skills shortages in the ICT sector, the objective of the study is to explore factors influencing ICT career choice among matric students in selected high schools in Zululand**.**

Specific objectives of this study to be reported on herein are;

- To explore the relationship between students' confidence and its influencing factors – self-efficacy and cognitive load;
- To explore the relationship between social influence and its influencing factors – career motivation and career relevance; and
- To investigate how students' confidence and social factors influence their ICT career education choice.

1.6 Significance of the Study

The study seeks to introduce more knowledge on the influencing constructs and their grounding basic elements in coming up with a conceptual framework for positive responses to ICT career development and orientation among matriculating students for industry specialists and for the Department of Education. This specific study intends to expose the cumulative, dependent and independent factors that establish sustainable linkages towards an ICT career choice development that satisfies the industry demands for ICT skills; and the alignment of such demands in ICT.

1.7 Rationale of the study

Given the emerging trends in the world towards the fourth industrial revolution (bringing with it machine learning, robotics, artificial intelligence among others), this study should help to answer critical questions in terms of the readiness of South Africa to embrace ICT subjects (Kangong 2019). Since today's matric students will make up part of the labour force of the country in the near future, it is necessary to understand their career preferences and how such preferences align with the need for more investment in ICT (Bannatyne, 2019). The study should provide useful observations and recommendations which could assist local, provincial and national governments to implement sound ICT policies for the provision of reliable ICT education in schools. Furthermore, the study will probe and it may provide answers to the influence of the intrinsic and extrinsic factors that affect matric students'

career choices, thus helping policy-makers to react to issues at the forefront of low ICT career preference.

1.8 Chapter Organisation

Chapter 1: Introduction and Background

This chapter introduced the research issue, that is, an exploration of factors influencing ICT career choice in education among matric students in selected rural high schools in Zululand, South Africa. The research aim, objectives and research questions were declared the research's rationale was highlighted and described as focusing mainly on providing an understanding of the influencing factors that can lead to positive responses to ICT career choice among matriculation students in the nominated High Schools.

Chapter 2: Literature Review

The literature review presents current and past literature pertaining to ICTs and their influence in establishing and modelling career choice among High School students. Industry literature focusing on challenges of adopting ICT's and of explaining their benefits for career choice development is explored. Literature pertaining to career relevance and choice, social influences and career choice, cognitive learning theory, Keller's theory, and aspects of scholar perceptions towards ICT are explained in depth and reviewed.

Chapter 3: Research Methodology and Design

The chapter will explain the chosen research strategy that the study will use to gather its primary data from the research setting. The research philosophy influencing the methodology and design is explained. The sampling strategy, technique, methods of data administration and analysis are described the ethical considerations to be followed by the researcher are also explained.

Chapter 4: Results and Analysis of Findings

Primary results gathered from empirical evidence from the school settings established in the study are presented, analysed and discussed following the research objectives. The presented results are also analysed in light of the current literature and theory to explain the implications of the outcomes of factors influencing an ICT career choice by matric students in selected rural high schools in Zululand, South Africa.

Chapter 5: Summary of Findings.

Findings are reviewed in this chapter in accordance with the key research questions guiding the study. Research gaps for future research pertaining to factors influencing ICT career choice in education among matric students in selected rural high schools in Zululand are

identified. The study further provides recommendations based on a conceptual model that best suits interventions to influence ICT career choice in education among matric students in the chosen research setting.

1.9 Summary

The chapter introduced the research phenomenon focusing on factors influencing ICT career choice in education among matric students in the chosen research setting. The research aim, and research problem were declared. The research's significance was explained and the research objectives and questions were outlined. The chapter declared the organisation of chapters and study limitations. The next chapter provides a presentation of the research's literature review.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

According to Azusa Pacific University (APU) writing centre (2015), literature review entails the compilation and evaluation of research available on a certain topic or issue being studied. It is crucial to explain the choice of a research methodology as well as to state the basis for comparison of study results. Gcora (2016) maintains that a valuable literature review should be underpinned by a definite theory cornerstone, a report of published works that is associated with the researcher's exploration as well as its analysis. The literature review for this research covers the underlying theories that assist in explaining the factors influencing choice thereby establishing research constructs. The literature review also explores empirical studies which explain the factors influencing career choices by students from high school up to university. These studies show how individual factors and the environment surrounding students influence their overall choice, hence showing the key reasons why few students in South Africa are choosing a career in ICT.

2.2 Definition of ICT

ICT, it is argued, encompasses a broad range of computer- aided technology applications that are used to solve problems and to generate solutions from given data and device inputs (Somekh 2014). Information is understood as a set of grouped data that is organised and structured in such a way that meaningful comprehension of this data is understood (Tondeur, et al. 2012). Communication refers to the interactions that occur between a sending and a receiving party to transmit information or electronic messages (Somekh, 2014). Communication is executed through mediums and channels that require a user to be proficient in the communication protocols used (Tondeur, et al. 2012). Technologies, from devices to software and to networking channels or platforms, fulfil the principle of information communication technology (Somekh, 2014). As such, ICT becomes the combined effect of information, the manner of its communication, and the technologies that are employed in ensuring that the information is efficiently and effectively transmitted or shared, using appropriate tools (Tearle 2013).

2.3 Global trends in ICT

This section reviews international trends in ICT development that include investments in ICT infrastructure and access by communities in both developing and developed countries. A global view of the ICT sector reveals that the careers in ICT are in greater demand than ever while they are also evolving into new innovative demands from designers and developers of applications and computer hardware. As explained by Schwab (2018), in the Fourth Industrial Revolution (FIR), a new and inevitable phenomenon is at the centre of technological advancement and newer standards are expected to change the manner in which business is done. For instance, the FIR is expected to ensure that there is a seamless transmission of real-time data in different platforms in such a manner that it also provides for machine learning in improving business processes and functions. With this improvement comes the demand to produce products and goods that meet the new quality demands infused by FIR internet of things and services, vertically and horizontally across its entire value chain in changing and shaping the ICT business of the world.

2.3.1 ICT trends in developed countries

Woetzel, Seong, Wang, Manyika, Chui & Wong (2017) highlight the fact that investment in ICT infrastructure that include Computer software, hardware, internet and broadband equipment, for example, is key in determining growth in advanced economies. Schwab counters that the impact of ICT infrastructure, which is measured as the monetary value of capital services as a percentage of GDP, is useful in the assessment of the ICT sector's contribution (Schwab 2018). As shown in Figure 2.1, the USA has managed to secure a lead globally, and maintains strong competitiveness when compared to other OECD member states (Woetzel, Seong and Manyika 2017). Meanwhile, India and China appear to be emerging as front-runners in the ICT space, specifically with respect to their high levels of capital investment that ICT infrastructure brings to GDP growth (Barefoot, et al. 2018).

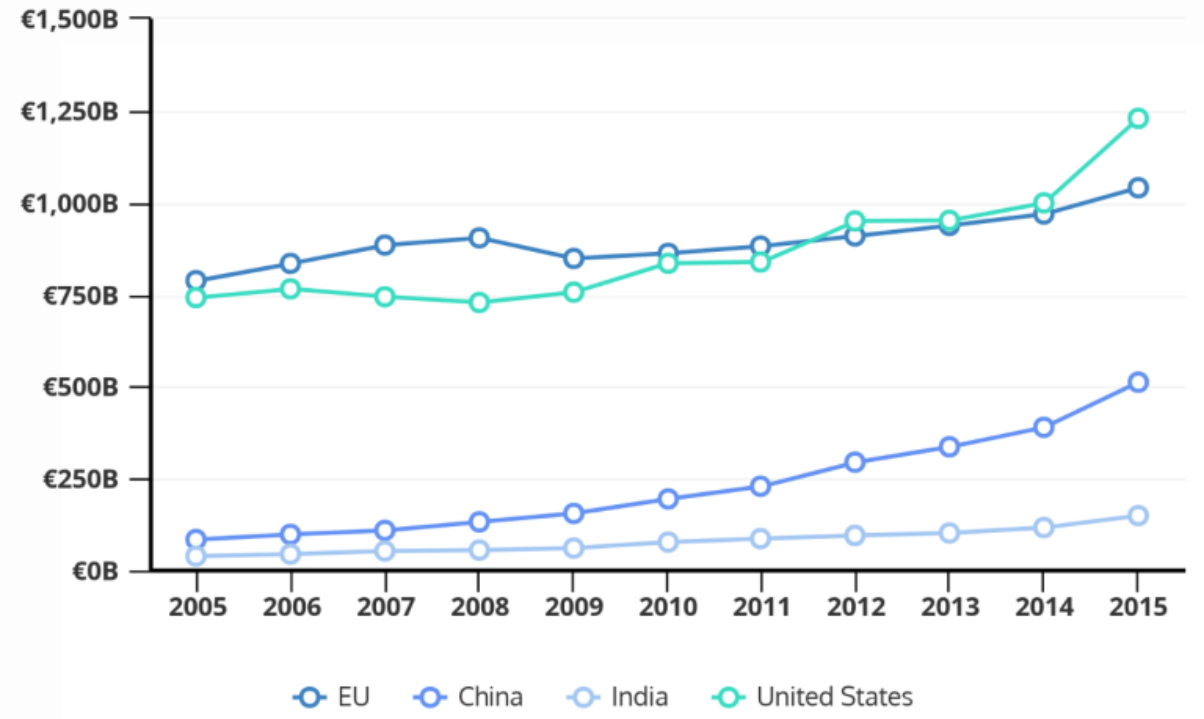


Figure 2.1: ICT global trends and competitiveness.

Source: Adopted from Woetzel *et al.*, (2017:3)

In assessing levels of reach of electronic learning in schools across the developed world, recent literature is more difficult to obtain, in all likelihood, because access to e-learning has become generally available, hence there are fewer studies focusing on the accessibility, challenges and strategies for the developed world. Uzunboylu (2006) found, through a literature survey of European Union (EU) e-learning approaches, that the EU has largely exerted a positive impact on the access of ICT learning in schools in member countries. In ensuring e-learning becomes a reality for many students in primary and secondary schools, interventions such as provision of necessary infrastructure and equipment, implementation of teacher training, delivery of quality content, encouraging the cooperation and networking among stakeholders, promoting digital literacy and the launch of EU digital campuses have been implemented successfully in EU countries (Uzunboylu, 2006:1).

Elsewhere in the United States of America (USA), Geith and Vignare (2008) note that the provision of, and access to e-learning worldwide is a human right. Consequently, e-learning strategies need to address legal, financial or distance barriers that may disadvantage some learners from accessing services. Geith and Vignare (2008) further note that, while e-learning is on the rise worldwide, a comparison between the USA and the EU shows that the growth in

e-learning was faster in the USA (which had grown from nearly 0 to 3.5 million registrations between 1998 and 2008), mainly due to the high numbers of non-traditional full time working individuals attending school.

While e-learning application in basic and higher education grew rapidly throughout the 2000s, not all developed countries experienced this rapid growth (Aoki, 2010:854). According to Aoki (2010), Japan experienced slow growth in e-learning during the 2000s while other countries were developing quickly. Instead, the education system stayed generally teacher-centred and calls to revolutionise education through e-learning were ignored. The slow growth was attributed to the general lack of pedagogical innovation in Japanese educational institutions which resulted in up to 82% of classes being provided employing a lecture-based approach, with content coming from lectures attended and textbooks read. However, from 2008, the use of e-learning in Japan began to improve, with up to 73.1% of higher education institutions implementing ICT systems by 2010.

2.3.2 ICT trends in developing countries

In several developing countries, online education is looked at as a solution to the increase in demand for higher education through increasing the number of individuals that can be taught by one institution at a time. For instance, in Pakistan, e-learning is promoted as a tool to spearhead ‘education for all’ since it manages to reach students living in remote areas; and who cannot afford mainstream higher education (Iqbal & Ahmad, 2010). Meanwhile, in Botswana, online education works to limit the number of large classrooms, hence increasing enrolment numbers (Ikpe, 2011). Online education is also expected to assist in simproving computer literacy skills in students, which are relevant in the current workforce (Addah, 2012; Khater, Nasar, & Khraisat, 2011).

Several challenges have been noted pertaining to the promotion of e-learning in developing countries. For instance, a survey of educators and students at 3 universities in Nigeria found that low acceptance of online education was due to the low awareness levels, low levels of computer literacy, unreliable platforms, poor ICT infrastructure, and expensive implementation costs (Folorunso, Ogunseye, & Sharma, 2006). In addition, challenges faced in Pakistani universities included the lack of ICT infrastructure; limited access to computers for students; and poorly trained educators. Furthermore, the need for schools to translate English as the predominant language on the internet into local languages such as Urdu to reach a more students (Iqbal & Ahmad, 2010) presented a further challenge. Addah (2012)

further noted that resistance to online education in Ghana, for instance, came from students' fear of isolation and computer illiteracy.

In a number of previous studies conducted on the factors affecting ICT reach, it was mostly assumed that these factors contributed to low levels of computer literacy that in turn negatively affects the adoption of online education. Bediang *et al.*, (2013)'s survey of students in Cameroon found that two-thirds of students in schools were not familiar with the concept of online education, and 17 % did not own a personal computer. Most students who used internet services only had basic Web search and email sending skills. In another study conducted in the country of Jordan, Akhu-Zaheya *et al.*, (2011) discovered that the majority of students did not have computers at home and to a larger extent, they used web searching, email and word processing only. Such students with limited use of computers at home and at school developed computer anxiety, leading to computer illiteracy.

2.4 ICT sector and jobs in South Africa

According to the University of Kent's College of Communication and Information (2016), the ICT field is one of the fields which represent a career path for the future; and this includes a study in distinct fields such as database analysis, information security, privacy coordination, digital strategies and web marketing management. In fact, the ICT field is one of the fields still available on the SA Department of Home Affairs 'critical skills list' released in 2019. The published list by SA Department of Home Affairs (2019: 12-23) specifies that the South African government is still short of IT individuals who are as shown in table 2.1

Table 2.1: South Africa Critical Skills

CISCO Solution Specialists	Data Centre Operations
1. CISCO Engineers	**2.** Network Specialist (Security)
3. Solutions Architects in Telecommunications and ICT	**4.** Database Specialists
5. Integrated Developers (PHP, Perl, Java)	**6.** Microsoft System Engineers
7. Network Analyst	**8.** Network Controllers
9. IT Security Specialist	**10.** AV Specialists (Anti-virus)
11. System Integration Specialist	**12.** Desktop support Engineers
13. Enterprise Architects	

Source: SA Department of Home Affairs (2019:12-23)

Hence, the existence of an ICT field in SA's critical skills list which signifies that career options are available but are still hard to fill due to the low registration of entrants of ICT

professionals at tertiary level in relevant subjects for the development of such skills (Parliamentary Monitoring Group 2016). Despite the low numbers of ICT professionals graduating with ICT qualifications in South Africa, there has been a steady growth in the size of the sector itself in both developing and developed economies (College of Communication and Information, 2016). Meanwhile, according to the Department of Higher Education and Training (2019), the ICT sector in SA has already exceeded the Agriculture sector in size; contributing about R93 billion (2.7% of total GDP) by the end of 2014. These growth statistics and scarce skills list show how important it is for current matric students to consider pursuing a career in the ICT sector.

2.4.1 South Africa's ICT Policy

South Africa's ICT Policy is recognised and backed by several constitutional provisions such as the *Electronic Communications Act Number 36 of 2005, National CyberSecurity Policy Framework (2015)* and *Electronic Communications and Transactions (Ect) Act 25 of 2002.* According to the ICT policy, key public institutions such as schools should become hubs for spearheading the digital society in South Africa due to their central community roles (Department of Telecommunications and Postal Services, 2016). Brown and Brown (2008) however note that there is a major limitation to South Africa's ICT policy since it only signals intent to implement measures, with limited understanding of whether a given policy was or is being implemented faithfully. The policy also does not document what impact (if any) resulted from implementing specific policies. Based on a review of ICT policy documents in South Africa, Bannatyne (2019) found that most policies address, to varying degrees, themes such as: vision and planning, ICT infrastructure; educators; skills and competencies; learning resources for schools as well as education Management Information Systems (MIS). Policies were also found to cover key governance issues such as the research, innovation, monitoring and evaluation of developmental interventions and the equity, inclusion and safety of ICT in schools (Bannatyne, 2019).

Bannatyne (2019)also notes that there exists a number of 'cross-cutting themes' which appear regularly in some policies; and relating to issues such as mobile learning; distance learning; Early Childhood Development (ECD); community engagement; resources for open education; and data privacy that are on the agenda for certain countries.

2.4.2 Provisioning of ICTs in South African Schools

This section discusses the access and availability of ICT infrastructure in SA's primary and secondary schools. Niebel (2018) stresses that the South African economy continues to limit the growth of ICTs as its economic clients limit their budgets on ICTs. This is while the global market is observed to be shifting owing to the Trump Administration in the United States of America as well as the persistently increasing influence of Chinese technological developments. This has also ensured a stronger demand for ICT skills on a global scale as shown in Figure2.1shown global ICT trends. In a 2016 finding, Crossan *et al.,* (2018) report that the Department of Basic Education met with the Department of Telecommunications and Postal Services with regards to the provision of ICT connectivity in all schools through South Africa. The meeting included other stakeholders such as the Independent Communications Authority of South Africa (ICASA) and the Universal Service and Access Agency of South Africa (USAASA). In addition, stakeholders representing the educational sector and ICT network operations were also in attendance at the conference.

Gaps and areas of concern with the provisioning of adequate and sound ICTs in schools are moreover largely affected by the lack of clarity on the specific meaning of what is implied by connectivity and the clarification of the responsibilities and roles of all stakeholders involved in the plan (Crossan, et al. 2018). Schwab (2018), makes the important point that ICT is not a solution but rather the road to a solution for the teaching practice in preparation for an ICT career. However, the findings reveal a gap in teacher training for provisioning ICTs for schools in South Africa.

Akhtar, Patel, and Khan (2013) nonetheless, reiterate that it is essential to provide educator learning and engagement through ensuring that there exists a clear and working relationship between educators and students. Such an action requires a roll-out programme that is pro-poor, focusing mainly on bridging the digital divide between rural and urban schools. For instance, Bannatyne (2019) suggests that students in credibly assessed poor schools ought to be given tablets. This is mentioned (Paas, van Merrienboer and Rees 2004) to heighten the learning experience through several models and the students' capabilities towards experiencing the possibility of taking ICT as a career choice in future studies.

2.4.3 Rural Schools and ICT Access

Bannatyne (2019) investigated the challenges of access to ICT in South African rural schools, and observed that underdevelopment in rural schools is an impediment to the advancement of ICT learning in the classroom. He highlights that there are still rural schools in large numbers

that have inadequate structures, erratic electrical supply, and limited capacity to use ICT resources adequately for instructional learning. For instance, some of the extreme conditions that are experienced in underdeveloped KwaZuluNatal rural schools include the need for secure buildings, followed by appropriate desks, reliable electricity, telephone networks, and mobile network access before computers can be acquired and installed for instructional learning (Bannatyne 2019).

The class-size in terms of the student: teacher ratio can also be observed to be much higher in rural regions. Furthermore, apart from the lack of well-equipped classrooms and a large number of students in rural classrooms (who are predominantly black), there is a lack of consistency in quality as it remains poor in terms of academic performance of the students who are without adequate resources. In addition to poor rural conditions for ICT learning, the UNESCO (2002:138) notes that most educators are poorly-trained and have limited incentive to live in the areas where they teach. This situation, when combined with "startlingly limited facilities and resources to assist them in their tasks, compromises 'the rights of children within education".

2.4.4 Crime and vandalism of ICT equipment in schools

Bannatyne (2019) highlights that in several government offices where connectivity was supposed to be provided, one key challenge was the issue of crime and vandalism. Businesstech (2019) corroborates this by stating that crime is affecting schools badly with the destruction of equipment, theft of the devices and vandalism of infrastructure. At times in certain areas, evidence of organised crime in destroying ICT infrastructure was found. Bannatyne (2019) reiterates that the aspects of crime ought to be tacitly addressed to reduce possible impact on the teaching and the integration of ICT into schools learning.

Crime in South Africa is largely influenced by the state of the economy and the historical economic imbalances that still prevail in the employment sector and in the household income and credit worthiness of its citizens (Statistics South Africa 2019). This is exacerbated by reduced growth rate of the economy that is also experiencing rising unemployment among its youths and young adults. In that vein, there has been a spate of protests over the quality of life that is deteriorating in the republic. The levels of crime in South Africa have not spared schools and infrastructure development. For instance, it was found that a school's ICT centre where over 12 desktops were installed for ICT learning were stolen after only two weeks of being installed at the school. A challenge of this nature has been mentioned by Brown & Lent (2016) as one of the factors affecting the development of information and communication

technologies within schools as both students and community members have the tendency to break into classrooms and steal equipment that is purposed for learning. Cybersecurity readiness has also been lagging in most of the South African communities, therefore negating efforts to broaden ICT skills knowledge in the same communities. South Africa's Telecommunications and Postal Services (2017) noted that 2017 saw increased attacks on national infrastructure, data breaches involving the information of individual citizens and attacks on big organisations. The survey notes that cybersecurity awareness should be prioritised in order to achieve behaviour change.

2.4.5 Range of career choices in ICT, South Africa

ICT as a career choice is influenced by the emerging socio-technological demand that is increasingly responding to the FIR. This is because information has become the new currency in the world, where knowledge is increasingly becoming that intangible organisational asset of equal importance to the very current assets in financial terms (Businesstech 2019). Akhtar, Patel, & Khan (2013) highlight that ICT is an incredible field with a wide variety of ICT career choices that are beyond the support agencies and fixing of components. As such, ICT careers can span different disciplines where architects, engineers, and mobile and web developers have significant career roles to play under the banner of information and communication technology. For instance, according to Bannatyne, (2019) graduates in ICT at a higher learning level can specialise in their area of interest while the pace of change in these areas of interest in this dynamic field is unprecedented.

2.4.6 ICT infrastructure penetration in South Africa

With Artificial Intelligence (AI) and automation projected to have major impacts on South African enterprise in the coming years, governments and business have been encouraging young South Africans to be more interested in the ICT sector. However, regardless of the positive campaigns, South African schools still face several infrastructural challenges, meaning that many still do not have access to enough computers or reliable internet, thus placing learners at a disadvantage when compared to other learners in many other countries. This was further corroborated by Gillward, Mothobi & Rademan (2018) who argue the economic and social inequalities are contributing factors to the digital divide in the South African education sector. Statistics reported through the National Education Infrastructure Management System (NEIMS) in 2018 showed that a number of schools in the Eastern Cape, KwaZulu-Natal (KZN) and Limpopo were the most widely affected. As per the Department

of Basic Education, an estimated R16 billion is necessary to finance the capacitation of computer labs with reliable internet connectivity (Parliamentary Monitoring Group, 2016). Furthermore, the cost of infrastructure to erect space for a lab has to be initially surveyed by a quantity surveyor at each site, thus adding to the cost. Alexander *et al.*, (2010) also notes that the cost of connectivity infrastructure requires individual assessments for conforming to standard fibre, wireless, satellite or other requirements depending on the location where they will be erected. However, due to recent advancements in technology, it has been noted that nowadays it is not necessary to provide a computer laboratories to all schools, since the provision of mobile computer facilities has reduced the need for these (Businesstech 2019).

At a meeting hosted by the DBE and the Department of Telecommunications and Postal Services held in 2016 (Parliamentary Monitoring Group 2016), the provision of ICT education in schools was a central discussion point. It was discovered that for ICT learning to be successfully implemented throughout all schools in South Africa, there has to be an investment in teacher training. Teacher training should aim to advance the abilities, skills and capacity of educators to deliver effective ICT education. The focus however was noted to be mostly required in rural and previously disadvantaged schools, which included the five schools in Zululand targeted by this study. The meeting highlighted why it is so challenging for most rural schools to produce any matriculates who will pursue an ICT career since their local schools hardly possess resources to equip them with enough skill.

The World Bank Info Dev programme sponsored a study by Isaacs (2007), who sought to investigate the status of ICT education in SA and to discover current issues related to the use of ICT in education. The study noted that while ICT education is offered in virtually all South African tertiary institutions, the same cannot be said for primary and secondary schools, especially rural schools (Businesstech 2019). This creates a problem where students become introduced to ICT learning only when they approach a tertiary institution; but without sufficient background knowledge students will fail to pursue a successful ICT career. Table 2.2 presents the findings by Isaacs (2007) on levels of penetration of computers and computer usage in learning across the nine provinces of South Africa by 2005.

Table 2.2: Levels of computer reach in class learning across South African Schools

Province	Number of schools	% of schools with computers	% of schools with computers for teaching & learning
Eastern Cape	6 239	23.0%	7.8%
Free State	1 842	77.3%	25.9%
Gauteng	1 897	94.5%	78.8%
KwaZulu-Natal	5 653	43.6%	12.0%
Mpumalanga	1 863	52.9%	16.3%
Northern Cape	422	91.0%	60.4%
Limpopo	4 187	41.8%	8.7%
North West	2 025	67.6%	29.7%
Western Cape	1 454	97.0%	76.6%
National	**25 582**	**50.9%**	**22.6%**

Source: Isaacs (2007:9)[1]

Data shown in Table 2.3 reveal the distribution of computer labs in South African schools from the viewpoint of a provincial landscape (Isaacs, 2007). It can be observed that considerable effort has been invested in computing and equipping technologies in schools across the provinces (Isaacs, 2017: 9). Kwa Zulu Natal is observed to have some of the highest number of computer equipment installations, however, the vast number of the schools that do benefit from this are in urban centres and not rural areas where a significant number of schools are situated.

Table 2.3 shows that 2 950 primary schools and 935 secondary schools had no computer labs in KZN in the year 2019. On the other hand, 2 342 primary schools and 1 964 secondary schools in KZN had internet connectivity in 2018. The level of internet connectivity in KZN province compares favourably with other provinces, only being lower than Eastern Cape (2 456) and Limpopo (2 546) for primary schools and being highest in high schools. However, it is possible that the significant installations of ICT infrastructure and connectivity could largely be based in urban schools rather than in any of the numerous rural schools that have suffered from immense under-development (Businesstech 2019).

[1]After a rigorous search, no published comprehensive information on ICT penetration in South African schools was found beyond the 2007 report quoted in this study.

Table 2.3: Number of computer labs and internet connectivity

Province	No computer labs		Internet connectivity	
	Primary schools	High schools	Primary schools	High schools
Eastern cape	4 049	685	2 456	1 322
Free State	388	144	306	171
Gauteng	235	154	280	107
KwaZulu-Natal	2 950	935	2 342	1 964
Limpopo	2 138	1 119	2 546	838
Mpumalanga	735	291	852	679
North West	644	161	281	275
Northern Cape	216	31	0	0
Western Cape	503	70	250	13
Total	**11 858**	**3 590**	**9 313**	**5 369**

Source: Adopted from Businesstech (2019: Online*)*

2.4.7 Socio-economic outlook and ICT infrastructure penetration in KZN

This subsection discusses the socio-economic characteristics of the KZN province and explores the extent of provision of ICT services across the province. According to the KZN Provincial Government (2019:7)'s socio-economic review and outlook, the KZN province was the second most populated in the country behind Gauteng, holding 11.3 million residents which make up 19.7% of the provincial share of the population. This was an increase of 5.2% in absolute figures from the 2011-2018 period figure of 11.1 million residents (KZN Provincial Government, 2019:8). Further, as shown by the KZN province's population pyramid (KZN Provincial Government, 2019:9), the majority of residents in the province are made up of the Millennial and new generation population groupings (Dimmock 2019). These generations are more ICT savvy and have significant parts of their lives that rely on the constant availability of reliable ICT infrastructure (Dimmock 2019). Consequently, the KZN provincial government has to ensure that ICT infrastructure is provided across the province, which includes the installation of ICT services in primary and secondary schools for learning.

According to the KZN Provincial Planning Commission (PPC)(2018:118), ensuring that sufficient information technology infrastructure is available for the development needs of KZN is amongst one of the province's key targets for 'strategic infrastructure' to be developed by 2035. In the efforts to develop ICT infrastructure, by the end of 2018, more than 28 thousand kilometres of fibre optic cable had been installed in various districts and

the metropolitan areas in the province, 1 999 schools have been connected to the internet (against a 2020 target of 1 800) and 131 municipal digital access centres have been created (KZN Provincial Planning Commission, 2018:122). However, the PPC notes that ICT infrastructure development remains a challenge in the KZN rural areas due to harsh terrain. Regardless of the challenges, the provincial authorities have managed to make positive movement in fostering ICT skills development among KZN residents. For instance, through the recent KZN Smart Exchange Incubator programme and the Moses Kotane Institute introducedin Richards Bay and Port Shepstone (KZN Provincial Planning Commission, 2018:122).

2.5 Factors influencing ICT Career Choices among Students

The previous section presented the theoretical aspects underpinning the career choices by students. This section offers a comprehensive discussion of empirical literature on the previous studies conducted and their findings in relation to factors influencing career choice in ICT. Literature is discussed in terms of individual factors rather than where in the world studies were conducted; hence it provides a global view of what influences career choices of students as they advance into tertiary education.

2.5.1 Computer self-efficacy

Considering that self-efficacy is correlated to specific accomplishments/ subjects, computer self-efficacy measurers one individual's ability to succeed in some computer-related exercises (Alexander *et al.,* 2010). Inadequate presentation which is applicable to ICT courses representative at secondary school can be factor to individual's unrealistic computer self-efficacy. High school students with little or no exposure to ICT may find it extremely difficult to make a career choice out of ICT due to unrealistically high expectations and their coping mechanism with the course may be a concern (Alexander *et al.,* 2010; Galpin *et al.,* 2003; Johnson *et al.,* 2008; Seymour *et al.,* 2005).

Although learners who were reported to have experienced sufficient access to ICT at school tended to have trust in their ICT skills (Alexander, et al. 2010), the opposite has also been observed, that is, self-efficacy can diminish once the learners have actual experience and a realistic apprehension of the course structure, or rather, how the course is facilitated at high school may cause panic (Alexander *et al.,* 2010).Accordingly, the exposure of students to computing -related activities increases computer self-efficacy. For students in the rural

schools who are less exposed to computing-related activities, their computer self-efficacy is presumably low.

Various empirical studies have linked self-efficacy to career decision-making among students. Smith (2015) established that students with different self-efficacy profiles tend to have different motivations and overall choices in terms of their career. In another study, Bozgeyikli, Eroğlu and Hamurcu (2009) investigated how the relationship between one student's socio- economic status and his/her self-efficacy helps explain different career decisions among youths in Turkey. The study found that socio-economic status significantly affects youg people's self-efficacy, which in turn affects their career decisions. While using the theoretical formulations of the Social Cognitive Career Theory (SCCT), Bozgeyikli *et al.*, (2009) found that demographicfactors such as age andgender interact with the young people's contextual environmental factors (such as social support) to result in an overall influence on career decision- making.

In arguing for the influence of self-efficacy on career choices, scholars argue that self-efficacy among students affects different elements of their personalities, which leads to distinct decisions on careers. One such scholar is Reddan (2015) who established that differences in self-efficacy among students leads to differences in self-appraisal, goal selection, occupational information, planning and problem-solving (Reddan, 2015:291). Reddan (2015) corroborates arguments such as those of Leong and Barak (2001) who stress that self-esteem has a positive influence on vocational behaviour of students. therefore, it can be seen that where self-esteem is a significant influencer of career choices, interventions among students should target enhancing their confidence levels with what they can do, for instance executing a number of computer tasks in an ICT module at school.

A similar finding by Chi, Glaser and Rees (2012) found that the aspect of self-efficacy is critical in generating self-confidence towards adopting a career choice. In a study conducted at a South African school, it was found that 50% of the students in a survey admitted to experiencing challenges with computer self-efficacy when it comes to computing and IT in general (Meyer & Gent, 2016). The reasons given by the students involved the perceived difficulty in understanding computers while some students interviewed in a small sample size attested to their peers telling them that computers are difficult and akin to a medical degree

attempt at a higher level. Such perceptions according to Chi, Glaser, & Rees (2012) generate diminished interest in understanding computer programming or in learning computers.

With regard to career decision-making, self-efficacy can be measured using several variables with techniques such as multiple logistic regression. This was applied by Ogutu, Odera and Maragia (2017) in their study which sought to investigate the extent to which self-efficacy can be used as a predictor of career decisions among students in Kenya. Ogutu *et al.,* (2017) identified, defined and tested a total of 8 variables measuring self-efficacy. The variables included: confidence to seek the teachers' help on career decisions; confidence in expressing one's opinion on career choice in front of peers; ability to cheer oneself up even in times of career setbacks; confidence to stay focused in a world of multiple distractions; staying calm even when scared of the consequences of a certain career decision; confidence to become friends with other students; discussing one's career; confidence in proudly talking about one's future career plans and tolerance of fun and arguments from peers in matters regarding career choice.

From the listed variables, it was found that variables such as confidence in seeking help in career decisions, confidence in expressing oneself in front of peers, becoming friends with other people, discussing one's career, proudly standing up to talk about one's future career plans, and tolerating arguments on career related matters can all possibly yield significant results. Consequently, in targeting self-efficacy enhancement among students, focus can be placed on building their confidence and abilities to openly speak about their career dreams, making friends with people moving in a similar career direction and withstanding criticisms that may arise from friends on peers on matters relating to their career. However, Edokpolor (2018), while noting that self-confidence is an important explainer of career decisions, found no significant relationship between self-efficacy of students and their career choice. Rather, Edokpolor (2018) found significant differences in career decision interests between male and female students, as well as students studying different majors at the university. This shows that there is still no consensus on the overall effect and extent to which self-efficacy of students determines their career choices. Based on this review, this study will explore how reported self-efficacy among matric students in the Zululand region relates to their choice of an ICT career, and compare results with those to be found in the literature.

2.5.2 Cognitive load

According to Kalyuga (2009) the invention of effective ICT-based learning environments must maintain focus on how the human mind works and how it establishes its cognitive limitations. Most knowledge acquisition processes take place prudently and involve the knowledge base of the student. Consciousness and knowledge base are associated with two necessary cognitive mental syntheses which are working memory and long-term memory (Kalyuga, 2009). Their characteristics are essential, and they have been well-established in learning and instruction theoretical frameworks (Kalyuga, 2009). Mental resources that are used when people are learning and carrying out various procedures are restricted by the scope and time of working memory that represents a major component influencing the effectiveness and efficiency of acquisition. If more than a few clumps of data are processed simultaneously, working memory may become overloaded and inhibit learning (Kalyuga, 2009). Illustration of cognitive load factors that may influence the strength of ICT-based learning surroundings are layers of constituent interactivity in learning materials, their spatial and temporal constellation, and redundant representations of information (Kalyuga, 2009). These aspects are crucial when assessing how the rural schools prepare the students for different mental projects that are computer related, given that they have limited resources.

In a different study, Ariel (2014) used a literature review approach to assess the relationship between cognitive load and decision regret. Ariel (2014)'s hypothesis was that the increase in cognitive load will likely push the decision-maker into making the wrong choice, thus resulting in decision regret. The study established that high cognitive load is likely to shift a person's mind from a rule-based decision strategy to a similarity-based strategy where a person will hardly use any analytical thinking in making a decision. While similarity-based thinking can help in simple and repetitive tasks, they become virtually inapplicable where complex decisions such as choosing a career by a matric student are involved. Nevertheless, Ariel (2014:21) could not establish a significant correlation between increasing cognitive load and decision regret. There were however notable differences in decision regret between individuals who had extensive cognitive load and those with less.

2.5.3 Social Influence in Career Choice

Empirical studies suggest that there are various social factors affecting students' career choice. Such factors relate to how the environment within which students reside such as parents, peers, teachers at matric, the internet and other public media affect students' choices

through bringing in fresh ideas and alternatives. Puertas, Arósquipa and Gutiérrez (2013) studied international literature from low, middle- and high-income countries to assess the factors influencing career choice among medical students. Their study came up with two major factors which were then grouped into intrinsic (personal) and extrinsic (environmental/social) factors. Puertas *et al.*,(2013:351) also identified patterns among the factors such that each factor was either a facilitator or a barrier to students' choice of a career. Social factors discovered by the study include the availability of role models, exposure and career advice as facilitators while low income, lack of prestige and poor environments were barriers. In addition, Puertas *et al.*,(2013:351) found a set of factors that specifically hinder students in low-income areas from choosing careers they are interested in, for instance, the intellectual challenges and lack of specific career advice. Therefore, there is a suggestion that factors affecting students' career choices also depend on the overall location of the students themselves. While families' role, attitude towards social problems and length of stay in an area can affect career choice by students in richer countries (Puertas *et al.,* 2013:353), students in poorer countries are initially affected by their limited access to essential career information.

Naz et al., (2014) conducted a study focused on critically analysing the effect of peers and friends on young people's career decision-making. Through a combination of secondary sourced data and data from a questionnaire distributed to 100 students, Naz et al., (2014:1193) found that the influence of peers and friends on young people's career choices is stronger than parental influence. The forms of influence through which peers and friends influence career choices among young people include help in career decisions, help in selection of profession, help in selection of a job, help in employment,and help in negotiating earning.

From the list, it can be seen that peers and friends affect several elements of young people's career decisions. This includes influence on the overall decision-making, selection of a profession, selection of a job within a profession, assisting in emplyment as well as in negotiating earnings. Findings by Naz *et al.,* (2014)point to the value of career influence as an asset for developing career decision-making among young people. However, this finding also points to the potental dangers of peer influence leading to some young people making bad career choices basedon what they hear from their peers and friends, even though parents may try their best to guide their children towards making wiser career choices.

In a related study, Mtemeri (2017) investigated career choice influencing factors among secondary school students in the Midlands province of Zimbabwe. Through collecting data from 1010 students and 20 career guidance practitioners, Mtemeri (2017) established that career choice of students is affected by (i) family members (both nuclear and extended family), (ii) schools of study with reference to teacher influence and career guidance events hosted by the school, (iii) geographical location of schools especially the distinction between urban and rural schools, and (iv) peers through advice and encouragement. While Mtemeri (2017) corroborates Naz *et al.*, (2014) on the influence of peers on career choice, his study shows that parental/ family influence is stronger than peer influence on students' career choice (Mtemeri, 2017:87). Moreover, Mtemeri (2017), while agreeing with Rajabi *et al.*, (2012), his findings conflict with findings by Dickison *et al.*, (2017) on how gender influencescareer choice among students.

Shumba & Naong (2012) carried out their own study which targeted university students from selected universities in the KZN, Western Cape and Eastern Cape provinces. Their study sought to investigate the different personal and environmental factors that affect students' choice of a career path. It emerged that students' personal abilities, their families and teachers around them significantly affect their choice of careers; which signifies the importance of students growing up in enabling environments (Shumba & Naong, 2012:173). This is so because if parents and teachers already possess knowledge of the value and importance of an ICT career, they are likely to influence students in question to pursue such; but where knowledge hardly exists, students can be influenced to pursue other careers. These students are more likely to originate from poorer areas where schools themselves are hardly invested in ICT, such as the targeted schools in the Zululand region.

In a study in Malaysian high schools, (Alexander, et al. 2010) found that social influence is highly significant when compared to other factors that were used in the survey used to investigate ICT as a career choice in high school students. In particular, students coming from rural schools, were found to give the highest level of agreeableness to statements that attested to social factors having a role in the career choice by students. The influence of people's cultural norms and values has been mentioned as being critical in career choice among learners at high schools (Brown and Lent 2016). This is also corroborated by Chi, Glaser, and Rees (2012) who assert that cultural values have the connotation of influencing what are

perceived as being promising and prestigious forms of career according to the knowledge of the elders in certain communities.

Several other studies have corroborated on how an enabling environment is crucial in students' choice of careers albeit in different fields (Akerman, 2012; Maharaj, 2008; Van-Rensberg, 2017). A study by Maharaj (2008) and later by Akerman (2012) in the KwaZulu-Natal province all found that the community around students significantly influences their career aspirations. Students were found to be affected by the expected difficulty level, the opinions of their teachers, parents and peers, the amount of work required to qualify for a certain career, and the value of subject for future studies or careers (Akerman, 2012:44). Similarly, Maharaj (2008:78) while using ANOVA testing, pointed towards parental influence and peer influence as key influencers of students' choice of a career students in the KwaZulu-Natal province.

While there are disagreements in literature on the extent of impact of each factor, there is general agreement that outside factors which make up students' environmentare instrumental in influencing their career decision-making. In their study in Kenya, Ogutu, Odera and Maragia (2017:16) also found that career decisions of high school students are significantly affected by their peers. Evidence from literature shows minimal divergencies on the influence of the school environment, family and peers on students' career choices. However, evidence appears to diverge on the influence of gender on career choice of students, as shown by disagreements in findings from separate studies (Dickison *et al.,* 2017; Marcus, 2017; Mtemeri, 2017; Rajabi *et al.,* 2012). For instance, scholars Njoki, Wabwoba and Micheni (2016) argue that gender is a significant explainer of differences in ICT career choices, leading to low uptake of ICT jobs by women. However, Rajabi *et al.,* (2012) and later Mtemeri (2017) all found no evidence of significant differences in career preference between genders.

According to Keller (2013) Social Influence can be referred to as the extent to which one individual perceives that others believe he or she should use the new system or not (Keller, 2013). Three important variables are derived from Technology Acceptance Models which match Social Influence (Keller, 2013). These entail the Subjective Norm (derived from the Theory of Reasoned Action (TRA)), the Technology Acceptance Model (TAM), the Theory of Planned Behaviour (TPB), the Decomposed Theory of Planned Behaviour (DTPB), and

the Combined TAM and TPB (C–TAM–TPB) theories (defined as the person's perception that most people who are important to them think that they must or must not perform the behaviour in question) (Brown and Lent 2016).

The Social Factors theory (derived from the Model of PC Utilisation), refers to the individual's conceptualisation of a reference group's individual culture, interpersonal agreements that the person has made with others in specific social situations. Image (derived from Innovation Diffusion Theory (IDT)), refers to the extent to which use of an innovation is perceived to enhance an individual person's image or status in a social system (Brown and Lent 2016). Many studies (Hackett & Byars, 2012) point out that Social Influence plays a complex role of in the acceptance of Technology. Hackett & Byars (2012) note that the intensity of social influence it is subject to a wide range of conditional factors. The influence of social factors was found to be varied in terms of intensity through the interplay of three mechanisms: Compliance, Internalisation, and Identification.

While Internalisation, and Identification relate to change and modification of an individual's belief structure and/ or leading to the individual's response to potentially gain from a specific situation or social status, Compliance as a mechanism changes an individual's intention as a result of social pressure. In other words, an individual will likely comply with the impact of social influence (especially for those referent to others with an ability to motivate and reward desired behaviour and penalise unwanted behaviour) in the presence of the moderating effect brought out by voluntarily use.

The influence of families and peers on career choice seems to extend beyond high school into University despite the students having gained some personal independence from their families. Kumar (2016) studied a cross section of 175 Universitystudents at selected Universities in Ethiopia. The study found that college students were still significantly influenced by their parents and families in choosing career paths. It was further established that fathers have a greater influence on students' career choice than mothers. In a related study by Hellen, Omari and Mong'are (2017), 1998 university students were studied to establish whether gender, age, peer and parental factors influenced career choice. The study discovered that while gender and age significantly explained differences in career choice among university students, parental and peer influence have a moderate influence (Hellen *et al.,* 2017:82). While findings by Kumar (2016) suggest that parental influence remains strong

even in college, Hellen *et al,.* (2017) argue that in college, personal rather than outside factors take greater precedence in explaining students' career choices. Hellen *et al.*, (2017)'s findings suggest that as students become more independent, it becomes up to them to make wise career choices due to the minimal influence of their families.

2.5.4 Career Relevance and Career Motivation

Investigations into factors influencing career choice in literature hinge on the choices that made matric students choose to pursue a certain educational field. Research has shown that familyinfluence is a significant factor in explaining matric students' choice of a career (Shumba &Naong, 2012). The second factor that is evident is the student's ability to identify their preferred career. As noted by Nyamwange (2016), career relevance and career motivation are key factors influencing of career choice among learners. For instance, a review of students' motivations and interests showed that most students are likely to select a career path that they already have interest in / enjoy, rather than one they are not interested in (Nyamwange, 2016:96).

Bannatyne (2019) asserts that students and their parents are adamant about the scarcity of ICT Jobs, and perhaps that the ICT major is hard to do; hence the lack of motivation to pursue ICT education (Babin, Grant, & Sawal, 2010a). A study conducted in 2016 states that fewer than one percent (1%) of matric students take IT as a subject because it is perceived as being too technical or requiring high-level mathematics skills (Hamid, 2014). A previous study deduced that role model encouragement, and the nature of relationships are the contributing factors in the career alternatives of students (Perrone *et al.*, 2001).

Some empirical studies have gone to great lengths to examine the effect that role models have on students' career choices. The study used a two surveys approach such that students answered a distinct questionnaire both before and after three speakers (role models) came to the school and presented motivational arguments for female students to pursue STEM subjects. The study established that while an impact on students' choice was established, there was little overall statistical significance citing the influence of role models.

In a related study, Quimby and De Santis (2006) disagree with Van-Raden (2011). In their study, self-efficacy and role model influence were assessed using multiple logistic regression analysis of responses from 368 students to establish the degree to which each affect the

choice of a career. Quimby and De Santis (2006) found that indeed self-efficacy and the influence of role models account for significant variations in career choices among students. Therefore, while results on the significance of role model influence appear to differ between different studies, it is generally agreed that role models offer an influence, and aspects such as career advice and coaching should be taken more seriously.

Cultural connotations and realities affecting the adoption of technologies in many parts of the globe in developing economies make it imperative to note that the South African context of economic development may hinder the notion that ICTs can create career choices for young learners in poor communities. This is because most elders and guardians are of the belief that traditional professions such as Accounting, Teaching, and other science professions are more rewarding and promising of a better future for their children (students).

Location is also mentioned by Kirschner, Paas, and Kirschner (2011) as a critical element in determining the level of technology adoption or acceptance in each setting. This is because location is linked to social influence and the ease of use of a system. For instance, learners who are based in remote areas are largely negatively affected by electricity supply and infrastructure development. This can be deemed to affect the smooth availability of electricity as such locations of learning are at a distance from the learning environment to supply uninterrupted electricity that facilitates adequate learning resources in the classroom. Location is also mentioned by Barefoot *et al.*, (2018) to illuminate the importance of having access to power grids that ensure there is electrical supply to facilitate learning in rural schools. In South Africa, it can be agreed that remote areas suffer from under-development and one of the deficiencies of development in such areas is network connectivity and electricity supply that is not interrupted.

2.5.5 Influence of ICT infrastructure on ICT career choice

According to Calitz (2015) the challenges faced by the school systems where IT is a subject on offer include curricula challenges, problems relating to the delivery of IT teaching, availability of skilled educators and perceptions of IT and the ICT Industry by student. These problems are likely to extend into the poor provision of ICT learning in schools, hence negatively affecting the likelihood of students studying and pursuing ICT subjects at university, due to their poor ICT background (Calitz, 2015).

South African schooling is structured to provide education that fosters autonomy to all students by offering subjects that should equip them with skills deemed necessary for them to take up specific careers (Calitz, 2015). The structure of the ICT curriculum) offered sometimes restricts students' career choice. Chi *et al*., (2012) and Dlodlo (2009) add that informatiom technology and computer application is a course that is examinable at provincial level for Grade 10 students, and at National level for Grade 12 students (Dlodlo, 2009). However due to the limited accessibility of ICT in rural areas, such courses cannot be taught in their curriculums (Dlodlo, 2009). Furthermore, CAT (Computer Applications Technology) courses which provide teaching for office applications are offered in not more than16% of secondary schools; and only 5% of secondary schools offer IT courses at a relatively advanced level (Calitz, 2015). Serious challenges with the ICT educational infrastructure, the academic capacity of the educators and the number of learners who take the high school IT course further exacerbated the situation, since these are declining sharply (Calitz 2010:73). This issue arises because of ICT implementation and educational development in which South African schools are still lagging behind (Mdlongwa, 2012).

The challenges above are corroborated by a comparative research study conducted into ICT and enhanced learning at High Schools in the Eastern Cape. It was found that both students and teachers felt that the current CAT as a subject was being undervalued and not given sufficient weight by Universities for them to accept matric students into ICT degree courses (Mdlongwa, 2012). Past research has revealed that some of the older generation of educators are struggling to utilise ICT in their teaching and, also, there is a shortage of qualified educators to facilitate ICT subjects like CAT in the schools, which affects scholars (Mdlongwa, 2012). The training of teachers especially in the IT subject should be prioritised and constant. Educators require constant training and re-skilling in their skills, and institutions offering the CAT and IT usually require educators to provide the required grooming and skills development necessary to colleagues (Koorsse, Calitz, & Cilliers, 2010). Educational institutions with IT as a high school module have a challenge in finding suitable facilitators and in providing ICT substructure (Calitz *et al.,* 2013).

2.5.6 Students' perceptions of ICT

A negative attitude maybe developed by students towards computer studies in high school (Havenga& Mentz, 2009). In SA, studies reveal that the secondary school IT module has an unfavourable effect on vocation alternatives made by students hereafter and has negatively

impacted the figure of professionals entering the ICT industry and those qualifying from institutions of higher learning (Koorsse, Cilliers, & Calitz, 2010). The pool of scholarly persons choosing IT as a module in Standard 8-10 is shrinking (Koorsse*et al.,* 2010). As proven in a previous study, the ICT field is less appealing than the others (Calitz *et al.,* 2015; Koorse *et al.,* 2010).

Previously conducted research has put considerable emphasis on establishing the cause of the apathy by students in selecting the computer field as a vocation option at university (Koorsse*et al.,* 2010). The verdict specifies that students are not knowledgeable about the ICT space and the availability of jobs in the ICT industry. Findings showed that students' perception of the field of computing from varies between different genders, cultures and other factors such as experience with using computers (Seymour & Serumola, 2016). Students' perception about ICT professionals is misleading, they believe that ICT career is only coding oriented, and ICT professionals work in isolation (Benamati, Ozdemir, & Smith, 2010). South African scholars and their career advisors can be blamed for condemning the ICT line of work as being doomed, hence the disinclination towards ICT studies (Alexander *et al.,* 2010; Benamati *et al.,* 2010; Calitz *et al.,* 2015).

2.5.7 Summary of factors influencing ICT career choice

Overall, a discussion into the factors influencing career choices of students shows a field rich with conflict regarding the influence of a number of factors. However, despite conflicting findings, there is a general agreement that students' career choices are largely affected by the environment in which they live and where they study (Kumar, 2016; Mtemeri, 2017; Rajabi *et al.,* 2012) as well as their self-efficacy, cognitive load and confidence levels (Alexander *et al.,* 2010). Difference in findings may be explained possibly by the differing conceptual structures applied in different researches. A review of some empirical studies shows variablity in the definition of variables (Hong Pang, 2014) and the arrangement of factors, and the patterns of questions put forward (Mtemeri, 2017; Rajabi *et al.,*2012). Figure 2.2 shows the conceptualisation of factors influencing ICT career choice by Park *et al.,* (2018).

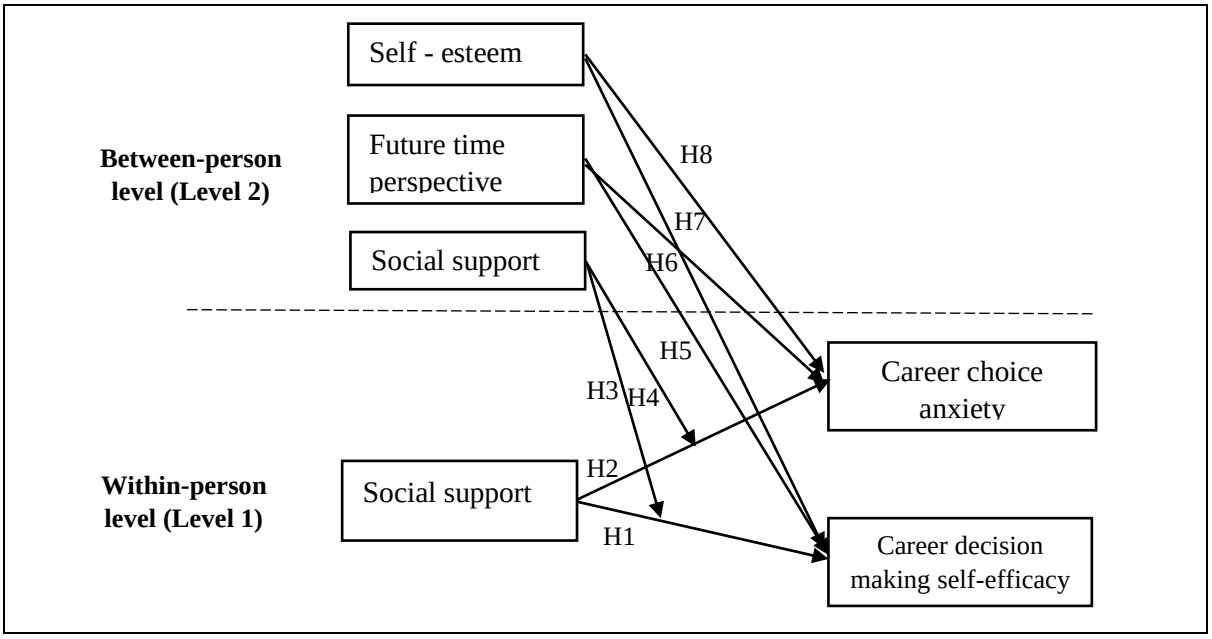


Figure 2.2: Conceptualisation of factors influencing career choice.

Source: Adopted from Park et al., (2018:7)

As shown on Figure 2.2, Park *et al.,* (2018) conceptualise factors influencing career choice as an interaction between self-esteem, future time perspective and social support, culminating in career choice anxiety and career decision-making self-efficacy. Park *et al.,* (2018:7)'s model hypothesises that there is an interaction between personal and interpersonal factors influencing career decisions. While a factor such as social influence can lead to increased anxiety due to the influence of peer pressure and high expectations,positive effects such as high confidence levels can reduce career choice anxiety and allow students to pursue a career of their own choosing (Park *et al.*,2018:7). Figure 2.3 shows the conceptualisation of factors by Hong Pang (2014).

On Figure 2.3, Hong Pang (2014) conceptualises the factors influencing career choice as inclusive of three distinct groups namely extrinsic, intrinsic, and altruistic factors. In addition to adding a different variable (altruistic factors), Hong Pang (2014) uses gender as a moderating variable, even though studies such as Mtemeri (2017) and Rajabi *et al.,* (2012) found that gender was a non-significant variable explaining differences in career choices. It is however observable that despite the difference in geographical area and time of study, previous empirical studies have generally defined a number of key factors that affect career choices of students, whether in high school or at university.Future studies should further explore the interaction of these factors and also seek to settle the debate on the extent of

influence of gender on the choices of a career as well as the varying influence of parents and families on career choice decissions by students in high school and at university.

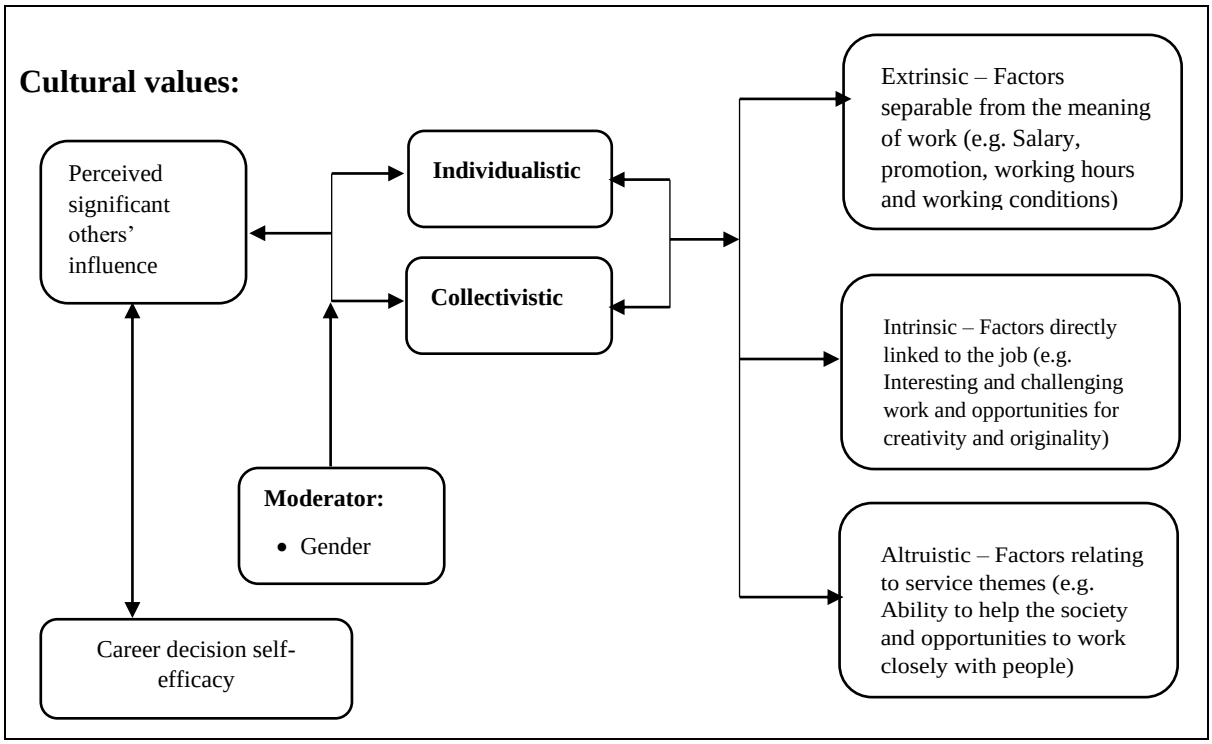


Figure 2.3: Conceptualisation of factors influencing career choice.

Source: Adopted from: Hong Pang (2014:5)

2.6 Research Modelling

This section presents an overview of theories and concepts that will be used in this study. The researcher understands a conceptual framework as pertinent to understanding and addressing the research problem of this study. In shaping the conceptual framework for this study, four theories namely; the Keller's ARCS Motivational model (Keller, 2012), Social Cognitive Career Theory (SCCT) (Bandura, 1986), Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh *et al*., 2003), and Gamification and Cognitive Load Theory (Sweller, Merrienboer & Paas (1998) are discussed in this section. The reason behind the choice of the above-mentioned theories is based on the idea that the theories focused on explaining or addressing career development aspects, how educational and career choices are made and processes which can encourage and sustain students' motivation. All these elements resonate with the research problem which the researcher aimed to explore. Previous research has been carried out using the same theories to address a similar research concept as the research in question (Kirlidog, Van der Vyver, Zeeman, & Coetzee, 2016).

2.6.1 Social Cognitive Career Theory (SCCT)

The SCCT has been in existence for a number of years, and aims to explain three interrelated aspects of career development: self-efficacy, outcome expectation and goals (Brown and Lent 2016).

Under the SCCT, self-efficacy refers to an individual person's belief that he/she can perform a particular activity or behaviour (Hackett & Byars, 2012). Outcome expectations are determined by what one aims to achieve, or accomplish as a consequence of engaging in a particular activity or behaviour (Brown & Lent, 2016). In addition, goals are argued to be personal development and accomplishment intentions towards engaging in a particular activity or the attainment of certain performance levels on the targeted task or activity or behaviour (Brown & Lent, 2016). By setting goals, people help to shape and lead their own behaviour and to endure it in the lack of more instantaneous affirmative feedback and regardless of expected impediments. Social cognitive theory hypothesises that goals are significantly entangled with both outcome expectations and self-efficacy, that is, students, as in the context of this study, are more inclined to set goals that are consistent with their interpretations of their individual ICT proficiencies and of the outcomes they expect to accomplish from following ICT careers as a specific course of action (Hackett & Byars, 2012).

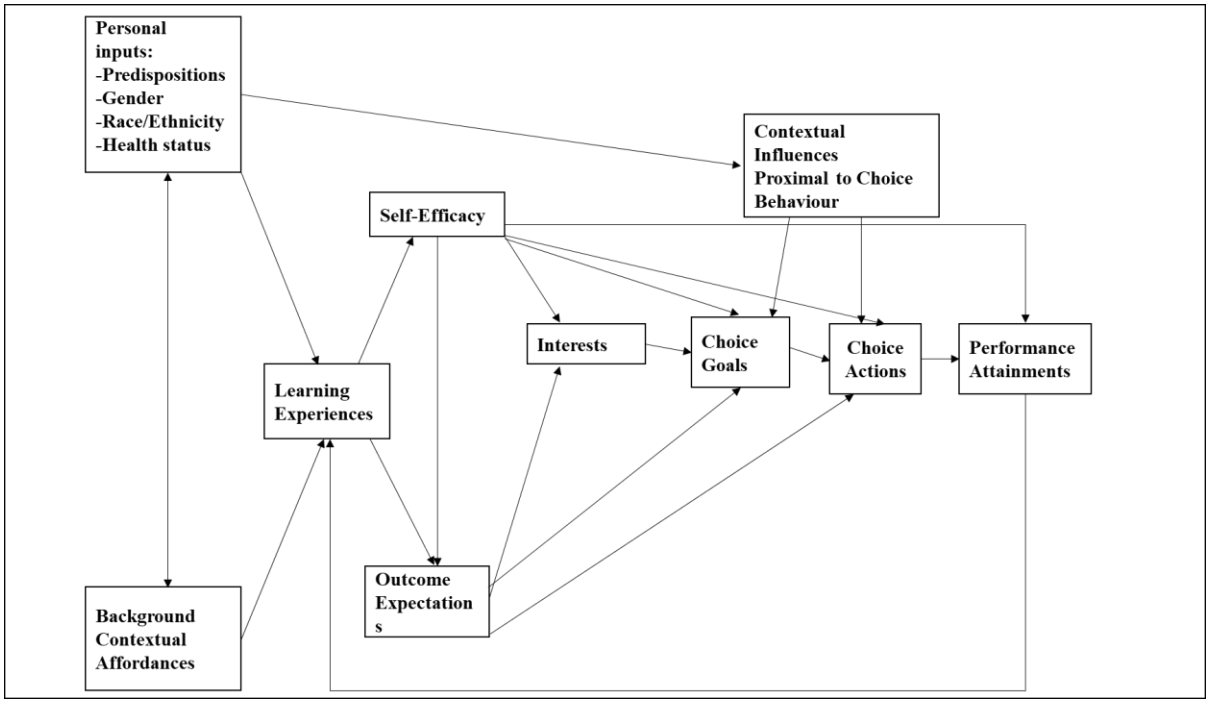


Figure 2.4: Social Cognitive Career Theory

Source: Adopted from Brown and Lent (2016:358)

The SCCT argues that social and structural factors indirectly impact on career choice through individual factors (Alexander *et al.,* 2010). The SCCT was hence chosen as a key second theory formulating this research's conceptual structure since it explores the influence of both structural/ extrinsic and individual factors. The SCCT also displays how career interests evolve over time in response to lived experiences; and has been applied to studies on career choices made by students (Cohen & Parsotam, 2010).

A review of the SCCT theory as shown in Figure 2.4 argues that to establish a learning experience, one's background, including parental or guardian support over perceived and interesting career prospects and one's personal inputs such as age, gender and race, combine as attributes to achieve its formation (Hackett & Betz, 2011). Learning experiences such as exposure to certain behaviour through learning and practice bring about self-efficacy. These experiences bring a better projection of the consequences of what one can accomplish from engaging in the particular behaviour and activities (Alexander *et al.,* 2010). Self-efficacy and outcome expectations are antecedents to the generation of interest in a particular activity or behavioural engagement by an individual (Hackett & Betz, 2011). Interest is posited to be an influencer in the choice of goals, and this is further aided by factors such as race, predisposition, gender, and aspects of affordability. Establishing choice actions for a chosen career, is further proposed to be influenced by interest, goal choice and contextual proximate choice behaviours that are offshoots of a person's input and background (Hackett &Byars, 2012). The theory argues that performance attainments are determined by the presence of a choice of actions and an interest generated from outcome expectations and self-efficacy (Hackett & Betz, 2011). While the SCCT will be fully measured in this study, it is not used in isolation, but rather in combination with other models. This is because the SCCT does not consider the social influence on career choice even though multiple studies have linked social influence to variations in career choice among students.

2.6.2 The Unified Theory of Acceptance and Use of Technology

The notion of technology usage is a characteristic that is typically attributed to ICT based career personnel in a generic context. This study considers that the behaviour of students and their attitude towards usage of technology-based applications in problem-solving and general lifestyle is a critical element of motivation towards a career choice in ICTs (Chi, Glaser and Rees 2012). At the same time, a student's understanding is based on what is expected of users and on what the system application in delivering business solutions entails (Manasse 2013).

In doing so, the learner has a better comprehension of the requirements of skills in ICTs and its significance in solving world problems. So it is better understood when a learner comprehends first the importance of what can be expected from using a system performance wise. It is also critically important for young students to be buoyed by the FIR that entails internet of things and services in the manner the world is doing business today. Doing so implies that the social influence of using an ICT based application is essential in decision-making for young students towards appreciation and consideration of ICT based career choices. Figure 2.5 shows the conceptualisation of the UTAUT.

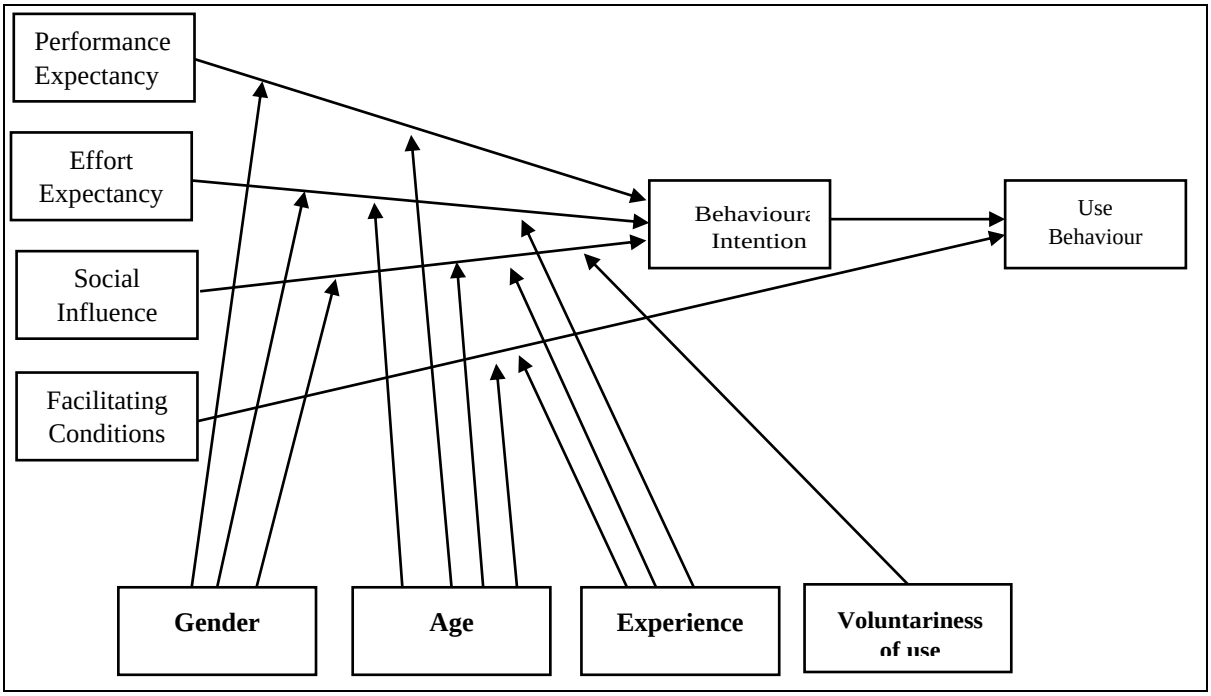


Figure 2.5: UTAUT theory conceptualisation

Source: Adopted from Petersen, Pather and Tucker (2018:204)

The UTAUT theory has been widely acclaimed for its consideration of essential factors that are linked to behavioural attitudes of end-users of systems and designed to be considered in depicting how best end-users may adopt usage of a system in question (Moore and Benbasat 2013). The theory is grounded on the philosophy that accepting a habit is only effective when the outcomes of the habit are known and determined to bring a superior performance or better result than the current or conventional way of doing things. However, in adopting such habits and behaviour, users would need to understand the reality of the benefits of embedding themselves with the habit or characteristic in sustaining the existence of new ways of achieving things (Tondeur, et al. 2012). The habit therefore requires a motivational set of elements that sustain the individual to better understand the requirements of the new ways of

doing things and to execute these accordingly. In the same way, the UTAUT theory comes with critical constructs for learning ICTs which are: performance expectancy, effort expectancy and supporting conditions.

Conditions that are defined as 'facilitating conditions' normally refer to the extent to which a person believes that specific organisational and technical infrastructure exists to support their use of the system (Brown and Lent 2016). Moore and Benbasat, (2013) note that there are three variables which are derived from Technology Acceptance Models.

Meanwhile, Yang and Yoo (2014) are of the view that experience and Cod Age moderate the relationship between Intention to use and Facilitating Conditions. With increases in experience, this effect becomes stronger especially among those in the older age group. Relative to ICTs usage and adoption among students for ICT career decision-making, the UTAUT theory entails, as a critical instrument for instructional administrators, planners and teachers that illuminates, and determines how best learners could adopt the usage of technology-based learning tools in developing an appreciation for the use of technology-based solutions. For instance, the expectancy theory can be linked to the cognitive need to mentally process logical thoughts using elements of relevance that exhibit the environmental inputs and operands of a system from a manual based system to a technology-based system relative to the performance of the outcome or quality of the task executed.

2.6.3 Keller's ARCS Motivational Model

John Keller was the original developer of the ARCS Model of motivation. Keller's ARCS Model proposes that individuals only engage in an activity if they consider it as a stepping-stone to their success and that it will satisfy their personal needs (Weibell, 2011).The instructional model consists of four main factors that produce and sustain motivation for learning in people and also the strategies to achieve them.

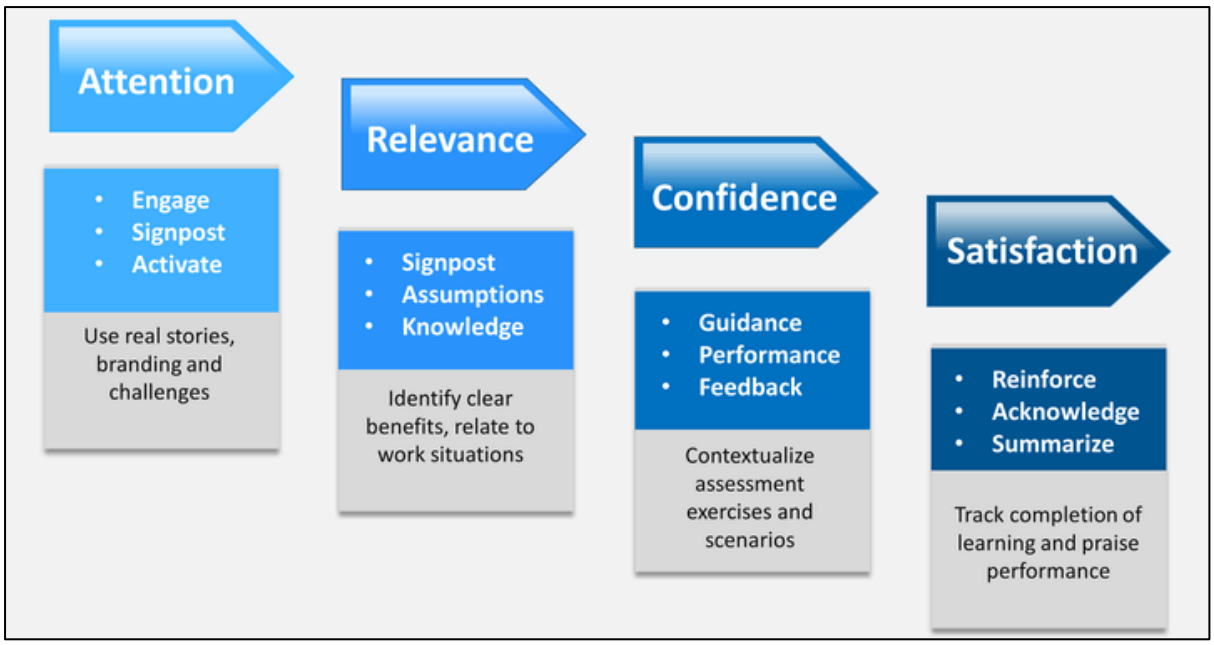


Figure 2.6: Keller's ARCS Motivational Model.

Source: Adopted from (Keller, 1979:57)

2.6.3.1 Attention

Keller (2010) notes that attention can be realised either through perceptual arousal (the use of uncertainty or surprise to gain one's interest) or inquiry arousal (posing questions and problems to be solved by a person in order to gain their attention). For the purpose of generating subject interest, learner attention needs to be captured (Keller, 1987). Keller (2010) asserts that in cases where typically it is the first time that course/topic is introduced to learners, motivational strategies can best be used as a try-out test. Chi, Glaser, & Rees (2012)note that where strategies implemented are revised and gaps identified, periodic reviews to address the instructional learning approach towards new content material and knowledge, a process of continuous improvement, ought to be in place in the strategy lifecycle. Brown & Lent (2016)note that in newly introduced modules such as ICTs and in particular, in developing countries, it is critically important to ensure that motivational approaches to learning as explained in the steps above and these ought to be implemented soon after the course ends when thoughts/are still fresh in one's mind.

2.6.3.2 Relevance

Relevance highlights the importance of a student's understanding of why they should put effort into a given task (Weibell, 2011). According to Keller (2009), there are various strategies teachers can use to establish relevance as a way of motivating students. These

include building up experience through the use of existing skills to build up new skill, proving how useful the present skill will become in the future, matching the needs of today's dynamic and risk-taking student by offering new challenges and allowing the students to choose different methodologies in pursuing their work.

2.6.3.3. Confidence

Confidence relates to the significance of students feeling confident in their power to succeed (Weibell, 2011). Keller (2009) argues that it is important for teachers to raise their students' confidence levels by showing them that they can achieve set targets. Confidence building also entails ensuring existing feedback channels and giving students targets and performance measurement opportunities.

2.6.3.4Satisfaction

Satisfaction is considered a critical element that enhances the level of confidence and motivation when learning new material. Satisfaction is defined as a condition where a person feels fulfilled by an act or situation where the individual is a part of or has an interest in. In the field of education, Keller (1987)'s model, the Attention, Relevance, Confidence, and Satisfaction (ARCS) Model, creates, stimulates, and maintains motivational strategies employed in instructional design. Studies evaluating Keller's model and application have proven the validity of the four key constructs and their expected positive effects on students' attitude and performance (Keller, 2012).

It is evident from Keller's model that building confidence and relevance can be highly useful in this study's context where more matric students should be encouraged to take up subjects in the ICT field. The model will not be adopted fully in this study since other constructs of Attention and Satisfaction mostly apply where ICT knowledge is fully grown, and students would be focusing on growing their knowledge. In the target schools, there is still a general low uptake of ICT from lower grades to matric, hence the need to build better relevance and students' confidence.

2.6.4 Gamification and Cognitive Load Theory

The idea of Cognitive Load Theory is to posit that mental ability in working memory is restricted so much that if an academic task is too complex, learning will be jeopardised (Jong, 2010). Cognitive Load Theory recommends that since working memory is restricted, scholars

may have information overload and, if the intricacy of their instructional materials is not administered well, the repercussion will be cognitive overload (Vasile*et al.*, 2010).

Gamification refers to the usage of game-based approaches in enhancing participation in non-gaming environments that incorporate learning and training (Longo, 2019). ICT skills challenges for students, as in the context of this study, can be used to engage ICT students to start learning particular computer technology applications tasks, and also to encourage reluctant students to engage in content. According to Nuria (2017), since students nowadays easily become bored, it is imperative to introduce gaming-based approaches to career guidance. Consequently, the gamification theory becomes relevant to the career choice discussion since scholars have identified that gaming-based approaches can be used in managing cognitive load as a result of career development learning exposure (Nuria, 2017).

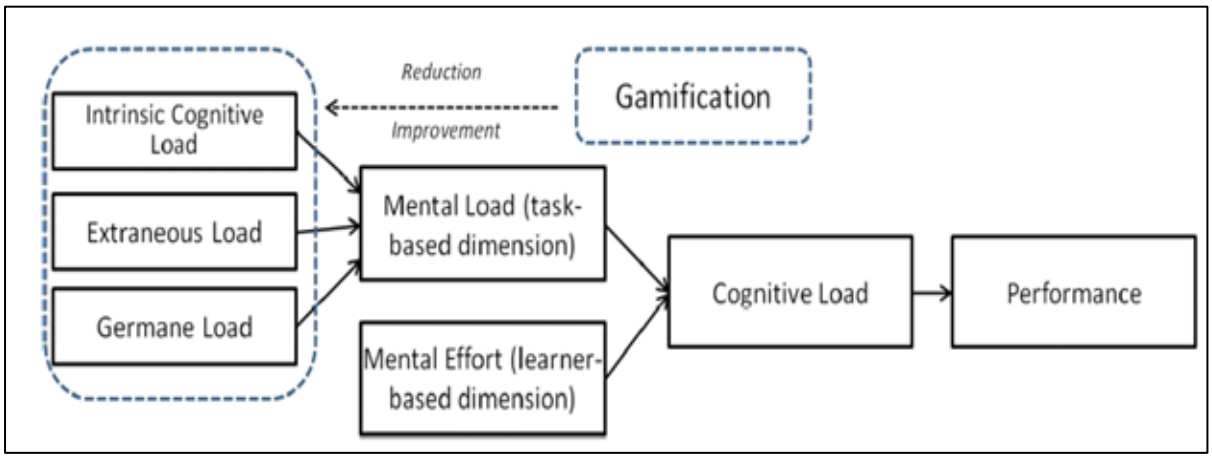


Figure 2.7: Gamification and Cognitive Load Theory.

Source: Adopted from Sweller *et al.*, (1998)

Gamification is proposed to enhance the cognitive development of students with motivation, engagement and encouragement for learners to 'immerse themselves' with intrinsic and extraneous load of new information in a manner that results in mental load which is a better understanding of task-based aptitudes. Studies have noted that the gamification theory is applicable and beneficial in learning contexts since it is active, leads to greater motivation and satisfaction among students, accommodates different learning styles, reinforces the mastery of skills, and provides an interactive platform for decision-making (Nuria, 2017).

2.6.4.1 Intrinsic, Extraneous and Germane Load

Intrinsic, extraneous and germane load are explained in this sub-section. These form the three dimensions of the cognitive load as shown in Figure 2.7.

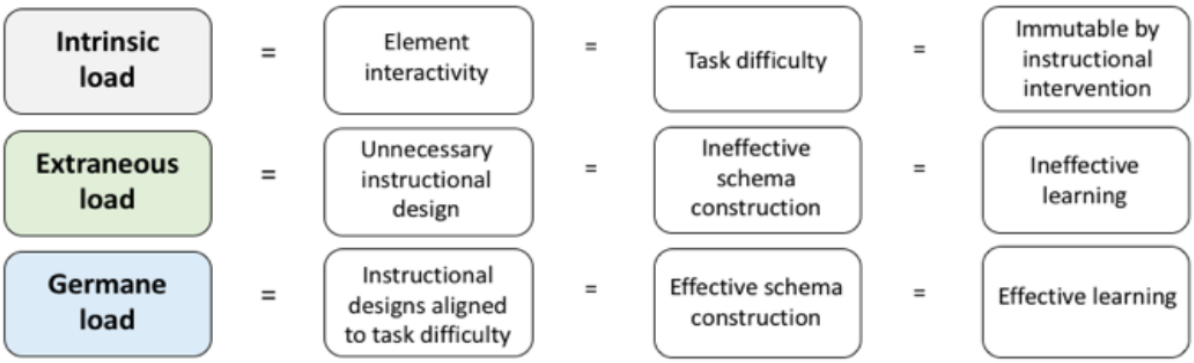


Figure 2.8: Intrinsic Extraneous and Germane Load

Source: Alexander *et al.*, (2010:5)

Together with mental effort, a student-based dimension, cognitive load is attained (Alexander *et al.*, 2010) and the outcome is a higher cognitive -based performance of the chosen tasks or activities. In the context of this specific study, it can be argued that the ICT teaching approaches may require structuring assessment to ascertain aspects of intensive material interactions in ICT classes, and their implications for the students' abilities to comprehend the new knowledge. In this study, the Gamification theory will be implemented fully, with specific focus on the cognitive load. This means that, due to the complexity in breaking down smaller aspects of cognitive load such as germane load, the researcher will measure the overall load, which is the cognitive load.

The argument behind the theory is that the working capacity if the memory is very limited and is the reason why some students tend to grasp a concept much better than others in a given sample of the same age ranges (Longo, 2019). However, it is important to remember how the working capacity of a human mind is generally small for all people (Longo, 2019).

The Cognitive Load theory and its principles can be applied to classroom learning in several ways (Chi, Glaser and Rees 2012). The first strategy according to Chi *et al.*, (2012) stress that teachers must tailor lessons according to the student's existing knowledge. The same authors further attest that teachers ought to use a lot of examples when teaching students new skills and content. Brown & Lent (2016)counter that this can be attained by usage of simpler

problems until they gradually become a little more complex to ensure the flow of understanding the added conceptual elements to new knowledge are grasped, understood and applied in problem-solving or in generating solutions of an ICT nature in the context of this study. the latter conforms to the subsequent strategy where there is a need gradually to increase the independency of ICT problem-solving as students become more proficient with the new concepts being used in class learning.

In the context of this study, literature on the Cognitive Load Theory also entails that the next strategy in class learning application of its principles requires the teacher to cut out non-essential information, while also ensuring that they present all essential information. The subsequent strategy is to ensure that information being taught is simplified as much as possible with illustrations orally and visually to heighten the cognitive understanding of elements being taught and their integration into the learning subject's content for comprehension and problem- solving.

The argument behind the theory says that working capacity of the human memory is very limited and is the reason why some students tend to grasp concepts much better than others in a given sample of the same age range (Businesstech 2019). However, as pointed out above, it is important to remember that the human mind's working capacity is generally small for all people.

Sweller and Colleagues (Brown and Lent 2016)in their effort to locate cognitive load within the subject of educational psychology and instructional design propose that three forms of cognitive load (intrinsic, extraneous and germane loads) are additive as shown in Figure 2.8.

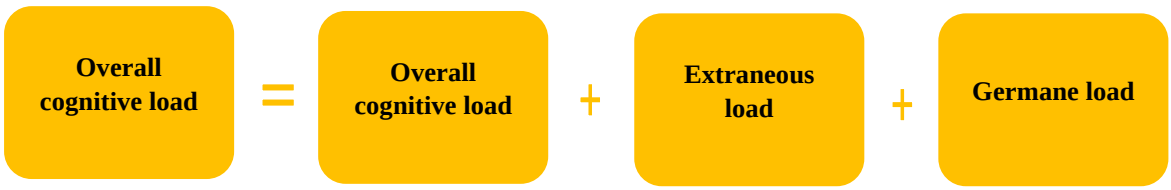


Figure 2.9: The derivation of overall cognitive load
Source: Adopted from Miwa, Terai, and Mizuno (2016:5)

Figure 2.9 shows the relationships of the three forms of cognitive load in the cognitive load theory (Miwa, Terai and Mizuno 2016).

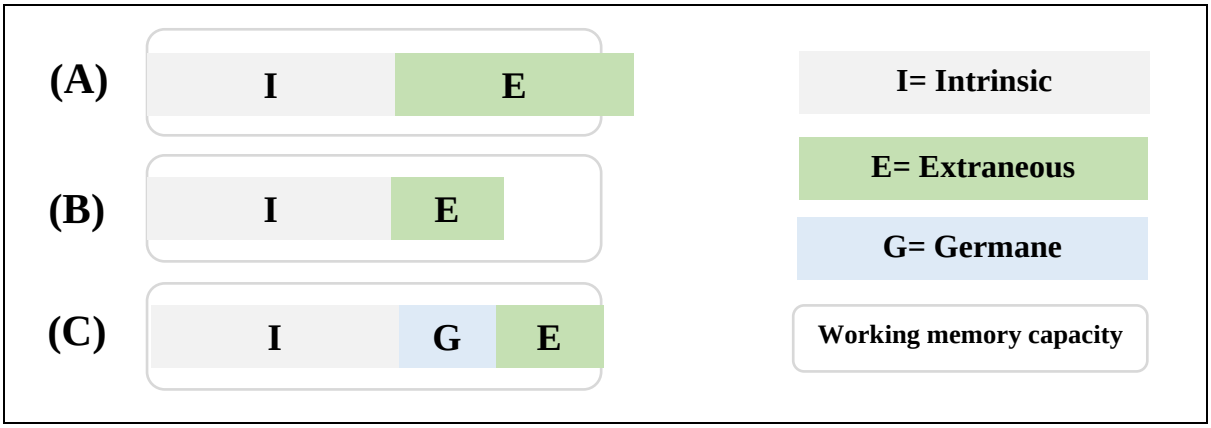


Figure 2.10: Relationships existingamong three cognitive load types
Source: Adopted from Miwa, K., Kojima, K., Terai, H., & Mizuno, Y. (2016:5)

As depicted in Figure 2.9, the condition in (A) (overload), cognitive load levels exceed the working memory limits of the learner owing to the increase in extraneous load. The net effect is that errors become more prone in the learner r during the learning process, and there is also a longer time required for the execution of tasks. This can have the effect of a learner becoming unable to effectively perform specific tasks. In condition (B), there is sparse working memory capacity and the learner can perform optimally on a given underlying task. Where spare capacity is available, CLT proposes an increase in the germane load so as to activate learning tasks, as in Condition (C).

2.6.4.2Cognitive load causal factors

A core construct within the CLT is the Cognitive load. Cognitive Load is considered as multi-dimensional. Paas, Van Merriënboer, & Adam (1994) proposed that the cognitive load is intuitively defined as a mental cost resulting from an underlying cognitive task on the human cognitive system. Two types of factor are known to interact with the cognitive load and these are mentioned by (Pintrich and Schunk 2016) and (Niebel 2018) as causal and assessment factors.

Causal factors are found to influence cognitive load whilst assessment factors are affected by the cognitive load. Brown & Lent (2016) attest to the fact that causal factors entailed in the task (T) are structure, novelty and pressure required for the task to be accomplished or executed. Causal factors also involve environmental features (E). These comprise noise and temperature where the task (T) is executed together with the interactions (E * T). Brown & Lent (2016) further attest to the fact that causal factors of the cognitive load interactions feature as the characteristics of the learner. These entail as the cognitive style, capabilities, and previous learner knowledge. Causal factors therefore integrate the interaction between

the learner's characteristics and the environment (E * L), while they also take into account the interactions between task, the environment, and the learner's characteristics (E*(T * L)) (Brown and Lent 2016).

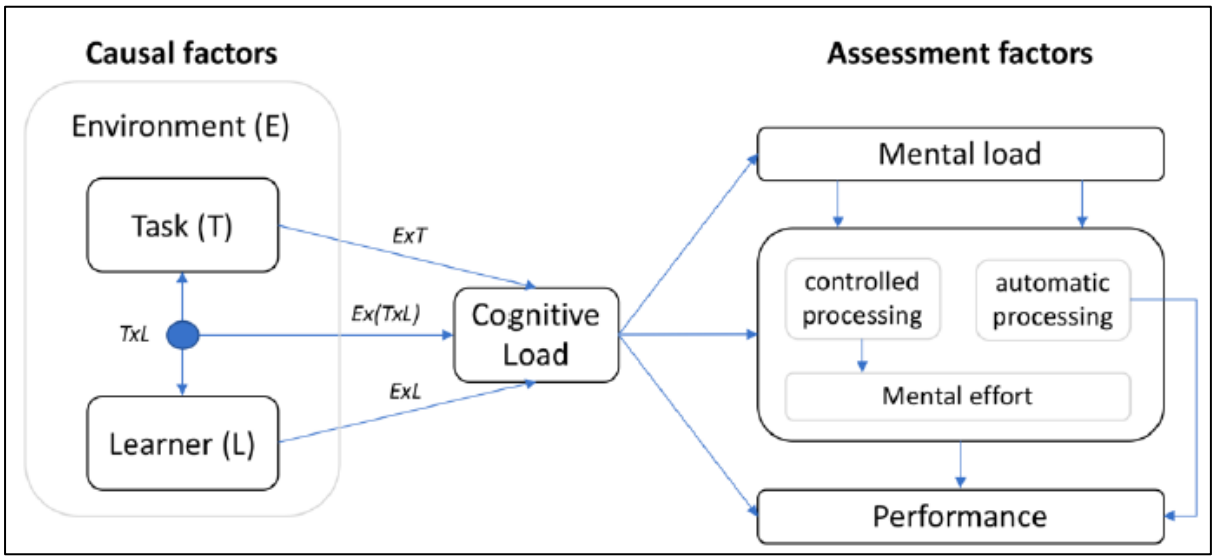


Figure 2.11: Causal and assessment factors of the cognitive load

Source: Adopted from Paas, van Merrienboer and Rees (2004:4)

2.6.4.3Three dimensions of cognitive load assessment factors

Assessment factors involve the three dimensions of mental effort, mental load, and mental performance as depicted in Figure 2.9. Vasile *et al.*, (2010) maintain that the mental load results from the task as well as the demands of the environment. The mental dimension is therefore a task-centred dimension that is considered to be constant and independent of the type of information that is loaded (Brown and Lent 2016). Mental effort reflects the amount of controlled processing in which the individual is engaged; and is known as is a human-centred dimension (Paas, Van Merriënboer, & Adam, 1994). It is influenced by the interaction between the environment and task (ExT), the subject characteristics and their interaction with the environment (ExL) as well as the interaction of a student with the given task in a specific environment (E x (T x L)). Similarly, mental performance levels are affected by the factors that affect mental effort (Alexander, et al. 2010). Several other factors might influence cognitive load (Longo & Barrett, 2010), but studies in the field have not yet produced an exhaustive list (Longo and Leva, 2017).

Longo (2017) presents two questions that the researcher believes all educators and curriculum developers should refer to when reviewing approaches to lesson planning and curriculum development. The first question, as related to Figure 2.9 above, enquires into whether or not

the students studied new content or skill to be learnt. Where not, the suggested approach is to determine what an example ought to visualise and where it should be placed in the lesson or lesson sequence (Longo and Leva 2017). The next step requires determining the point at which students should be working independently without instruction from the teacher. This determines whether or not it is too early or too late to introduce independent student practice in ICT topics.

Barefoot *et al.*, (2018)'s steps further suggest the need to determine the resources areas which do not contribute to essential concepts that students require learning in a subject. This entails determining where the curriculum and resources are placed and streamlined to allow greater room for integration into class learning. Barefoot *et al.*, (2018) conclude by stressing the need to ensure that the learning content is presented visually as well as verbally. If not, the learning environment needs to make use of diagrams, images or spatial organisers which are incorporated into learning resources and slide presentations (Longo, 2019; Barefoot *et al.*, 2018).

2.6.5 Adopted conceptual Framework

The proposed conceptual framework is formed on the basis of constructs generated by converging the four theoretical models that are: Keller's ARCS model, Cognitive Load Theory, Social Cognitive Career Theory, and the UTAUT theory.

For the SCCT, the key constructs extracted include self-efficacy, performance attainment, personal inputs and social influence/ community expectations. The construct of self-efficacy is derived from performance induced confidence as students participate in ICT-related subjects. For the Gamification theory, key constructs extracted include participation in class learning, mental effort by the student, mental load as well as the intrinsic and extrinsic cognitive load. In Keller's model, the constructs extracted were confidence in the learning process as well as relevance of knowledge attained and its importance in career choice. Career relevance for this model is derived from the relevance of knowledge gained during a study of ICT. Lastly, on the UTAUT theory, the extracted constructs include performance expectations of using computing technologies, social expectations from learning ICTs subjects, effort expectations arising from learning ICT subjects, status of the learning environment such as infrastructural capacity and the role of demographic factors inclusive of age, gender, ethnicity and geographical location.

Keller's model exposes converging constructs to ‘confidence and career relevance’ These can correlate with the SCCT's ‘self-efficacy and outcome expectations’ Relevance is buoyed by what one expects from an activity or behaviour (Hackett and Betz 2011). The cognitive load and gamification theory ensure that confidence is further attained through managing mental load. This is proposed to enhance the learning capabilities of students, while outcome expectations and defined or understood goals are supported with attaining high cognitive load which is argued to improve an individual's performance in comprehending ICT skills for career choice in IT. Therefore, key constructs have been taken into consideration from the theories into the conceptual approach. Below is the schematic representation of the proposed conceptual framework and the following constructs will be used in the study with the focus on ICT career education.

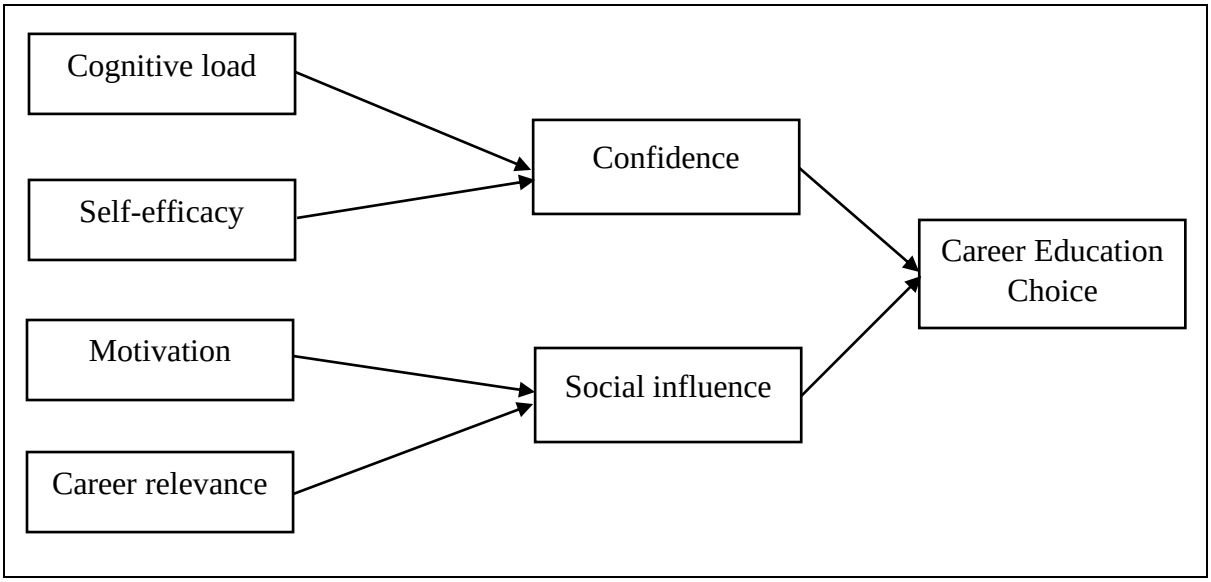


Figure 2.12: Adopted conceptual Framework for ICT Career Choice

Source: Researcher’s own planning

The conceptual framework hypothesises relationships to exist between variables that affect career choice as presented on Figure 2.11. For instance, the interaction between self-efficacy and cognitive load leads to the variable of confidence. According to Cowan, Slogrove, & Hoelson, (2012), self-efficacy works as a situation-specific form of confidence; and refers to one’s conviction that they are able to be successful at specific skills and tasks under named conditions. Consequently, confidence can have an impact on performance when efficacy expectation is high, and a person’s abilities are intact. Performance and efficacy expectation are strongly proportional to confidence (Keller, 2013; Skinner, 2013). Those with little or no

confidence spend more time and energy having self-doubt which results in poor performance and little achievement (Mikolyski, 2008). Akhtar, Patel & Khan (2013)assert that high self-efficacy is associated with confidence; therefore, a student who possesses both self-efficacy and confidence should make a better career education choice. Meanwhile, it has been found that cognitive overload will often result in a lower performance (Vasile *et al.,* 2010). Cognitive loading is related to performance, and it has been established that performance and confidence are statistically significant and positively correlated (Skinner, 2013). Other findings also confirm that lessening the complexity of ICT assessment improves student performance (Gillmor, Poggio & Embretson, 2015). An improved student performance which is associated with confidence and reduced cognitive load should enable a student to make better career education choices (Brown and Lent 2016).If students feel confident enough to accomplish their goals, their motivation for them to make a sound decision about the career education choice is likely to increase. Using the proposed conceptual model (part of which is based on Keller's ARCS model), confidence among matric students can hence be tested to establish its relationship to students' career choice as shown in the converging constructs (Table 2.4).

Kirschner, Paas, & Kirschner (2011) and Chi *et al.,* (2012) agree that Keller's motivational model constructs such as career relevance (in this case) are demonstrated by students' choice to inherit father's/mothers/guardian's occupation. This is also related to one of Keller's strategies for 'Relevance Called Modelling' (Weibell, 2011).In addition, motivation is the force that enlightens, and maintains goal-oriented behaviour. It is what causes people to take action (Cherry, 2017). Motivation explains the particular goals towards which students wish to achieve (Pintrich *et al.*, 1993; Maehr& Meyer, 1997). Therefore, self-efficacy affects the choices students make, such as whether to enrol in ICT education or not. Motivation can be an influence that comes from an outside source. Possible factors that can affect motivation include the social dimension, which is, how people in our social or peer group behave and what they believe in. Social influence is derived from Self-Efficacy Theory. Recent empirical studies have found that in various instances, parents take it upon themselves to influence the decision of their children's career selection (Pavel, 2015). The social influence construct will hence be used to investigate how career education choice is impacted by social factors that include peer pressure, family influence, the availability of ICT infrastructure enabling the study of ICT subjects and other factors. The chosen model for investigating the factors influencing ICT career choice is most suitable in solving the problem statement for this study since it was derived from a comprehension of four theoretical foundations that are relevant in

assessing these factors. An interaction of various theories was necessary to ensure weaknesses of one theory are neutralised by the strengths of another. This model will allow for a comprehensive assessment of not only the intrinsic and extrinsic factors influencing ICT career choice but also the relationships between factors themselves.

2.7 Summary

This chapter focused on reviewing existing theoretical and empirical literature on the factors affecting students' career choice. The theoretical review established the existence of theories proposing the influence of self-efficacy, cognitive load, confidence and other factors whilst empirical studies tested the applicability of such theories and at the same time assessed the impact of the society. This realisation therefore gave rise to the proposed conceptual framework for this study which encompasses both personal and social factors. A review of various existing theoretical models showed a general limitation in terms of models directly applicable to career choice among students. This gave rise to the synthesis of factors identified in empirical studies such as internal factors (self-efficacy, cognitive load and confidence) and external factors (career motivation, career relevance and social factors) with existing theories to construct a single conceptual structure (refer to Figure 2.12). While to a great extent it is noted that students' career choices are highly affected by their own personal characteristics (intrinsic factors) and the society in which they exist (extrinsic factors), there are general disagreements in literature on the exact magnitude and extent of such factors. This study will employ a customised conceptual structure to evaluate each factor and the influence of interactions among factors on students' ICT career choice. The next chapter will discuss the methodological approach proposed for this study in sampling, collection and analysis of the data collected from matric students in selected High Schools in Zululand.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the study's research paradigm, the study population, the sampling strategy used in the survey, the research instrument, the data administration, and the collection and the analysis of the survey findings relative to the determining factors affecting matric students' choice of IT subjects using a sample of selected schools in the Zululand region of KZN province. The purpose of this chapter is to provide a comprehensive narration of the research approach, procedures and processes used in the collection, analysis and presentation of findings.

Creswell (2012) notes that a research method can be viewed as means of obtaining knowledge through the use of an instrument for data collection. This chapter will explore the methodology in answering the following research questions:

- What is the relationship between students' confidence and its influencing factors – self-efficacy and cognitive load?
- What is the relationship between social influence and its influencing factors – career motivation and career relevance?
- How does students' confidence and social factors influence their ICT career education choice?

The next sub-section discusses the research philosophy that influenced the choice of the quantitative research method and design in the survey research approach used

3.2 Research Philosophy

In making a determination of the best research methodology to adopt for this study, consideration was given to the fact that there are typically, three main kinds of research philosophies employed in research which are: positivism, interpretivism and phenomenology (Creswell 2012). These are explained in the next sub-section and a summary of the chosen positivist research paradigm is explained thereafter.

Phenomenologists are of the belief that the world cannot be understood by merely subjecting its natural and social occurrences to numeric quantifications because such quantifications find it difficult to translate with ease texts and emotions, feelings and reactions by reducing these to numerical statistics (Saunders, Lewis, & Thornhill, 2016). The challenge however, with phenomenology is that of coming up with a conclusive understanding of the investigated

phenomenon, which is difficult because there are no objective results that can be used as benchmarks to what can be projected with statistical confidence (Creswell 2012).

Positivism, on the other hand, argues that to best understand the real world, one needs to establish numerical significances to what is occurring in a phenomenon (Babbie & Mouton, 2011). Establishing what is commonly known as the 'objective reality' is an element of positivism as it seeks to enhance the validity and accuracy of research results to influence precise decision-making processing (Saunders *et al.,* 2016). Positivism therefore is found to be the grounding philosophy for quantitative research as it establishes data accuracy with numerical quantifications necessary for understanding of a phenomenon's influencing variables and constructs (Babbie and Mouton 2011).

Interpretivism as a philosophy culminates from observation and interpretation of phenomenon, thus, to observe is to collect information about occurrences, while to interpret is to determine meaning of that information through the drawing of statistical inferences (Aikenhead, 1997). Walsham (1993) argues using the interpretive tradition, there exists no 'correct' or 'incorrect' theories. Reeves and Hedberg (2003:32) note that the "interpretive paradigm is concerned with understanding the world as it is from subjective experiences of individuals" (Reeves & Hedberg, 2003). Studies grounded in the interpretivist philosophy use meaning oriented methodologies, for instance the use of interviews or observations; which rely on a subjective relationship between the researcher and participants. Therefore, interpretive research will not predefine any dependent and explain variables, but rather considers the full complexity of human sense (Kaplan & Maxwell, 1994). Henning, van Rensburg, and Smit (2004) note that the key words relating to interpretivism are participation, collaboration and engagement.

This study was grounded in the positivism research paradigm. It followed the common research processes as identified by Saunders, Lewis and Thornhill (2012) whereby positivism is often associated with quantitative research studies. This study therefore quantitatively analysed the link between a number of factors and matric students' choice of ICT subjects as rooted in the positivist paradigm.

3.3 Research Approach

Saunders *et al.,*(2016:240) define research approaches as "plans and the procedure for research that encompasses steps from broad assumptions to detailed methods of data collection, analysis, and interpretation". A quantitative research methodology allows for the

objective reality to be established, from which accurate readings can be interpreted to give more conclusive understanding of what is studied (Saunders *et al.*, 2016). The usage of statistical inference and frequency distributions of given assertions enhances the validation of findings and establishes whether or not these can be generalised. This makes the quantitative approach attractive to use (Babbie and Mouton 2011).

A qualitative research approach is another approach applicable in research. However, there is need to ensure that the realities of challenges and opportunities as they exist within the stakeholders in ICT education and career choices among matric students takes precedence. Such realities are only validated and can be generalised when numerical interpretations with statistical backing are established. This brings about the objective reality of the situation that can be credited and relied upon for future decisions. In addition, the opportunity to establish congruency from survey feedback with pre-determined enquiries develops what could be hypothetical assumptions from what the study gathers and analyses. These attributes cannot be determined with a qualitative research approach as they seek to expose hidden underlying issues that can be illuminated with semi-structured in-depth questions that are not leading (Kothari, 2014). Moreover, while a qualitative research approach involves the researcher at the point of data collection, it brings constraints to bias elimination. This is not the case with the chosen quantitative research strategy as it eliminates the researcher from the point of data collection. Bias is minimised significantly in quantitative research compared to qualitative research (Babbie & Mouton, 2011).

By combining elements of both the quantitative and qualitative approaches, researchers can employ a mixed methods approach. In this approach, quantitative methods can be used to approve or disapprove study hypotheses through statistical inference while qualitative methods can be used to study deeper rooted issues and provide answers to why certain phenomena occur as they do (Chi, Glaser and Rees 2012). Through combining two approaches, the mixed methods approach neutralises disadvantages of both the qualitative and quantitative approaches. However, it is more complex to employ and requires comprehensive planning and preparation (Saunders et al., 2012). The main purpose of quantitative study is to identify a problem which can be investigated precisely, or for developing a set of hypotheses from an operational point of view (Kothari, 2014); and this was employed in this study (Chi, Glaser and Rees 2012). Data was obtained to investigate the developed conceptual construct's specific causal factors in relation to student's choice of

ICT education. A descriptive survey design was adopted to establish the realities of what is occurring within the students' development towards ICT proficiencies and career development in the selected targeted KZN schools (Kothari, 2014). This study applied the quantitative approach in assessing how each factor, as determined by the adopted conceptual structure, affected the dependent variable (Babbie and Mouton 2011).

3.4 Research Strategy

Datt (2016) views a research strategy as an overall plan of how the study will go about answering research questions developed. There are 7main research strategies the main aims of which include the conducting of experiments, surveys, case studies and the application of ethnography.

An experimental research strategy involves the use of two variables, one of which is a constant (Mitchell 2015). This strategy is synonymous with quantitative research and it is mainly applicable in instances where not enough information is available about a phenomenon before a decision is made. The experimental approach was not appropriate since it does not allow for a study of one specific population grouping.

A quasi-experimental research resembles an experimental strategy, but it cannot be fully classified as an experimental research strategy. In this strategy, the explainer variable is manipulated before any measurement of the dependent variable, thus eliminating the directionality problem.

Simulation research strategies involve the creation of a model to represent an authentic phenomenon. The purpose of simulation research is to mimic possible real-life outcomes in a controlled environment. This strategy was not suitable for this study since establishing the factors impacting career choice can be conducted through a survey of a sample.

A Survey research strategy is synonymous with quantitative research where a sample or entire population participates in a study (Datt, 2016). Surveys manage to collect information on attitudes, opinions, behaviour or characteristics of the population. This study employed the survey strategy as it was the most appropriate, based on its ability to explore any phenomenon from the perspective of a chosen target population.

Case study research is a commonly employed strategy in the social sciences, and it involves the empirical analysis of a phenomenon in a real-life looking context. In a case study strategy, an in-depth enquiry is conducted into a single individual, group of persons or events

to establish the underlying issues. The case study approach was not appropriate for this study since it requires an in-depth assessment of a certain population bound by a specific context.

Ethnography research is a strategy valid in qualitative studies, it and involves an in-depth look into how people live their lives (Anderson, 2009). This strategy involves the researcher's immersion into the community of people he/she is studying to live their real experiences and make observations. This strategy was not employed in this study not only due to its cost and time intensiveness, but also because it applies to qualitative research approaches.

Correlational research strategies are non-experimental and include the measurement of two variables to ascertain their linear relationship with little regard for extraneous variables. It is a valid strategy where the researcher does not believe that the statistical relationship between two variables under test is a casual one.

3.5 Research Design

Research designs explain the systematic and logical steps that a research uses to gather primary information for future analysis (Saunders, Lewis and Thornhill 2016). This involves the design of the instrument for data collection, the identification of the target population, the sampling technique employed and the manner of data analysis. It therefore serves as a blueprint for the research's empirical evidence gathering and analysis (Creswell 2012).

Following the choice of research strategy, the descriptive-correlation survey design was applied in this study. Creswell (2012) argues that the descriptive research design pronounces on the description of a subject in response to questions such as what, who, where, when and how, associated with any research problem statement. In this study, answers to questions including 'what is the relationship between social influence and its influencing factors – career motivation and career relevance?' were analysed using the descriptive research design.

Correlational research design

Correlational research design explores the relationship that exists between established variables in the research study and uses statistical analysis in validating the correlations as they are computed in the study. However, the only drawback of correlational research design is in its lack of determining the cause and effect, and thus, this implies that it is mostly used

as an observational research design in relation to data collection and the design of the research instrument.

Causal comparative research design

Unlike a correlational research design, this attempts to discover the cause and effect relationship between two variables in the study. In this research design, the researcher does not manipulate the independent variable, and neither is there any assignment of groups of variables. The casual comparative research design rather determines, identifies and exposes control groups' attitudes towards the variables in the study. The results are compared with results from the group that was not exposed to the variables.

Experimental research design

In an experimental research design, often termed as true experimentation, the researcher uses scientific techniques to investigate the cause-and-effect relationship between groups of study variables. The researcher is further expected to control all but 1 variable (which will be explainer variable). In doing so, the effects of the explainer variable on the dependent variable(s) can be established and analysed in determining the relationship that exists.

Descriptive research design

A descriptive research design is one which uses frequencies and statistical distributions of data in explaining the occurrences as they happen in the study. However, the descriptive research design does not offer an opportunity for the researcher to explain the causative factors affecting the research issue investigated, as they merely describe the quantified findings. In doing so, they mainly serve as an observational explanation of the research findings without essentially offering the explanations as to why such observations are emerging from the investigated phenomenon (Saunders et al., 2016).

The research used a descriptive and correlational research design approach. This served to give objective frequency readings accurately, that reflect exactly the survey data outcomes for each variable subjected for enquiry (Babbie and Mouton 2011). At the same time, using a correlational research element in the design enabled the researcher to explore the relationships that exist between dependent and independent variables in this study (Moore and Benbasat 2013).

3.6 Research Site and Setting

Study site is the actual area or research setting where the research will be carried out (Babbie and Mouton 2011). The chosen study site was the Zululand Region in KwaZulu-Natal. Zululand consists of five Circuit Management Centres (otherwise depicted as districts in this study) namely, Nongoma, Ulundi, Phongolo, Edumbe, and Vryheid. The researcher chose Zululand as the study site since most residents in it are of historically disadvantaged origin. Zululand, in the KZN province, moreover, has the biggest area of rural land in South Africa that is underdeveloped. According to the information obtained from the Department of education, Zululand is the historical disadvantaged region facing the following challenges: poor infrastructure, some areas do not have electricity, with one laptop per school, and lack of trained teachers to facilitate ICT studies. This study was conducted in the Zululand region and test the effects on poor communities as noted by Puertas *et al.*,(2013). The choice of Zululand was further motivated by the potential generalisability of the research findings, where from an extreme socio-economic constraint prevalent in the large rural setting, appropriate interventions from analysed findings could be made. These would be projected by the researcher to be more holistically addressing the ICT career education choice problem from the leaners in the targeted rural schools by the generalisability elements of the study as nearly all schools are faced with similar socio-economic constraints.

3.7 Sampling design

A sample refers to the small number of research subjects including people that are accessed and provide contributions to the research process to allow for analysis of the research findings and understanding of the research phenomenon (Datt, 2016). Saunders *et al.,* (2016), define a sample as a representation of the target population in a study. A sampling technique therefore becomes the process approach used to identify sampling elements (people) who will contribute to the research as its primary data sources. The combination of the two (sample and sampling technique), can be termed as a sampling strategy. A sampling strategy explains the target population and the sampling method(s) used in gathering data from the identified data sources within the target population, and a justification of the manner in which the sampling was done by the researcher (Saunders *et al.,* 2016; Creswell, 2013). In the following sub-sections, the target population of the study is explained first, followed by the sampling strategy used, and the rationale for the stratified simple random sampling technique adopted for the research's survey.

3.7.1 Population of the Study

For this study, the target population was composed of selected high school pupils in Zululand, and it consisted of 85 matric students on average per school. The total target population therefore projected to be accessible for the research was 325 matric students. The schools identified by the researcher are situated in previously, demographically and historically, disadvantaged communities focusing on five public High Schools in the Zululand Region. These schools are scattered in different areas within the Region. This population was chosen for the study because it is a mixed school population in the historically disadvantaged areas of Zululand.

3.7.2 Sampling Technique

It is important to note that there are two broad sampling strategies, probability and non-probability sampling. In a non-probability sampling approach, there is an unequal chance that all targeted research participants in the target population could be selected (Trochim, 2014). Types of non-probability sampling strategies include convenience sampling, judgmental sampling, and quota sampling among others (Babbie and Mouton 2011) Conversely, a probability sampling approach typically ensures that an equal opportunity for all research elements in the target population exists for participation into the study (Creswell, 2012). While this study adopted a quantitative research method, this section explains the types of quantitative probability sampling techniques as they are used in the research's chosen design. These probability sampling techniques are explained in the following sub-sections.

The first technique is a simple random sampling technique. This is a probability sampling approach that uses statistical probability tables to randomly and arbitrarily select research participants from an ordered list of potential and equally accessible survey participants. In doing so, a simple random sampling procedure entails the researcher obtaining a list of people in alphabetical order, for instance, in an organisational setting, and counting off the number of respondents required for the study until the minimum sample size is established from the list. The list therefore forms the target population or accessible population of the research process.

However, the drawback with a simple random, sampling technique is that is fails to identify critical sectors of the target population in a study by introducing an arbitrary conceptual approach to the selection of participants by starting from any point in the list as long as the

researcher uses his/her knowledge to determine that the starting satisfies the attainment of the minimum or required sample size at the conclusion of selection of the participants in the given ordered list of names (Saunders *et al.*, 2016:267; Creswell, 2012). This implies for this study that a consideration of alternative probability sampling techniques, in this context, the systematic and stratified random sampling techniques, require evaluation for this study. The systematic random sampling technique is explained in the next sub-section.

The second technique is a systematic random sampling technique. This uses a constant factor (also known as the K^{th} constant factor), which is a number used to generate participants from a survey list by way of selecting each Kth number from a starting point in the target population list until the required sample size is reached for the research. The procedure in systematic sampling therefore follows that at every multiple of the Kth number, the participant with the name in the list corresponding to the multiple number for the constant (K), is selected as a member of the survey participants for the research process. For this study, this would have implied that from the 325 target population members, to attain 203 survey participants, the researcher had to select every first number in the list, thereby being forced to defy even the principles of a simple random sampling technique. This is because the target population size is 325, limiting the mathematical practicality of the systematic random sampling technique for this study. With that, a stratified simple random sampling technique's rationale as the chosen sampling technique is explained in the next sub-section.

The third technique is a stratified random sampling technique, and it was used for this study. A stratified simple random sampling technique is one which defines the target population in line with some inclusion and exclusion criteria which categorises survey participants into specific strata that relate to the inclusion and exclusion criteria utilised by the researcher. In application to this enquiry, the researcher determined that the 5 initially targeted schools were initially what formed as the five strata that would sum up as the reflective 203 survey participants from the 325 projected target population for access to the study's primary data contributions.

While the stratified sampling technique was chosen since it was most appropriate for the study, there are a variety of other random and non-random sampling techniques available in quantitative studies.

3.7.3 Sample size

The list of schools and number of students who participated in the study per school is shown in Table 3.1. As showing in Table 3.1, students who took part in this study came from 13 out of 30 high schools offering the Computer Applications Technology (CAT) module in the Zululand region as an ICT subject at matric level.

Table 3.1: Distribution of participants by school name

Name of school		Number of pupils	Percentage
1.	Dwaleni	25	13.2%
2.	Isihlahlase	8	4.2%
3.	James Nxuma	20	10.5%
4.	King Bhekiz	22	11.6%
5.	KwaNotshelw	3	1.6%
6.	Lwandokwakh	10	5.3%
7.	Mahlabathin	18	9.5%
8.	Maqhingendo	18	9.5%
9.	Mchitheki High	19	10.0%
10.	Ngali High	12	6.3%
11.	Nsikayendlu	11	5.8%
12.	Phongola High	9	4.7%
13.	Phumanyova	15	7.9%
	Total	**190**	**100.0**

Source: *Primary Research Data*

In Table 3.1, the highest number of students who participated were from Dwaleni high school (13.2%), and other schools such as James Nxuma and King Bhekiz have a fairly high number of students who participated. Meanwhile KwaNotshelw and Isihlahlase high schools had the lowest number of students who participated, at 1.6% and 4.2% respectively. While some schools have a minimal number of students studying the CAT module especially due to limited computer and laboratory infrastructure, others with more robust computer infrastructure were found to offer the CAT module to more than 30 students at a time. A report by KZN Department of Education (2018) reveals this trend.

Table 3.2: High schools in the Zululand region

Item	Frequency	Percentage
Total number of high schools in the Zululand region	194	100%
Number of schools offering the CAT module	30	15.5% (of total)
Number of schools targeted	13	43.3% (of 30 schools)

Source: KZN Department of Education (2018: Online)

In reference to Table 3.2, it was all more fitting to use the planned stratified sampling technique, and in this case, 13 strata were used representing 13 schools that have access to CAT modules in matric. The number of 13 schools which participated in the study was selected since they were rural schools with limited ICT infrastructure, allowing for the study to investigate how such settings affect students' ICT career choice. In addition, the sample of 13 schools was selected based on the ease of access of the schools for the researcher with a limited budget. All schools were in the same region and relatively close to each other, allowing the researcher to travel between them with ease, saving time and money.The stratified random sampling approach was further employed in individual participant selection, where the students were divided into sub-groups based on their gender and whether they are already studying IT related subjects at matric or not. This was most appropriate since it allowed for a fair representation of students selected in each major category, thus limiting the chances of bias and distortion of results where students from different categories show highly varied behaviour. The following was the inclusion and exclusion criteria applied for participants in this study.

3.7.4 Inclusion and exclusion criteria

The study included students who met all of the following criteria: matric students studying in High Schools in the Zululand region in KwaZulu-Natal Province, all matric students studying in High Schools in the Zululand region in KwaZulu-Natal Province already studying IT related subjects and survey to ensure that there is an arbitrary representation of gender realities among the participants in the study.

On the other hand, the exclusion criteria were as follows: matric students in other regions of KZN Province and other South African provinces, non-matric students in the accessed

schools in the study, and matric students accessible in the targeted schools (target population), but not having any prior experience of class learning concerning ICT (the CAT module) in this study.

3.8 Data Collection Instrument

Data for the study were collected through a quantitative questionnaire which was distributed among matric students from selected schools in the Zululand region. The collection of data followed the UKZN's field research procedures which include the observance of a strict code of ethical conduct

3.8.1 Questionnaire Design

The questionnaire used was accompanied by the gatekeeper's letter and an ethical clearance letter from the university. It also contained an informed consent section on the front page for the participants or their parents (in case of under-age participants) to sign as acknowledgement of informed participation. There were two major sections in the questionnaire as follows:

Section A contained demographic related questions. It sought to establish the participants' age, gender, ethnic background, school name, home language and whether each participant was currently studying an IT related subject or not. Section B measured the factors affecting matric students' choice of ICT at university based on literature. These factors are self-efficacy, cognitive load, confidence, career motivation, social influence, career relevance and career education choice as determined in the research's conceptual approach to improved learner's inclination towards ICT career education choice in the research phenomenon. The Likert scale was used as a measuring instrument for the weighted answers. Scenarios were presented to participants for them to select a relevant response on a five-point Likert scale ranging from 'Strongly Disagree' to 'Strongly Agree'. The instrument design for the survey data collection was derived from the conceptual approach that the research used in framing its theoretical underpinning to understanding the ICT career choice education path for leaners who are studying ICTs in the targeted schools.

3.8.2 Data Collection Procedure

Primary data only was collected for the use in analysis towards achieving research objectives in this study. The data on factors influencing the choice of ICT education were gathered quantitatively through a questionnaire which was distributed to students to take home and bring back (completed) the next day). This research instrument was mainly chosen due to the fact that it is aligned to the study's chosen methodology, the pattern nominated; and allowed the researcher to gain admission to role players' insight regarding the research problem.

The instrument design is derived from the conceptual approach that influences the study on ICT career education choice. For leaners, the survey instrument, and the relative statements subjected to them with a Likert Scale as a measuring tool for the response weights, was used to gather primary data for subsequent analysis. It can further be observed that all survey statements that are in the research instrument are mapped and linked with each specific construct to which they seek to generate primary responses for analysis. For instance, Cognitive load and self-efficacy have their corresponding survey statements where each construct has a statement similar to the following: "7.1. I recall all that I learn about computers", to which learners used the Likert Scale measuring tool in choosing their most appropriate answer.

A limitation that nearly threatened to undermine the quality of the research findings was experienced at the stage of accessing the targeted schools for the study. The researcher experienced constraints in accessing the schools as had been projected at the initiation of the study. Within most of the targeted schools, the researcher observed that the total number of ICT learning matric students at matric level, and in each initially determined strata (school) was insufficient to establish the total sum of the stratified sampling strategy for the research's data collection process as had been planned. In mitigating this accessibility of the required survey participants, and within the same contextual research environment as a region, the researcher made the choice to expand accessibility to the initial target population by means of incorporating more schools, and using the same inclusion and exclusion criterion to establish the required sample size for the survey.

3.9 Validity and Reliability

Quality control procedures were instituted to assess data quality. According to Reisch (2004) the quality control process is defined as procedures and methods implemented to ensure that

data are collected properly, managed well, and utilised with precision taking into consideration reliability and validity.

3.9.1 Reliability analysis test

Reliability analysis tests the strength of a research instrument based on measuring internal consistency among variables measured (Babbie and Mouton 2011). A reliability analysis test allows the researcher to better assess individuals and to evaluate selection and prediction techniques (Revelle & Condon, 2018). This study calculated the Cronbach's alpha values for each of the variables of the study. Cronbach's alpha measures the internal consistency, that is, how closely related a set of items are as a group It is considered to be a measure of scale reliability (Revelle & Condon, 2018). The results are shown on the following Table 3.3.

Table 3.3: Reliability coefficients for the study variables

Variable	Number of items	Cronbach's alpha	Remark
Computer self-efficacy	5	0.742	Acceptable
Cognitive load	5	0.708	Acceptable
Confidence	5	0.732	Acceptable
Career motivation	5	0.895	Good
Social Influence	5	0.835	Good
Career relevance	4	0.765	Acceptable
Overall	6	0.758	Acceptable

Source: Primary Research Data

According to Tavakol and Dennick (2011), any alpha value greater than 0.7 (out of 1) is acceptable since it shows that the study variables measure what they are intended to measure. The highest reliability coefficient for this study was on career motivation, with an alpha value of 0.895 while the cognitive load's reliability value was lowest, with an alpha of 0.708. All variables were considered to be reliable based on the coefficients calculated, and data analysis with descriptive and inferential statistics commenced.

3.9.2 Validity

Validity determines the suitability and relevance of the study data in the survey statements to the research issue investigated (Creswell 2012). In determining the validity of the research

instrument, the research ensured that the research's conceptual approach to the problem statement guides the development of the research instrument. A pilot study was conducted to analyse, discover and rectify the validity of the research instrument based on preliminary results. The pilot, (which included 10 participants) was instrumental in allowing the researcher to update the questionnaire based on preliminary results. It allowed for an assessment of whether or not all questions were asked suitably to meet the primary objective of the study to its highest standard. In addition, raw questionnaire evaluation was conducted before capturing to ensure that only fully completed questionnaires were captured and admitted for analysis. This meant that all survey statements were aligned to the developed conceptual approach to the study.

3.10 Ethical Considerations

Ethical clearance for this report was provided by the UKZN Ethics committee. In order to obtain ethical approval from the Ethics Committee, the researcher had to meet the university requirements and a gate-keeper's letter was obtained from the Department of Education in Zululand and from participating schools. Once ethical clearance and the gatekeeper's letter were obtained, the researcher contacted schools directly to request permission from the Head/principal to collect data at the school.

3.10.1 Informed consent

Since most of the targeted students were below legal consent age, the researcher sought further informed approval from their parents. To obtain parental consent, students were required to take the uncompleted questionnaire home, and to ask their parents to sign for consent before they individually completed the questionnaires. They then submitted these to their teacher/principal for collection by the researcher. The researcher sought informed consent from the participants to ensure that dignity was maintained, and each prospective participant was accorded a chance to decide whether to participate or not, based on adequate information provided to them. The informed consent form was attached to each printed questionnaire and students/guardians were required to sign before taking part. Participation in was communicated to be voluntary, and any individual who was not interested in taking part was not coerced to participate in any way.

3.10.2 Privacy and confidentiality

Privacy and confidentiality were maintained, and participation was completely anonymous; and no personal information linking any participant to a specific questionnaire was collected.

Confidentiality was secured by storing away of completed questionnaires in a locker and this will only be opened, with the primary evidence intact, when the full research report is published, and with full consent from the primary survey contributing school's authority.

3.10.3 Anonymity

All research participants were asked not to share their personal details disclosed in the data collection instrument. To preserve anonymity each participant used a code that was only known to the participant and the researcher from each of the strata that was used as a data source from each school.

3.11 Summary

The chapter presented the methodology which was followed in the assessment of factors influencing students' ICT career choice. The chapter discussed the choice of the positivist research philosophy due to its effectiveness in quantitative studies, and also the descriptive survey research design. The chapter also presented the study area and setting, which was chosen to collect data from students residing in rural, low income neighbourhoods to establish in detail the impact of society on ICT career choice. Discussion on the population, sampling frame, sampling design as well as inclusion-exclusion criteria is also presented. The chapter also introduced the research instrument used in data collection as well as the various ethical considerations that were adhered to in field data collection. This study follows previously adopted and proven approaches in sampling, data collection and analysis of data from 203 matric students in the Zululand region.

The next chapter focuses on the presentation of results of the study on the factors influencing ICT career choice using the quantitative research approach.

CHAPTER FOUR: PRESENTATION AND DISCUSSION OF FINDINGS

4.1. Introduction

This chapter presents and discusses the results collected from a sample of matric students from 13 schools in the Zululand region, KwaZulu-Natal. This chapter presents findings from the study, and links to the originally developed research question as well as to the theoretical framework of the study developed in chapter 2. The data analysis chapter was important since it provided the basis for the confirmation or rejection of existing hypotheses. It is data analysis allowed the researcher to draw conclusions with regard to a phenomenon under investigation. This study focused on meeting the following research objectives:

- To determine the relationship between students' confidence and its influencing factors – self-efficacy and cognitive load;
- To ascertain the relationship between social influence and its influencing factors – career motivation and career relevance; and
- To determine how students' confidence and social factors influence their ICT career education choice.

4.2. Statistical data analysis

Data Analysis involves the conventional employment of statistical techniques to give meaning to raw datathrough the review and assessment of data (Saunders et al., 2016). Data collected using the questionnaire method were analysed using the statistical package for social sciences (SPSS) version 25. The data were then presented utilising the inferential and descriptive statistics.

4.2.1. Descriptive analysis

Narkhede (2018) defines descriptive analysis as the scientific attempt to summarise and organise data so it can be understood. In describing the data, a researcher does not attempt to make inferences for the whole population; but relies on what the data shows at face value to make conclusions. The process of descriptive analysis involves the analysis of measures of central tendency (such as median, mean and mode) in addition to the measures of dispersion (such as standard deviation, variance and skewness). Tables and charts were also used to further visually present the data.

4.2.2. Inferential analysis

Inferential statistical analysis helps researchers make estimations on the overall population responses based on the ample data collected. According to Upton and Cook (2008) statistical inferencing involves the use of data analysis to deduce properties contained in an underlying probability distribution. Through the use of established hypotheses, this study utilised statistical inferencing to test the extent to which the null hypotheses on the factors influencing students' ICT career choice held.

Several statistical tests were conducted during the process of data analysis in this study. An independent samples t-test was employed to establish the factors influencing ICT career choice among students, based on the pre-determined factors. An independent samples t-test measures the statistical significance of means between two unrelated groups (Longo & Leva, 2017). Non-parametric tests were conducted as complements to the independent samples t-test and sought to establish the factors influencing students' ICT career choice, where data was assumed not to be normally distributed. Two non-parametric tests were run: the Kruskal-Wallis H test and the Kolmogrov-Smirnov Z test. The Kruskal-Wallis H test allows the researcher to determine if there are statistically significant differences between two or more groups of an independent variable (Ostertagova, Ostertag & Kovac, 2014) while Kolmogrov-Smirnov Z test is useful in the sense that the distribution of statistics does not depend on cumulative distribution function being tested (Hassani & Silva, 2015). The Pearson correlation and Spearman Rank correlations were conducted to establish the linear relationship between pre-determined factors and students' ICT career choice. This followed a study by Mtemeri (2017). Factor analysis was used to establish the overall flow of factors influencing students' ICT career choice and how they independently relate to each other. A Principal Components Analysis (PCA) approach was run as part of Factor Analysis. This approach was chosen for its low noise sensitivity, the reduced requirements for capacity memory and increased efficiency (Karamizadeh, Abdullah, Manaf, Zamani & Hooman, 2013). A Chi-square test of independence was also run to assess the extent of influence of students' demographic variables on ICT career choice. Following previous studies by Ogutu *et al.,*(2017), Edokpolor (2018) Quimby De-Santis (2006) as well as Twombly (2017) who used regression analysis as the main model for establishing factors influencing students' ICT career choice, this study also utilised a multiple logistic regression model as the main study model. In their studies, factors influencing students' career choice were classified as independent/explanatory variables while the choice to pursue a career in ICT or not was classified as the dependant variable as indicated by the following equation:

$y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon$……...Equation 4.1

Where

$y =$ ICT career choice

$X_1 =$ Self-efficacy

$X_2 =$ Cognitive load

$X_3 =$ Confidence

$X_4 =$ Career motivation

$X_5 =$ Social influence

$X_6 =$ Career relevance

$\alpha =$ The constant

$\varepsilon =$ The error term

$\beta_1 - \beta_6 =$ The coefficients/strength of impact of factor $X_1 - X_6$

4.3. Response rate

This study targeted a total of 203 students from 13 high schools across the Zululand region of KwaZulu-Natal province. Of the 203 targets, a total of 190 questionnaires were received in good order for analysis, giving a response rate of 93.6%. 10 questionnaires were incomplete and could not be analysed.

4.4. Demographic information

Since the students who took part in this study were of the same race and home language, these demographic variables were not analysed in this study. This section presents the distribution of participants in terms of age, gender and name of school at which the student/ was studying.

4.4.1. Age

The majority of students (76%) were found to be between 17 and 19 years of age; while the other group (20%) were 20 years and older. The rest of the students (4%) were between 15 and 16 years of age. Table 4.1presents the results on gender distribution. Results show that students who participated in the study were generally of the same age group; with an average range of five years between the youngest and oldest.

Table 4.1: Participants' age groups

Age group	Number	Percentage
15 – 16 years	38	20%
17 – 19 years	144	76%
20 and above	8	4%
Total	190	100%

Source: Primary Research Data

4.4.2. Gender

Table 4.2 shows the distribution of participants by gender.

Table 4.2: Gender of student participants

Gender	Number	Percentage
Boys	66	35%
Girls	124	65%
Total	190	100%

Source: Primary Research Data

The participants were made up of 66 boys (35%) and 124 girls (65%). The sample of participants was skewed towards girls.

4.4.3. Participating schools

The students who took part in the collection of data were from 13 high schools, all of which were offering the CAT module in the Zululand region. Table 4.3presents the distribution of students who took part from these 13 high schools.

In Table 4.3, the highest number of students who participated in the survey were from Dwaleni high school (13.2%), and other schools such as James Nxumalo high school and King Bhekuzulu high school have a fairly high number of students who participated.

Table 4.3: Distribution of participants by school name

School No.	Name of school	Number of pupils	Percentage
1.	Dwaleni High School	25	13.2%
2.	Isihlahlasenkosi High School	8	4.2%
3.	James Nxumalo Agricultural High School	20	10.5%
4.	King Bhekuzulu High School	22	11.6%
5.	KwaNotshelwa High School	3	1.6%
6.	Lwandokwakho High school	10	5.3%
7.	Mahlabathini Secondary School	18	9.5%
8.	Maqhingendoda High School	18	9.5%
9.	Mchitheki High School	19	10.0%
10	Ngali High School	12	6.3%
11	Nsikayendlu High School	11	5.8%
12.	Phongola High School	9	4.7%
13	Phumanyova High School	15	7.9%
	Total	**190**	**100.0**

Source: Primary Research Data

4.5. Descriptive analysis of factors influencing ICT career choice

The purpose of this section is to analyse the distribution of participants' responses on six factors influencing ICT career choice namely computer self-efficacy, cognitive load handling capacity, confidence, career motivation, career relevance and social influence. The analysis utilises frequencies, means as well as standard deviations to assess the central tendency and dispersion characteristics of the data (Saunders *et al.,* 2016). Descriptive statistics will be used in the study to explain the frequencies as they occur in the study.

4.5.1. Self-efficacy

This study utilised Cowan *et al.,* (2012)'s understanding that self-efficacy as a form of confidence and talks to a person's conviction for success under different conditions. Participants were provided with a series of scenarios measuring self-efficacy and asked to indicate their agreement or disagreement levels. The stronger the level of agreement with a scenario provided, the stronger a student's level of self-efficacy as per research instrument. Table 4.5 summarises the results of a descriptive exploration of self-efficacy among 190 students from 13 schools in the Zululand region while Table 4.4 shows the central tendency and dispersion of the same data.

Results of a descriptive analysis of self-efficacy show that the majority of students possess strong computer self-efficacy as evidenced by their abilities to perform tasks effectively in their computer modules as well as to learn theoretical and practical aspects effectively. In the first scenario of learning theoretical concepts about computers well, the majority (83.2%) agreed and strongly agreed, others (13.7%) disagreed and strongly disagreed while the rest (3.2%) said they do not know. In the second scenario relating to the effective learning of practical computer aspects, the majority of students (86.3%) agreed and strongly agreed, others (7.4%) disagreed and strongly disagreed while the rest (6.3%) said they do not know.

Table 4.4: Computer self-efficacy of student participants

I can…	Strongly Disagree	Disagree	Don't know	Agree	Strongly Agree
learn theoretical topics about computers well	1.6%	12.1%	3.2%	60.0%	23.2%
learn practical topics about computers effectively	1.1%	6.3%	6.3%	58.9%	27.4%
remember all that I learn about computers	3.7%	30.0%	10.0%	43.7%	12.6%
effectively perform all tasks or exercises in my computer module	1.6%	16.3%	8.4%	57.9%	15.8%
perform well in my computer assessment	2.6%	18.9%	7.9%	52.1%	18.4%
Overall[2]	**2.1%**	**16.7%**	**7.2%**	**54.5%**	**19.5%**

Source: Primary Study Data

When asked whether or not they remember all that they learn about computers, more than half of students (56.3%) agreed and strongly agreed, another group (33.7%) disagreed and strongly disagreed while 10% were not sure. On the effective performance of all tasks in a computer module, most students (73.7%) also agreed and strongly agreed, 17.9% disagreed and strongly disagreed while 8.4% were not sure. In the last scenario of performance in computer assessment, the majority of students (70.5%) agreed and strongly agreed, 21.5% disagreed and strongly disagreed while 7.9% did not know. Overall, 74% of students demonstrated a high level of self-efficacy while 18.8% showed low levels, and 7.2% were unsure of their level of computer self-efficacy.

In Table 4.5, the first scenario relating to students' ability to learn theoretical topics about computers well, the mean was found to be 3.91 with the mode equal to the median at 4, and a standard deviation of 0.941. In the second scenario of learning practical topics about computers well, the mean was 4.05 with a mode equal to the median at 4, and a standard deviation of 0.828.

[2]Due to rounding off, the overall figures may not necessarily add up to 100%

Table 4.5: Descriptives on self-efficacy

I can…	Mean	Mode	Median	Std. Deviation
learn theoretical topics about computers well	3.91	4	4	0.941
learn practical topics about computers effectively	4.05	4	4	0.828
remember all that I learn about computers.	3.32	4	4	1.139
effectively perform all tasks or exercises in my computer module	3.70	4	4	0.976
perform well in my computer assessment	3.65	4	4	1.067

Source: Primary Study Data

In the third scenario, a mean of 3.32 was found, a mode equal to the median of 4 and a standard deviation of 1.139. In the fourth scenario, the mean was 3.70, the mode was equal to the median of four and the standard deviation was 0.976. In the last scenario relating to students' ability to perform well in computer assessments, the mean was 3.65, mode equal to the median of 4 and a standard deviation of 1.067. The majority of means were all close but below four (between 'neutral' and 'agree'); while similarly, the majority of standard deviations were less than one except for two cases.

4.5.2. Cognitive load

YU (2016) and Vasile *et al.*, (2010) believe that since memory processing ability is limited, overload of information availed to a student results in the failure of students to process information effectively; hence low performance as a result of a higher cognitive load. Following this principle, the study sought to test the extent to which students in high schools of the Zululand region possess high cognitive capacities which are required for higher performance in ICT subjects. Table 4.6 presents results of a descriptive assessment of student participants' cognitive abilities.

Table 4.6: Students' cognitive load

I can…	Strongly Disagree	Disagree	Don't know	Agree	Strongly Agree
recall all that I learn about computers	2.1%	27.9%	9.5%	50.5%	10.0%
relate to topics that I learn about in computer studies.	1.1%	6.8%	3.7%	67.9%	20.5%
understand computers well through computer learning	0.5%	12.1%	6.8%	60.0%	20.5%
apply what I learnt about computers	2.1%	7.9%	5.3%	55.8%	28.9%
follow instructions/ explanations during ICT learning was very effective	1.6%	12.6%	8.9%	53.2%	23.7%
Overall	**1.5%**	**13.5%**	**6.8%**	**57.5%**	**20.7%**

Source: Primary Study Data

Similar to self-efficacy, students who participated in the study generally displayed high cognitive abilities; with up to 88% cumulatively agreeing that they are able to relate well and understand topics they learn about computers. In the first scenario of recalling all that is learnt about computers, the majority (60.5%) of students agreed and strongly agreed while another group (30%) disagreed and strongly disagreed and the last group (9.5%) were not sure. In the second scenario of relating to topics that are learnt about computers, most students (88.4%) agreed and strongly agreed to it while 7.9% disagreed and strongly disagreed, and 3.7% did not know. In the next scenario of understanding computers well through computer learning, the majority (80.5%) of students agreed and strongly agreed, another group (12.6%) disagreed and strongly disagreed while 6.8% were not sure. In the next scenario relating to the application of what is learnt through computers, most students (84.7%) agreed and strongly agreed while other students (10%) disagreed and strongly disagreed, and 5.3% were not sure. On the last scenario of following instructions and explanations during ICT learning, the majority (76.9%) of students agreed and strongly agreed, another group (14.2%) disagreed and strongly disagreed, and 8.9% were unsure. Overall, 15% of the students demonstrated weaker cognitive abilities, 6.8% were unsure of

their ability to handle high cognitive loads and 78.2% demonstrated strong cognitive abilities. Table 4.7 summarises the centricity and dispersion of data on cognitive load.

Table 4.7: Descriptives of cognitive load

I can…	Mean	Mode	Median	Std. Deviation
recall all that I learn about computers	3.38	4	4	1.061
relate to topics that I learn about computers	4.00	4	4	0.783
understand computers well through computer learning	3.88	4	4	0.892
apply what I learnt about in computer studies	4.02	4	4	0.923
follow instructions/ explanations during IT learning was very effective.	3.85	4	4	0.977

Source: Primary Study Data

In Table 4.7, on the first scenario relating to students' ability to recall all they learn about computers, the mean was 3.38 with a mode equal to the median of 4, and a standard deviation of 1.061. On the second scenario of relating to topics learnt about computers, the mean was equal to both the mode and median of 4, and the standard deviation was lowest at 0.783. In the third scenario of understanding computers well through computer learning, the mean was 3.88, the mode was equal to the median at 4 and the standard deviation was 0.892. In the fourth scenario relating to the application of what was learnt about computers, the mean was 4.02 with a mode equal to the median of 4 and a standard deviation of 0.923. In the last scenario relating to the ability to follow instructions, the mean was 3.85, the mode was equal to the median of 4 and a standard deviation of 0.977. The largest spread of responses was observed for the first description where students attested to whether or not they recall all they learn about computers (mean 3.38, standard deviation 1.061). The modal and median responses for all scenarios were equal (4) and they coincided with the 'agree' category.

4.5.3. Confidence

In the ARCS model, Keller (2009) underscores the fact that students' confidence levels with their ability to achieve their goals in the future are crucial in determining career choice. Accordingly, this study sought to establish the levels of confidence displayed by students in

high schools in the Zululand region on their abilities to learn computer subjects. The results of a descriptive analysis are summarised in Table 4.8.

Table 4.8: Students' ICT confidence levels

I can…	Strongly Disagree	Disagree	Don't know	Agree	Strongly Agree
learn operating computers from my failures	1.6%	18.4%	14.7%	47.4%	17.9%
help my friends to learn computers	2.6%	16.3%	3.7%	43.2%	34.2%
answer questions in my computer assessment without much thinking	7.4%	39.5%	10.5%	35.3%	7.4%
understand computer topics through by self-study	4.7%	20.5%	4.7%	51.6%	18.4%
respond to my teachers' questions in front of the whole class	8.4%	15.8%	3.7%	42.6%	29.5%
Overall	**4.9%**	**22.1%**	**7.5%**	**44%**	**21.5%**

Source: Primary Research Data

As shown in Table 4.8, in all five scenarios, students demonstrated strong confidence with their computer learning abilities. However, unlike self-efficacy and cognitive abilities, a comparatively high number of students displayed lower confidence levels. In the first scenario of learning the operation of computers from personal failures, 65.3% of students agreed and strongly agreed to it, 20% disagreed and strongly disagreed while 14.7% were not sure. In the second scenario of helping friends to learn computers, 77.4% of students agreed and strongly agreed, 18.9% disagreed and strongly disagreed while 3.7% were not sure. In the scenario of answering questions in computer assessments without much thinking, 46.9% disagreed and strongly disagreed, 42.7% agreed and strongly agreed while 10.5% were not sure whether they agreed or disagreed. In the next scenario of understanding computers through self-study 70% of students agreed and strongly agreed, 25.2% disagreed and strongly disagreed while 4.7% were not sure. In the last scenario of responding to teachers' questions in front of the whole class, 72.1% agreed and strongly agreed, 24.2% disagreed and strongly

disagreed while 3.7% were not sure. Overall, about 27% of the students demonstrated low confidence levels; with 7.5% being unsure of their confidence and 65.5% demonstrating high confidence.

Table 4.9: Descriptives on confidence

I can…	Mean	Mode	Median	Std. Deviation
learn operating computers from my failures	3.62	4	4	1.031
help my friends to learn computers	3.90	4	4	1.125
answer questions in my computer assessment without much thinking	2.96	3	2	1.278
understand computer topics through self-	3.58	4	4	1.146
respond to my teachers' questions in front of the whole class	3.69	4	4	1.156

Source: Primary Study Data

Unlike computer self-efficacy and cognitive load where the majority of the standard deviations were below 1, all of the standard deviations on confidence were greater than one, hence showing greater disagreements among participants. The lowest mean was found in the response that students are able to 'answer questions in the computer without much thinking', with a mean of 2.96 (0.084 standard error) and a standard deviation of 1.159, which was also the highest amongst measures of confidence. Meanwhile, the highest mean was found for the response that students are confident enough to 'help their friends to learn computers' with a mean of 3.90 (0.082 standard error) and a standard deviation of 1.125. The largest standard deviation (1.278) was for scenario three which suggested that students can answer questions in computer assessment without much thinking, where the mean (2.96) was not equal to the mode (3) and the median (2) response.

4.5.4. Career motivation

Further to personal factors, the study also sought to establish the extent of influence of students' motivation with ICT as a career on their choice of ICT. Career motivation, as a component of social influences, relates to the extent to which personal and outside motivators

encourage or discourage a student from pursuing a career in ICT. Table 4.10 presents the results on ICT career motivation of 190 students from 13 high schools in the Zululand region.

On Table 4.10, on the first scenario of passion with the ICT career, 63.1% of students agreed and strongly agreed that an ICT career is their passion, 31% disagreed and strongly disagreed while 5.8% were unsure. In the second scenario of the high paying nature of ICT, 53.7% of students agreed and strongly agreed, 25.2% of students disagreed and strongly disagreed while 21.1% were not sure.

Table 4.10: Career motivation of student participants

I prefer…	Strongly Disagree	Disagree	Don't know	Agree	Strongly Agree
ICT career as it is my passion	6.8%	24.2%	5.8%	40.5%	22.6%
ICT career as it is highly paying.	8.4%	16.8%	21.1%	34.2%	19.5%
ICT career as it is a job of convenience	3.7%	14.2%	20.0%	47.9%	14.2%
ICT career because I want to be updated with new technology	1.6%	6.8%	4.2%	42.1%	45.3%
ICT career as there are many job opportunities	3.7%	10.5%	11.6%	47.4%	26.8%
Overall	**4.8%**	**14.5%**	**12.5%**	**42.4%**	**25.7%**

Source: Primary Study Data

In the third scenario about the convenience of the ICT career, 62.1% of students agreed and strongly agreed, 17.9% disagreed and strongly disagreed while 20% were not sure. In the next scenario relating to the need to stay updated with technology, 87.4% agreed and strongly agreed, 8.4% disagreed and strongly disagreed while 4.2% were not sure. In the last scenario that an ICT field offers many job opportunities, 74.2% agreed and strongly agreed, 14.2% disagreed and strongly disagreed while 11.6% were not sure. Overall analysis shows that

19.3% of students are not motivated to pursue ICT as a career, 12.5% are unsure and 68.1% feel motivated to pursue a career in ICT.

Table 4.11: Descriptives on career motivation

I prefer…	Mean	Mode	Median	Std. Deviation
ICT career as it is my passion	3.48	4	4	1.267
ICT career as it is highly paying	3.39	4	4	1.216
ICT career as it is a job of convenience	3.55	4	4	1.021
ICT career because I want to be updated with new technology	4.23	4	5	0.929
ICT career as there are many job opportunities	3.83	4	4	1.056

Source: Primary Study Data

Results on Table 4.11 show that on the first scenario suggesting that ICT career is a passion for students, the mean was 3.48 with a mode equal to the median of 4 and a standard deviation of 1.267. In the second scenario relating to the high paying nature of ICT jobs, the mean was 3.39 with a mode equal to the median of 4 and a standard deviation of 1.216. In the third scenario relating to the job convenience of ICT, the mean was 3.55 with a mode equal to the median of 4 and a standard deviation of 1.021. In the fourth scenario relating to the need to stay updated with technology, the mean was 4.23 with a mode of 4, a median of 5 and a standard deviation of 0.929. In the last scenario of job opportunities in the ICT field, the mean was 3.83 with a mode equal to the median of 4 and a standard deviation of 1.056. The highest mean was found for the response that students 'prefer an ICT career because they want to be updated with new technology' (mean 4.23, standard deviation, 0.929); thus, showing that the desire to stay abreast of new technologies is likely to influence a number of students to choose a career in ICT. However, the narration that 'I prefer an ICT career because it is my passion' had the lowest mean (3.48) and the highest dispersion of responses, with a standard deviation of 1.267.

4.5.5. Career relevance

Pavel (2015) and Weibell (2011) note that most students make career decisions based on role models that they identify with in their young lives. Hence, students make career decisions based on the extent to which they think the career will be relevant to their current lives. This

study proposed a number of scenarios meant to measure the influence of ICT relevance, and the results are summarised in Table 4.12.

Table 4.12: Student participants' ICT career relevance

I prefer…	Strongly Disagree	Disagree	Don't know	Agree	Strongly Agree
ICT studies since they are a requirement for a Computer Science program at university	5.3%	17.4%	7.9%	56.8%	12.6%
ICT career for the development of my country	2.6%	10.0%	5.3%	47.4%	34.7%
ICT career because I can get a job with influence	3.2%	24.2%	14.2%	42.1%	16.3%
ICT career because there are different types of ICT jobs	0.5%	6.3%	5.3%	47.4%	40.5%
Overall	**2.9%**	**14.5%**	**8.2%**	**48.4%**	**26%**

Source: Primary Study Data

As shown on Table 4.12, there were four scenarios used to measure students' attitudes on career relevance. On the first scenario which suggests that students study ICT since it is a requirement to study computer science at university, 69.4% agreed and strongly agreed, 22.7% disagreed and strongly disagreed while 7.9% were not sure. On the second scenario suggesting that students study ICT for the development of their country, 82.1% agreed and strongly agreed, 12.6% disagreed and strongly disagreed while 5.3% were not sure. On the third scenario suggesting that students can get a job in the ICT field by job influence, 58.4% agreed and strongly agreed, 27.4% disagreed and strongly disagreed while 14.2% were not sure. On the fourth scenario suggesting that ICT career is preferable due to the different types of ICT jobs available, 87.9% agreed and strongly agreed, 6.8% disagreed and strongly disagreed while 5.3% were not sure. Overall, the 17.4% disagreed that their ICT career choice is based on its relevance to them, 8.2% were unsure and 74.4% agreed that they choose ICT as a career due to its relevance to them.

Table 4.13 shows that in the first scenario of the requirement of ICT modules for studying computer programs at university, the mean was 3.5 with a mode equal to the median of 4 and

a standard deviation of 1.082. On the second scenario relating to the need to study ICT for national development, the mean was 4.02 with a mode equal to the median of 4 and a standard deviation of 1.021.

Table 4.13: Descriptives on career relevance

Item	Mean	Mode	Median	Std. Deviation
I prefer computer studies because it is a requirement at university	3.54	4	4	1.082
I prefer an ICT career for the development of my country	4.02	4	4	1.021
I prefer an ICT career because I can get a job with influence	3.44	4	4	1.119
I prefer an ICT career because there are different types of ICT jobs	4.21	4	4	0.847

Source: Primary Study Data

In the third scenario of getting a job in ICT through influence, the mean was 3.44 with a mode equal to the median of 4 and a standard deviation of 1.119. In the last scenario indicating the preference of ICT due to the variety of jobs, the mean was 4.21 with a mode equal to the median of 4 and a standard deviation of 0.847. The means of responses were generally close to 4 whilst four out of five standard deviations were greater than one. In Table 4.13, the highest number of participants agreeing were in the response that an ICT career is preferred due to the different types of jobs it offers. This shows that on average, a number of students make career decisions based on the consideration of which careers are likely to provide the largest variety of job options to choose from. Meanwhile, with the highest standard deviation of 1.119 and a mean of 3.44, it was found that agreement is generally low for the response that students will be likely to get a job with influence in an ICT field.

4.5.6. Social influence

Aaronson (2004) notes that career choice among students is greatly influenced by the society around them. Influencers such as parents, teachers, media and the school environment are acknowledged as constantly shaping students' views about the careers around them, thus influencing their career choices. It is therefore necessary to investigate, among other factors, the influence of society on students' career choices, as presented on Table 4.14.

Table 4.14: Social influence on students' ICT career choice

I choose…	Strongly Disagree	Disagree	Don't know	Agree	Strongly Agree
to study ICT because my family encouraged me to do so	49.5%	34.2%	1.1%	9.5%	5.8%
computer studies because it is what my friends chose	57.9%	37.4%	0.0%	4.2%	0.5%
computer studies because my teacher makes it easy to understand	10.5%	20.5%	6.3%	46.3%	16.3%
computer studies because government supports ICT education through bursaries.	11.1%	30.0%	18.4%	34.2%	6.3%
to study ICT because my school has very good facilities	12.1%	25.8%	5.3%	38.9%	17.9%
Overall	**28.2%**	**29.6%**	**6.2%**	**26.6%**	**9.4%**

Source: Primary Study Data

In Table 4.14, five scenarios were used to measure social factors that affect students' ICT career choices. In the first scenario that suggests that family encourages students to pursue a career in ICT, the majority (83.7%) disagreed and strongly disagreed while 15.3% agreed and strongly agreed, and 1.1% were not sure. In the second scenario capturing the influence of friends, the majority of students (95.3%) disagreed and strongly disagreed while the rest (4.7%) agreed and strongly agreed. In the third scenario capturing the influence of teachers, the majority of students (62.6%) agreed and strongly agreed, the other group (31%) disagreed and strongly disagreed, and 6.3% were not sure. In the fourth scenario which suggests that students study ICT due to the existence of government support with through bursaries, 41.1% disagreed and strongly disagreed, 40.5% agreed and strongly agreed while 18.4% were not sure. In the fifth scenario citing the study of ICT due to the existence of good facilities at school, 56.8% agreed and strongly agreed, 38.2% disagreed and strongly disagreed while 5.3% were not sure. Overall, the majority of students (57.8%) disagree that society influences

their ICT career choice while others (36%) admit to the influence of society on their career choice.

Table 4.15: Descriptives on social influence

I choose…	Mean	Mode	Median	Std. Deviation
to study ICT because my family encouraged me to do so	1.88	2	1	1.182
computer studies because this is what my friends chose	1.52	1	1	0.754
computer studies because my teacher makes it easy to understand in class	3.37	4	4	1.269
computers studies because government supports ICT education by offering bursaries.	2.95	3	4	1.158
to study ICT because my school has very good facilities	3.25	4	4	1.340

Source: Primary Study Data

Table 4.15 shows that for the first scenario of studying ICT due to family encouragement, the mean was 1.88 with a mode of 2, a median of 1 and a standard deviation of 1.182. In the second scenario relating to the influence of friends, the mean was 1.52 with a mode equal to the median of 1 and a standard deviation of 0.754. In the third scenario of the influence of teachers' ability to make ICT easy to understand, the mean was 3.37 with a mode equal to the median of 4 and a standard deviation of 1.269. In the fourth scenario of studying ICT due to the existence of government support, the mean was 2.95 with a mode of 3, a median of 4 and a standard deviation of 1.158. In the last scenario of studying ICT due to the available school facilities, the mean was 3.25 with a mode equal to the median of 4 and a standard deviation of 1.340. The means for social influences were lower than three for the majority of cases, showing that a minimal number of students attested that they choose a career in ICT based on social influences. Meanwhile, the greatest variability of responses (standard deviation equal to 1.340) was found on the notion that students 'choose ICT because their respective schools have good facilities'.

4.5.7. Career education choice-

Upon a detailed exploration of various factors influencing career choice among students, students were asked whether or not they prefer to pursue an ICT career in the future. Table 4.16 summarises a number of questions posed to students with regard to their ICT career choice.

Table 4.16: ICT career choice of students

I prefer…	Strongly Disagree	Disagree	Don't know	Agree	Strongly Agree
studying ICT to get settled in an ICT job	5.8%	15.3%	6.3%	55.3%	17.4%
ICT career than ICT education	7.4%	22.6%	17.4%	38.9%	13.7%
to study computer studies because it prepares me for self-employment.	2.1%	12.1%	4.7%	50.5%	30.5%
neither ICT education nor ICT career	20.0%	38.9%	13.2%	20.5%	7.4%

Source: Primary Study Data

As shown on Table 4.16 72.7% of the students highlighted that they were considering settling in an ICT job in the future while 21.1% said they were not considering an ICT career and 6.3% were unsure. In addition, 52.6% admitted that they prefer working in ICT even though they do not enjoy studying computer subjects at school. Meanwhile, 27.9% of students noted that they prefer neither ICT education nor the ICT career. In addition, 81% of students agreed and strongly agreed to the fact that they study ICT since it prepares them for self-employment, while 14.2% disagreed and strongly disagreed to that, and 4.7% were undecided. Table 4.17 further breaks down these responses by presenting central tendency and dispersion values for each case under ICT career choice.

Table 4.17: Descriptives on ICT career choice

Item	Mean	Mode	Median	Std. Deviation
I prefer studying ICT to get settled in an ICT job	3.63	4	4	1.113
I prefer an ICT career rather than an ICT education.	3.29	4	4	1.175
I prefer to study computer studies because it prepares me for self-employment.	3.95	4	4	1.015
I prefer neither an ICT education nor an ICT career.	2.56	2	2	1.227

Source: Primary Research Data

Table 4.17 shows that in the first scenario of studying ICT to settle on an ICT job, the mean was 3.63 with a mode equal to the median of 4 and a standard deviation of 1.113. In the second scenario suggesting that one prefers an ICT career rather than an ICT education, the mean was 3.29 with a mode equal to the median of 4 and a standard deviation of 1.175. In the third scenario of using ICT learning as preparation for self-employment, the mean was found to be 3.95 with a mode equal to the median of 4 and a standard deviation of 1.015. In the last scenario suggesting that one preferred neither an ICT education nor a career, the mean was 2.56 with a mode equal to the median of 2 and a standard deviation of 1.227. Responses were generally spread between participants, as evidenced by standard deviations being consistently above one.

4.6. Inferential analysis of factors influencing ICT career choice

In addition to descriptive assessments of factors affecting ICT career choice among students in high schools in the Zululand region conducted in section 4.5, statistical inferencing was conducted based on the study's conceptual structure. To establish the level of significance of different factors, the study utilised a multiple logistics regression model as the main model of the study; while linear correlation analysis, independent samples t-tests, factor analysis and chi-square tests were utilised to ensure comparison of results. The study also utilised non-parametric analytical tools to cater for the limited normality in the distribution of responses (as evidenced by high standard deviations in some variables).

4.6.1. Correlation and t-test analysis

Table 4.18 summarises the results of the Pearson correlation and Spearman rank correlation tests conducted on the relationship between a number of factors and ICT career choice of students. According to Gogtay and Thatte (2017), Pearson's correlation measures the linear relationship between two variables to establish what happens to one variable when the other increases or decreases. This is conducted with the assumption that data are normally distributed, thus Pearson's results will be inadequate where data is not normally distributed. Spearman's correlation measures the same as Pearson's correlation coefficient but relaxes the assumption that data of participants is normally distributed. As per the study's conceptual structure, the interaction between factors that contribute to confidence (computer self-efficacy and cognitive load) and social influence (career relevance and career motivation) were also analysed independently to establish the strength of influence on ICT career choice among secondary school students.

Table 4.18: Correlation results on factors influencing students' ICT career choice

Variable	Pearson's Correlation results	Spearman's Correlation results
Self-efficacy	0.306**	0.312**
Cognitive load	0.253**	0.252**
Confidence	0.205**	0.194**
Self-efficacy * Cognitive load	0.309**	0.314**
Career motivation	0.454**	0.420**
Career relevance	0.364**	0.311**
Social influence	0.267**	0.277**
Career relevance * Career motivation	0.456**	0.403**

*** Correlations are significant at the 1% level*

In Table 4.18, the results of Pearson's correlation analysis were 0.306 for computer self-efficacy, 0.253 for cognitive load, 0.205 for confidence, 0.454 for career motivation, 0.267 for social influence and 0.364 for career relevance and ICT career choice. Further, confidence, as deduced from the interaction of self-efficacy and cognitive load yielded a correlation coefficient of 0.309 with ICT career choice, and social influence, deduced from the interaction of career motivation and career relevance yielded a correlation coefficient of

0.456. All Pearson's correlations with the dependent variable were found to be positive and significant at the 99% confidence level. This shows that for instance, the increase in self-efficacy and ICT career motivation results in students becoming more willing to pursue an ICT career. Similarly, using Spearman's rank correlation, coefficients were 0.312 for computer self-efficacy, 0.252 for cognitive load, 0.194 for confidence, 0.420 for career motivation, 0.277 for social influence and 0.311 for career relevance and ICT career choice. Meanwhile, an independent samples t-test measures the statistical significance of means between two unrelated groups. Hence, an independent samples t-test is important in exploring how the mean of students' computer self-efficacy, cognitive load processing abilities and social influence among other factors compares with the mean of students' ICT career choice. Results of the tests are shown on Table 4.19

Table 4.19: Independent samples t-test results on factors influencing ICT career choice

Variable		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval	
									Lower	Upper
Self-efficacy	Equal variances assumed	.833	.363	4.406	188	.000	.43724	.09923	.24148	.63299
	Equal variances not assumed			4.573	99.031	.000	.43724	.09562	.24750	.62697
Cognitive load	Equal variances assumed	.608	.437	3.581	188	.000	.35780	.09991	.16071	.55490
	Equal variances not assumed			3.486	87.206	.001	.35780	.10265	.15378	.56182
Confidence	Equal variances assumed	.049	.826	2.877	188	.004	.31171	.10836	.09796	.52545
	Equal variances not assumed			2.898	93.153	.005	.31171	.10757	.09810	.52531
Self-efficacy*Cognitive load	Equal variances assumed	.770	.381	4.461	188	.000	.39752	.08911	.57331	.22173
	Equal variances not assumed	9.687	.002	4.568	96.314	.000	.64098	.08702	.57002	.22479

Continued: **Table 4.19: Independent samples t-test results on factors influencing ICT career choice**

Variable		**Levene's Test for Equality of Variances**		**t-test for Equality of Means**						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval	
									Lower	Upper
Career motivation	Equal variances assumed	3.790	.053	6.986	188	.000	.69320	.09922	.49746	.88894
	Equal variances not assumed			6.336	77.216	.000	.69320	.10941	.47535	.91105
Career relevance	Equal variances assumed	10.986	.001	5.365	188	.000	.58877	.10974	.37229	.80524
	Equal variances not assumed			4.523	69.376	.000	.58877	.13016	.32912	.84841
Social Influence	Equal variances assumed	1.522	.219	3.801	188	.000	.44142	.11613	.21234	.67050
	Equal variances not assumed			4.117	108.76	.000	.44142	.10722	.22889	.65394
Career motivation * Career relevance[3]	Equal variances assumed	9.687	.002	7.023	188	.000	.64098	.09127	.82102	.46095
	Equal variances not assumed			5.987	70.434	.000	.64098	.10706	.85449	.42748

Source: Primary Research Data

[3]Interaction of two factors

As shown on Table 4.19, computer self-efficacy had a test value of 4.573 ($p = 0.000$), cognitive load had a test value of 3.486 ($p = 0.001$), confidence had a test value of 2.898 ($p = 0.005$), the interaction between computer self-efficacy and cognitive load had a test value of 4.568 ($p = 0.000$), career motivation had a test value of 6.336 ($p = 0.000$), career relevance had a test value of 4.523 ($p = 0.005$), social influence had a test value of 4.117 ($p = 0.000$) and the interaction of career relevance and career motivation had a test value of 5.987 ($p = 0.000$).

Results of all variables rejected the null hypothesis ($p < 0.05$) with 95% confidence, thus concluding that self-efficacy, cognitive load processing ability, career motivation, social influence, career relevance and the interaction between factors affecting confidence and social factors all significantly influence ICT career choice among high school students in the Zululand region. Independent samples test results therefore corroborate findings from Pearson and Spearman's correlation analysis, which found significant, positive correlations between all the explanatory variables and the dependent variable.

4.6.2. Non-parametric analysis

According to Salkind (2010), non-parametric analytical tools do not make any assumptions about the underlying distribution of data being analysed. For instance, non-parametric tests comparing two independent samples (Mann-Whitney U tests, Kruskal-Wallis H tests and Kolmogrov-Smirnov Z tests) do not rely on the assumption that data are normally distributed. This section repeats the analysis of factors influencing ICT career choice assessed previously using correlation analysis and t-test analysis by incorporating two separate non-parametric tests for independent samples, the Mann-Whitney U test and the Kolmogrov-Smirnov Z test. Table 4.20 shows the variable ranks (descriptives) based on the Mann-Whitney U test.

In Table 4.20, it can be seen that up to 138 students attested to the fact that they chose a career in ICT, while 52 did not. The mean ranks show the proportional differences between students who choose ICT and those who did not, grouped by each of the six independent variables. The highest difference in the mean rank was observed on career motivation, where the mean rank for students who chose ICT was 109.59 against a mean rank of 58.10 for those who do not choose ICT.

Table 4.20: Variable ranks based on the Mann-Whitney U test

Variable	ICT Career choice	N	Mean Rank	Sum of Ranks	Std. Deviation	Std. Error of mean
Self-efficacy	Choose ICT	138	105.95	3524.50	0.62269	0.05301
	Do not choose ICT	52	67.78	14620.50	0.57389	0.07958
Cognitive load	Choose ICT	138	103.92	3803.50	0.60379	0.05140
	Do not choose ICT	52	73.14	14341.50	0.64074	0.08885
Confidence	Choose ICT	138	101.99	4070.00	0.66877	0.05693
	Do not choose ICT	52	78.27	14075.00	0.65817	0.09127
Career motivation	Choose ICT	138	109.59	3021.00	0.56923	0.04846
	Do not choose ICT	52	58.10	15124.00	0.70734	0.09809
Social Influence	Choose ICT	138	104.78	3685.50	0.58692	0.04996
	Do not choose ICT	52	70.88	14459.50	0.86673	0.12019
Career relevance	Choose ICT	138	105.88	3533.00	0.74438	0.06337
	Do not choose ICT	52	67.94	14612.00	0.62375	0.08650

Source: Primary Study Data

The lowest mean rank difference was observed on confidence, where the mean rank for those who choose ICT was 101.99 compared to 78.27 for those who did not choose ICT. Table 4.21 shows the results of the Mann-Whitney U test on the influence of all independent variables on the dependent variable.

Table 4.21: Mann-Whitney U test results on factors influencing ICT career choice

Variable	Mann-Whitney U value	Significance value
Self-efficacy	2146.5	0.000
Cognitive load	2425.5	0.001
Confidence	2692	0.008
Self-efficacy * Cognitive load	2215	0.000
Career motivation	1643	0.000
Career relevance	2155	0.000
Social influence	2307	0.000
Career motivation* Career relevance	2142	0.000

Source: Primary Study Data

As presented in Table 4.21, the test statistic for computer self-efficacy was 2146.5 (p = 0.000), 2425.5 for cognitive load (p = 0.001), 2692 for confidence (p = 0.008), 2215 for the interaction between computer self-efficacy and cognitive load (p = 0.000), 2155 for career relevance (p = 0.000), 1643 for career motivation (p = 0.000), 2307 for social influence (p = 0.000) and 2142 for the interaction between career relevance and career motivation (p = 0.000).

Tests on all factors rejected the null hypothesis with 95% confidence, thus concluding that computer self-efficacy, cognitive load, confidence, career relevance, career motivation, society and the interaction between confidence factors and society factors all influence ICT career choice among students in selected high schools in the Zululand region. These results further corroborate findings from correlation tests and the independent samples t-test. Further to the Mann-Whitney U test, an additional non-parametric test, the Kolmogorov-Smirnov Z test was also conducted to investigate all six independent variables, and the results are presented in Table 4.22.

Table 4.22: Kolmogorov-Smirnov Z test results on factors influencing ICT career choice

Variable	Kolmogorov-Smirnov Z value	Significance value
Self-efficacy	2.057	0.000
Cognitive load	1.391	0.042
Confidence	1.081	0.193
Self-efficacy * Cognitive load	1.011	0.000
Career motivation	2.667	0.000
Career relevance	1.709	0.006
Social influence	2.040	0.000
Career motivation* Career relevance	1.952	0.000

Source: Primary Study Data

As presented on Table 4.22, the test statistic for computer self-efficacy was 2.057 (p = 0.000), 1.131 for cognitive load (p = 0.042), 1.081 for confidence (p = 0.193), 1.011 for the interaction between computer self-efficacy and cognitive load (p = 0.000), 2.667 for career motivation (p = 0.000), 2.040 for social influence (p = 0.000) and 1.709 for career relevance

(p = 0.006)and 1.952 for the interaction between career relevance and career motivation. All other variable tests confirm results of the previous tests which rejected the null hypotheses at the 5% significance level, except for confidence. With a significance value of 0.193 > 0.05, results of a Kolmogorov-Smirnov Z test fail to reject the null hypothesis, thus concluding that confidence levels of students do not significantly explain variances in the choice of ICT. These results conflict with findings of other tests namely the correlation tests, independent samples t-tests as well as the Mann-Whitney U test. Further, it is also notable that based on the Kolmogorov-Smirnov Z test, confidence as a standalone variable does not significantly influence students' ICT career choice, but confidence as derived from the interaction between self-efficacy and cognitive load had a significant bearing on students' ICT career choice.

4.6.3. Multiple logistic regression analysis

Following previous related studies, the main model for data analysis in this study was the multiple logistic regression model. From Chapter 3, the main regression model was constructed and it explores the influence of each independent factor as well as the combined influence of factors that affect ICT career choice among students (refer to Equation 1 in Chapter 3)All explanatory variables were entered simultaneously into the model, thus forming a multiple logistic regression model.

Table 4.23: Summary of the logistic regression model

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	171.421[a]	0.238	0.344

Source: Primary Research Data

Table 4.24: Classification table showing model's predictive accuracy

Observed			Predicted		
			ICT Career choice		Percentage Correct
			No	Yes	
Step 1	ICT Career choice	No	23	29	44.2
		Yes	12	126	91.3
	Overall Percentage				78.4

Source: Primary Research Data

The model's predictive accuracy of 78.4% is a desirable result according to Baidoo and Priestley (2016) whilst Nagelkerke's R square value of 0.544 is also desirable (refer to Table 4.23) as it shows that 54.4% of variances in students' ICT career choice are explained by the model (Nagelkerke 1991). Hence, according to the model tests presented in Tables 4.23 and 4.24, the multiple logistic regression conducted met the basic acceptance criteria for a strong predictive model. Table 4.24 shows the descriptive statistics of overall variables of the model[4] which include the means, standard deviations and standard errors.

Table 4.25 presents results of the main study model, the multiple logistic regression model.

Table 4.25: Regression results on factors influencing students' ICT career choice

Model variables	Beta value (β)	Standard Error of β	Significance (p) value
Self-efficacy	0.543	0.423	0.199
Cognitive load	0.285	0.397	0.473
Confidence	0.175	0.373	0.639
Self-efficacy * Cognitive load	0.502	0.375	0.181
Career motivation	1.153**	0.394	0.003
Career relevance	0.220*	0.327	0.021
Social Influence	0.791*	0.317	0.013
Career motivation * Career relevance	1.607**	0.368	0.000

***β is significant with 99% confidence*

**β is significant with 95% confidence*

Number of observations	:	190
Constant	:	-8.313**
Error term	:	0.163

Results of the model in Table 4.25 show that computer self-efficacy had a beta value of 0.543 (p = 0.199), cognitive load had a beta value of 0.285 (p = 0.473), confidence had a beta value of 0.175 (p = 0.639), the interaction between computer self-efficacy and cognitive load produced a beta value of 0.502 (p = 0.181), career motivation had a beta value of 1.153 (p = 0.003), career relevance had a beta value of 0.220 (p = 0021), social influence had a beta

[4] While in SPSS, the overall figures were deduced by calculating the average value of agreement/disagreement for each participant based on the responses for each variable and the number of cases in each variable

value of 0.791 (p = 0.013) and the interaction between career motivation and career relevance gave a beta value of 1.607 (p = 0.000).

Only four explanatory variables (career relevance, career motivation, social influence and the interaction between career relevance and career motivation) were significant in explaining students' ICT career choice (β significance value < 0.05). While the other variables are significant at the 5% level, career motivation (p = 0.003) and the interaction between career motivation and career relevance (p = 0.000) were found to be significant at the 1% level. Meanwhile, self-efficacy (β= 0.543; p = 0.199), cognitive load (β= 0.285; p = 0.397) and confidence (β= 0.175; p = 0.639) were found not to explain variances in ICT career choice significantly among students in selected high schools in the Zululand region. All personal factors (computer self-efficacy, cognitive load and confidence) were found to be insignificant explainers of ICT career choice even where computer self-efficacy was interacted with cognitive load. However, the interaction between social factors (career motivation and career relevance) appeared to increase the strength of effect of social factors on ICT career choice among students.

By extracting only significant variables from the model and introducing computed values, it can be concluded with 95% confidence that personal factors (self-efficacy, cognitive load, confidence and the interaction between personal factors) do not significantly influence students' ICT career choice in selected high schools in the Zululand region whilst impersonal factors (career motivation, career relevance, social influence and the interaction between social factors) significantly influence students' ICT career choice. The following model cascades from this conclusion, as per computed values:

$$\boldsymbol{ICT\ career\ choice} = (-\mathbf{8.313}) + \mathbf{1.153}\boldsymbol{X_1} + \mathbf{0.791}\boldsymbol{X_2} + \mathbf{0.22}\boldsymbol{X_3} + \mathbf{1.61}\boldsymbol{X_4} + \mathbf{0.163} \quad \text{.....Equation 4.2}$$

In summary, using data collected from this study, an individual high school student's likelihood of choosing an ICT career can be estimated by analysing their data on career relevance, career motivation and social influence. While results of the model also show positive beta values on self-efficacy, cognitive processing ability and confidence, these values were noted to be insignificant; hence were excluded from equation 2. However, it is keyto note that the values for Nagelkerke's R square (0.344 < 1) and predictive accuracy (78.4% < 100%) show the model is not perfect; hence other factors may be at play which influence students' ICT career, such as gender and age of students (see Figure 4.3 and Figure 4.4).

4.6.4. Factor Analysis

To ascertain the strength of factors used in the model, further factor analysis was run using the Principal Component Analysis (PCA) method of extraction. This section presents results of an inference into the strengths and relationships among explanatory variables based on PCA. Table 4.26 presents results of adequacy tests to ascertain whether factor analysis was appropriate for the dataset for this study.

Table 4.26: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.781
Bartlett's Test of Sphericity	Approx. Chi-Square	382.909
	df	15
	Sig.	.000

The value for the Kaiser-Meyer test of sampling adequacy of 0.781 measures effect size shows the sample is adequate for factor analysis while Bartlett's Test of Sphericity rejected the null hypothesis with 15 degrees of freedom, thus showing that there exists at least one positive and significant correlation between the factors of the study. In the PCA model, two components were extracted, and Table 4.27 shows the Eigen values for the factors based on the initial calculation and the rotated solutions.

Total extractions based on an un-rotated solution are 2.936 and 1.324 for factor 1 and factor 2 respectively; accounting for a cumulative variance of 71%. Other un-extracted factors accounted to 29% of the variances but were found to have weak relationships with the overall variables under investigation.

Table 4.27: Total variance explained by the factors explored in the study

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings*
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	2.936	48.939	48.939	2.936	48.939	48.939	2.749
2	1.324	22.075	71.014	1.324	22.075	71.014	1.765
3	.588	9.799	80.813				
4	.424	7.069	87.882				
5	.381	6.356	94.238				
6	.346	5.762	100.000				

The two components (component 1 and 2) result from the data reduction technique that separates analysis into components based on the covariance levels among factors. Based on the two component extractions, Table 4.28 shows the factor loadings for each dependent variable in the research.

Table 4.28. Factor loadings based on two component extractions

Variables	Component	
	1	**2**
Cognitive load	.860	-.048
Self-efficacy	.845	.026
Confidence	.825	-.064
Self-efficacy * Cognitive load	.957	.169
Social Influence	-.270	.870
Career relevance	.307	.715
Career motivation	.546	.548
Career relevance * Career motivation	.408	.882

In Table 4.28, variables cognitive load, self-efficacy, confidence and the interaction between computer self-efficacy and cognitive load all load fairly well with the first component (0.86, 0.845, 0.825 and 0.957 in loadings respectively), thus showing high correlations and covariances between the factors. Consequently, this suggests that students' confidence, for instance, increases at the same time that their computer self-efficacy improves and their cognitive load handling abilities improve as well. In addition, the strong loadings based on the interaction between computer self-efficacy and cognitive load show that both self-efficacy and cognitive load are strong explainers of students' confidence levels as hypothesised in this study's conceptual structure. Meanwhile, social influence shows a unique trend with component one, which is a negative 0.27. This result suggests that social influence is an outlier factor and is not correlated with other factors such as career relevance and career motivation. Inverse results are however notable with component 2, where social influence, career relevance and career motivation all load well (0.87, 0.715 and 0.548 in loadings respectively) and appear to be correlated with each other as compared to cognitive load, computer self-efficacy and confidence which have comparatively smaller loadings.

4.6.5. Influence of gender on ICT career choice

While the scope of this study did not seek to explore the effect of demographic variables on ICT career preference, this section explores the effect of gender and age groups of students on their career choice. The purpose of this section is to explore whether or not there are any other factors influencing ICT career choice beside the ones primarily targeted by this study. Figure 4.1 shows the percentage of pupils who attested that they desire to pursue or not to pursue a career in ICT, grouped by gender. Empirical studies such as Hackett and Betz (2011) found links between gender and ICT career choice, hence this section investigates the extent to which gender explains variances in ICT career choice.

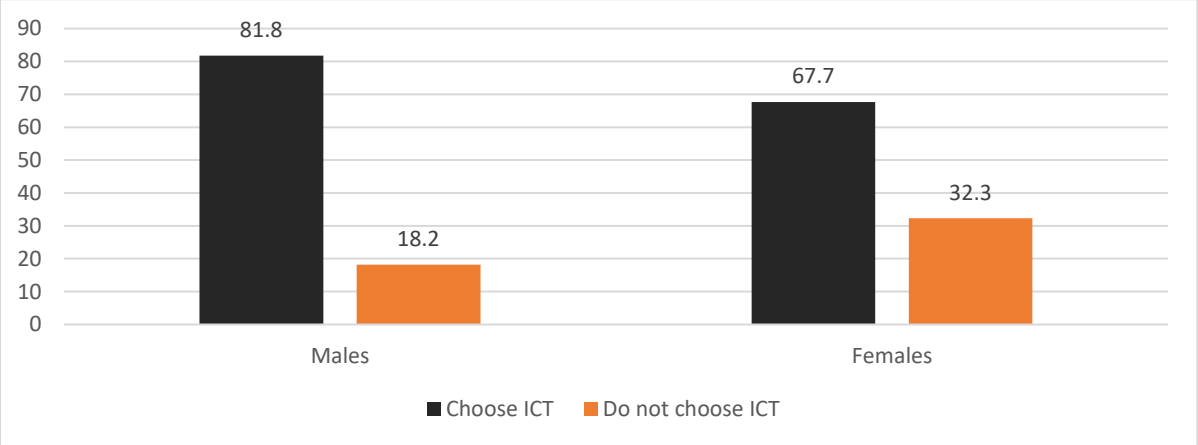


Figure 4.1: Students' gender and ICT career choice.

Source: Primary Research Data

To test for the significance of these differences between girls and boys, a chi-square test of independence was run to investigate the influence of gender on ICT career choice. The results of the test rejected the null hypothesis at the 5% significance level ($X^2 = 4.29; p = 0.038 < 0.05$), thus concluding that there are significant differences in ICT career choices between male and female school pupils in the Zululand region; and gender is a significant explainer of differences in ICT career choice.

4.6.6. Influence of age of ICT career choice

Further to gender, further exploration was conducted on the influence of age on ICT career choice among students. Figure 4.2 shows the distribution of students who choose and do not choose ICT grouped by age.

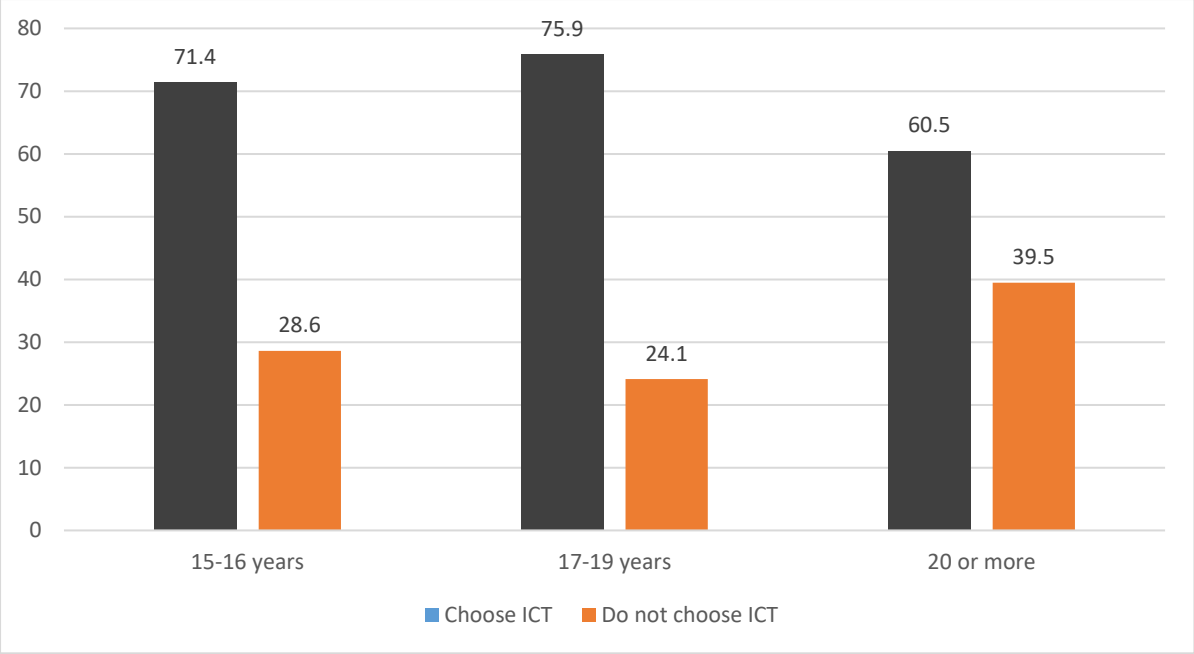


Figure 4.2: Students' age and ICT career choice

Source: Primary data

In Figure 4.2, 28.6% of students in the 15-16 year age group said they choose an ICT career while 71.4% said they do not, 24.1% of students in the 17-19 year age group said they choose an ICT career while 75.9% said they do not, and 39.5% of students in the 20 years/ older group said they choose an ICT career while 60.5% said they do not. A chi-square test of independence was further conducted to establish the extent to which age influences ICT career choice. Test results however could not reject the null hypothesis with 95% confidence ($X^2 = 3.57; p = 0.168 < 0.05$), thus concluding that age of students does not significantly explain differences in students' choice of ICT. Hackett and Betz (2011) are however of the view that among other factors such as parental guidance, gender and race, age of participants is a significant explainer of students' career choice since career priorities appear to change with age. It is likely though, that since the surveyed students are from a largely similar age group and from the same class, career priorities and dreams are still largely similar among them.

4.7. Chapter summary

This study sought to explore the extent to which six factors which are: computer self-efficacy, cognitive load processing ability, confidence, career motivation, social influence and career motivation affect ICT career choice among students from selected high schools in the Zululand region. Questionnaire data collected were analysed using both descriptive and

inferential statistical methods; with the multiple regression equation as the main model and other analysis tools used for triangulation purposes. Further to the main variables, the study also sought to assess the influence of students' gender and age on their ICT career choice.

Findings from descriptive analysis showed that to a significant extent, students responded positively to the influence of all factors in their choice of ICT. These results are corroborated by findings from Pearson's correlation coefficient, Spearman's rank correlation coefficient, an independent samples t-test and a Mann-Whitney U test; all of which rejected the null hypothesis and concluded that all factors investigated in this study positively influence ICT career choice. However, contrasting results were found in the main model where self-efficacy, cognitive processing ability and confidence were found to be insignificant in explaining variances in ICT career choice and social influence, career motivation and career relevance were found to significantly explain ICT career choice. In addition, a Kolmogorov-Smirnov Z test conducted on the influence of factors partially agrees with the main multiple logistic regression that confidence does not significantly explain variances in ICT career choice. Further analysis however showed that Kolmogorov-Smirnov Z test results disagreed with the main model on the influence of computer self-efficacy and cognitive load processing ability. In addition, findings from factor analysis showed that personal factors (computer self-efficacy, cognitive load processing ability and confidence) load well together and are positively correlated together while impersonal factors (career relevance, social influence and career motivation) also appear to load well together and are positively correlated with each other. These findings reinforce the framework of this study which conceptualises confidence as resulting from cognitive load processing ability and self-efficacy, while social influence was conceptualised to arise from career motivation and career relevance of students.

Correlation and t-test findings on the influence of self-efficacy are in line with findings by scholars such as Rajabi*et al.,* (2012) who found, through correlation analysis, that self-efficacy indicators are significant explainers of career choice. The findings are also in line with other studies which note that students' limited exposure to quality ICT education primary and high school often find it challenging to comprehend the subject, thus making them less likely to pursue an ICT education career as a result of their low self-efficacy (Alexander *et al.,* 2010; Johnson *et al.,* 2008; Galpin *et al.,* 2003; Seymour *et al.,* 2005). However, regression results on self-efficacy are not in agreement with the above-mentioned studies; since they show that computer self-efficacy of students does not significantly

influence their ICT career choice. The difference in statistical approaches likely explains these differences, since results from similar tests appear to be in agreement. On the influence of cognitive load, scholars such as Kalyuga (2009) have emphasised that the cognitive limitations of individuals should be considered in ICT learning, since overloading of information inhibits the efficiency of working memory functions. However, Kalyuga (2009) does not specify the extent to which cognitive overload is likely to influence ICT career choice. Similarly, Ariel (2014) could not find any significant correlations between increased cognitive abilities and career choice even though differences in choices between different cognitive groups were noted, hence these findings are in-line with multiple logistic regression findings in this study.

The study findings on the influence of external factors such as career relevance, career motivation and their interactionin this study are generally in line with findings from previous studies. For instance, Padayachee (2017)'s study notes that poor investment in functional ICT infrastructure in schools often leads to students dropping ICT subjects and, by, extension, not pursuing ICT subjects in higher education. In addition, Maharaj (2008) and later Akerman (2012) both found that communities among matric students in KwaZulu-Natal province significantly influence students' career choice. These influences were found to emanate from students' teachers as well as perceived career relevance of ICT subjects, as students weigh the likely relevance of ICT subjects to their future career dreams. Moreover, findings on the influence of society on career choice corroborate Puertas*et al.,* (2013) who found, through the exploration of enablers and barriers to students' career choice that the availability of role models, exposure and career advice are facilitators while low income, lack of prestige and poor environments are barriers. Meanwhile, Babin*et al.*, (2010b) and Hamid (2014) found that several parents and students believe ICT qualifications cater for limited career options, hence they decide not to pursue ICT subjects in school or higher learning institutions. In contrast, this study found that the majority of students prefer to pursue an ICT career due to the availability of numerous career options upon completion of studies. Overall, it is notable that study findings are largely in-line with previous literature, although differences in findings and conclusions exist, likely influenced by the different environments each study was conducted in.

The next chapter presents the conclusion and recommendations for areas of further research.

CHAPTER FIVE: FINDINGS AND RECOMMENDATIONS

5.1. Introduction

This study explored the factors that influence ICT career choice using a case study of matric students from selected schools in the Zululand region, KwaZulu-Natal. In the previous chapter, data was presented using descriptive and inferential statistical methods, and results were discussed in relation to previous literature on the factors affecting career choice. As explored in the research problem statement, the underlying problem targeted by this study was the diminishing uptake of ICT - related programmes at universities in South Africa. It was noted by Hamid (2014), Calitz *et al.*,(2015) and the JSCE (2018) that the shortage of human resources being trained for ICT jobs is generally arising due to the low uptake of ICT-related subjects at matric level. As a result, this study targeted a sample of matric students to explore possible reasons for the low uptake of ICT-related subjects. This chapter summarises findings of the study, draws conclusions, and makes recommendations on the best approaches to promote greater participation in ICT subjects and interest in ICT careers by young students. The chapter synthesises results and presents an overall picture based on the findings, and makes appropriate recommendations to promote interest in the ICT career among students.

5.2. Answering the research questions

This section explores the extent to which the three research questions of the study have been answered by summarising results presented and interpreted in chapter 4.

5.3.1 Research Question 1

What is the relationship between students' confidence and its influencing factors – self-efficacy and cognitive load?

In answering this research question, a set of questions responding to self-efficacy and cognitive load were posed to participants. Participants were also asked to indicate whether their study of ICT subjects was to ensure they settle in an ICT career in their future. As per this study's conceptual structure, it was hypothesised that computer self-efficacy and cognitive load are key components of confidence, hence the interaction between the two variables can determine confidence levels among participants of the study. As a result, computer self-efficacy was combined with cognitive load to establish the 'confidence' factor, which in turn was tested for the extent to which it influences ICT career choice among students. Table 5.1 summarises the key criteria used to measure computer self-efficacy and cognitive load.

Table 0.1: Criteria for measuring self-efficacy and cognitive load

Criteria	Question number on questionnaire
Computer self-efficacy	
Effective learning of computer theory	6.1
Effective earning of practical applications	6.2
Ability to recall	6.3
Effective task performance	6.4
Ability to excel in assessments	6.5
Cognitive load	
Ability to recall bulk information	7.1
Ability to relate to computer topics	7.2
Understanding	7.3
Application of learning	7.4
Ability to follow instructions	7.5

Cowan, Slogrove, and Hoelson, (2012) note that self-efficacy is a form of confidence that is specific to one's situation; and is concerned with one's conviction that he/she can succeed at specific tasks and skills. Akhtar, Patel &Khan (2013) as well as Vasile*et al*., (2010) hypothesised a positive relationship between self-efficacy and confidence, as well as cognitive load and confidence. In this study, correlations, a t-test and non-parametric test results showed that the interaction between self-efficacy and cognitive load helped to explain the confidence variable to a significant extent (refer to Table 4.18, 4.19, 4.21 and 4.22). A positive relationship between both explainers of confidence and their interactions confirm findings by Akhtar, Patel &Khan (2013), and Vasile*et al*., (2010) that show that enhancing confidence in matric students can be achieved by working to enhance their self-efficacy and their cognitive functioning.

Bozgeyikli*et al*., (2009) notes that a positive and significant relationship between self-efficacy, confidence and career choice among school going students exists. Chi, Glaser & Rees (2012) argue that self-efficacy levels among students normally affect their confidence in choosing appropriate careers for themselves. In this study, results from most tests conducted

established that self-efficacy and cognitive load are significant explainers of ICT career choice among high school students in selected Zululand schools. Correlation tests conducted using Pearson's correlation and Spearman's rank correlation(Table 4.18) both showed positive and significant linear associations between self-efficacy and ICT career choice as well as cognitive load and ICT career choice. Similarly, non-parametric tests (Table 4.21 and 4.22) and independent samples tests (Table 4.19) conducted corroborated the results of correlation analysis. However, results of the main regression model showed that although the beta values for both explanatory variables were positive, they were not high enough to reject the null hypothesis (Table 4.25). Therefore, while the t-test and the correlation results confirmed the relationship between the dependent and explanatory variables, the main study model did not, and conclusions from the main model suggest that any variability in ICT career choice among students with different computer self-efficacy or cognitive processing levels are likely to be coincidental and cannot be applied to the entire population. However, regardless of the observed effect of confidence on ICT career choice, results from factor analysis showed that computer self-efficacy and cognitive load are both positively correlated with confidence (Table 4.28). Results of thet-test analysis, correlation and non-parametric analysis corroborate Rajabi*et al.,* (2012); Johnson *et al., (*2008); Alexander *et al.,* (2010);Galpin *et al.,* (2003); and Seymour *et al.,* (2005); who found that confidence and social factors affect career choice among students. However, these results are not in line with the findings by Ariel (2014) who found that increases in confidence do not significantly result in changes in students' ICT career choice.

5.3.2 Research Question 2

What is the relationship between social influence and its influencing factors – career motivation and career relevance?

Career relevance and career motivation were each measured separately through a 5-point Likert Scale where a larger mean meant higher career motivation and relevance, and a smaller mean meant lower career motivation and relevance. A test on interaction between career relevance and career motivation was further conducted to establish the extent to which the interaction leads to social influence, which affects students' ICT career choice. Table 5.3 shows the criteria used in measuring career relevance and career motivation as well as their respective question numbers.

Table 0.2: Criteria for measuring career motivation and career relevance

Criteria	Question number on questionnaire
Career motivation	
ICT career passion	9.1
Need for high pay out	9.2
Job convenience in ICT	9.3
Desire to stay up to date with technology	9.4
Need to pursue many job opportunities within ICT	9.5
Career relevance	
ICT learning in high school as a stepping-stone into an ICT career	11.1
Desire to develop the country through ICT	11.2
Desire for ICT-related job influence	11.3
Desire to pursue a variety of job opportunities	11.4

Descriptive results on the variables of career relevance and career motivation showed that career relevance and motivation levels were fairly high among students from selected high schools who participated in the study. Kirschner, Paas, and Kirschner (2011) and Chi *et al.*, (2012) note that the career motivation variable is defined through students' desire to follow their father's/mothers/guardian's occupation. This, coupled with the relevance of ICT to a student's environment, helps to explain the social influence variable (Maehr& Meyer, 1997; Pintrich*et al.*, 1993). This study found that both career motivation and career choice as well as their interaction are positively correlated with the social influence variable (Table 4.18). Independent samples t-tests (Table 4.19) as well as non-parametric tests (Tables 4.21 and 4.22) also show that the interaction between career motivation and career was a strong positive predictor of social influence, confirming findings by Maehr and Meyer (1997) and Pintrich et *al.*, (1993). In addition, through factor analysis, it was further established that career motivation and career relevance as a variable was positively correlated with social influence, thus showing that social influence as a variable was indeed composed of career motivation and career relevance.

Bannatyne (2019) notes that the view among students and their parents that ICT qualifications are not as scarce as they thought leads to low uptake of ICT subjects in matric. Hamid (2014) adds that since ICT subjects are generally viewed as highly technical and challenging, fewer than 1% of students end up pursuing ICT-related subjects in matric, hence the low uptake. Factors discussed by Bannatyne (2019) and Hamid (2014) help explain the variable of career motivation, and theyshow that low ICT career motivation is a key factor leading to low uptake of ICT subjects, and an ICT career. In this study, data analysis through statistical tests showed generally similar results for both the variables of career motivation and career relevance, albeit with differences in the strength of influence. For instance, career motivation and career relevance showed Pearson's correlation coefficients of 0.454 and 0.364 respectively, and Spearman's rank correlation coefficients of 0.420 and 0.311 respectively (Table 4.18). This shows that although both variables are correlated with ICT career choice and are positive, career motivation has a stronger relationship than career relevance. Students who participated in this study demonstrated that their desire to pursue ICT was based on their personal motivations resulting from information availed to them (Maehr& Meyer, 1997; Pintrich*et al.,* 1993) rather than relying on their immediate families or living situations to determine their career choices. Moreover, other parametric and non-parametric tests conducted on the influence of career motivation all showed positive and significant results. The main multiple regression analysis showed beta values that were positive and significant at the 99% and 95% confidence levels for career motivation and career relevance respectively (Table 4.25). This confirms correlation results which showed that career motivation has a comparatively stronger influence on ICT career choice than career relevance.

5.3.3 Research Question 3

How does students' confidence and social factors influence their ICT career education choice?

The variable 'confidence' was measured through the use of a set of five questions posed on the participants. On a five-point Likert Scale ranging from 'strongly disagree' to 'strongly agree, a mean response that was closer to 5 (agree and strongly agree) signified high confidence while a mean response closer to 1 (disagree and strongly disagree) signified low confidence. Confidence was also deduced as a separate variable based on the interaction of computer self-efficacy and cognitive load. Table 5.2 shows the five criteria used in measuring confidence and their corresponding question numbers in the questionnaire.

Table 0.3: Criteria for measuring computer confidence

Criteria	Question number on questionnaire
Ability to learn from failures	8.1
Ability to share computer knowledge with peers	8.2
Studying with limited effort	8.3
Comprehension through self-reading	8.4
Ability to respond to questions in class	8.5

Weibell (2011) in agreement with Keller (2009) argue that confidence levels are key in explaining career choice among students. Where a student feels they possess the power and abilities required to succeed, he/she is likely to choose a career option that would ordinarily be considered challenging by others (Weibell, 2011; Keller, 2009). Similar to computer self-efficacy and cognitive load, the influence of confidence on students' ICT career choice was investigated using logistic regression analysis as the main model, while an independent samples t-test, Pearson and Spearman's correlation analysis, Mann-Whitney U test and the Kolmogorov-Smirnov Z test were also conducted. Results were found to be varied between tests, even though a generally positive relationship was identified in all tests (Tables 4.18, 4.19, 4.21, 4.22, 4.25 and 4.28). Results of the independent samples t-test, correlation analysis and the Mann-Whitney U test all rejected the null hypothesis and concluded that confidence levels with ICT learning significantly influence students' choice of ICT as a career. However, tests from a Kolmogorov-Smirnov Z test and the multiple logistic regression model failed to reject the null hypothesis, concluding that confidence levels in computer learning do not significantly explain differences in students' ICT career choices. These results were also true when computer self-efficacy was considered togetherwith cognitive load, and this showed that, based on independent samples t-tests and correlation analysis, confidence significantly influenced students' ICT career choice but based on the multiple logistic regression model, confidence was found to be an insignificant explainer of ICT career choice. Regression results on the influence of confidence are contrary to Weibell (2011) and Keller (2009) who both found positive and significant relationships between confidence and career choice.

From the literature, social influence was noted as a significant explainer of career choice among students, since the students' environment continuously reshapes their views on diverse matters as they interact with it. Puertas *et al.*, (2013) note that there are several variables in students' societies which can act as facilitators or barriers to students' ICT career choices. The availability of role models, exposure and career advice were found to be facilitators while low income, lack of prestige and poor environments were barriers. For Naz *et al.*, (2014) peer pressure, as a component of social influence, is higly significant in explaining students' choice of a career. Shumba & Naong (2012) argue that in students' career choice, family is the most significant factor that affects which career direction a student will take. As a result, the choices that students make in careers were hypothesised to be highly subject to their sarroundings, in particular family and peers. This study sought to investigate the direction and strength of social influence based on the criteria summarised on Table 5.4.

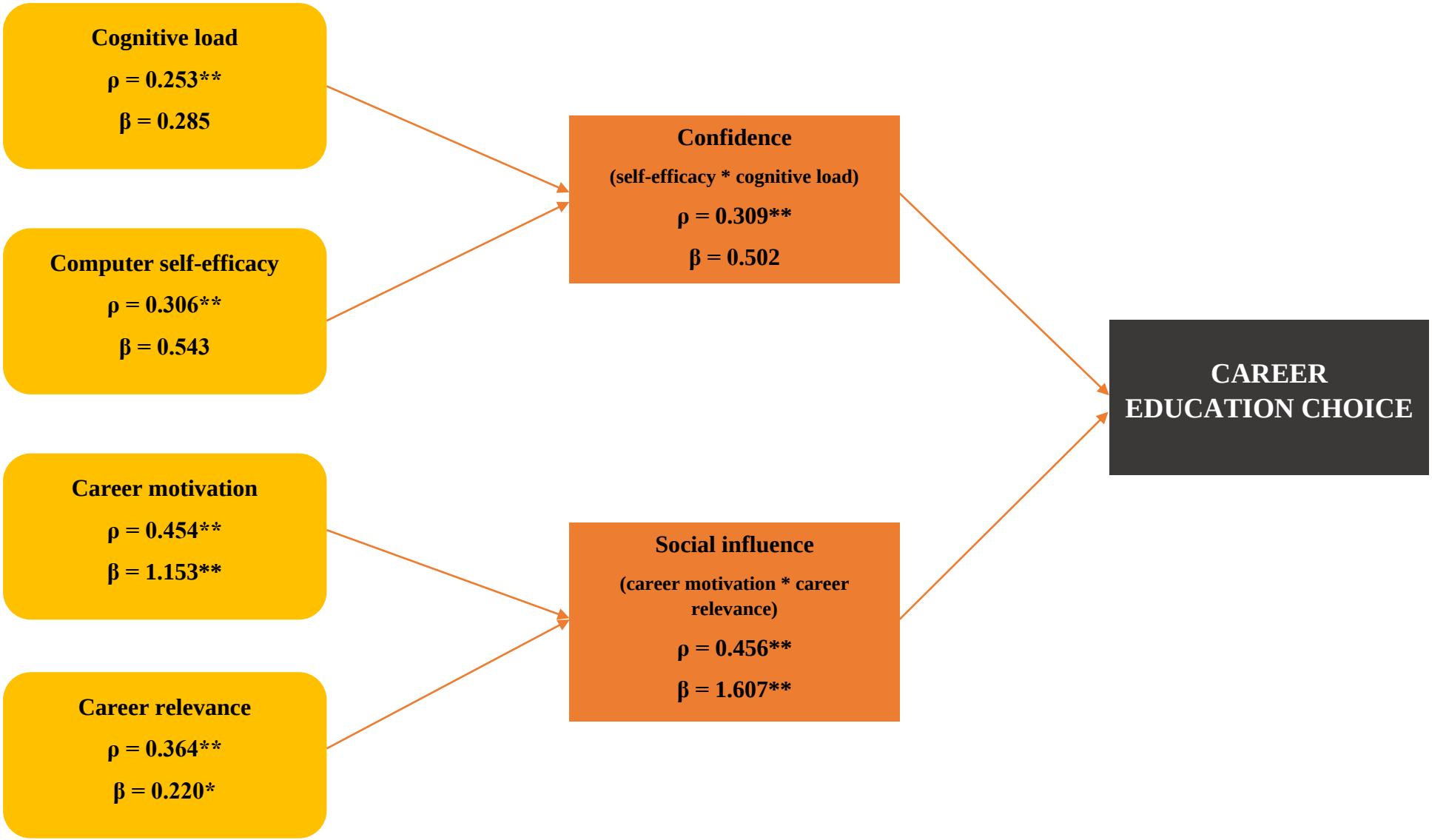
Table 0.4: Criteria for measuring social influence

Criteria	Question number on questionnaire
Family encouragement	10.1
Friends' peer pressure	10.2
Teacher influence in class	10.3
Abundance of government support	10.4
ICT infrastructure availability in school	10.5

Descriptive statistical analysis on the influence of social factors showed that family and peer influence were minimal in influencing students' ICT career choice. This is contrary to Puertas *et al.*,(2013) and Naz *et al.*, (2014) both of which found family and peer pressure to be significant predictors of ICT career choice. Instead of being influenced by their parents and friends to make career decisions, students claimed that their teachers' eloquence in delivery of computer learning, the availability of government support for ICT related learning as well as the availability of reliable ICT infrastructure in school motivates students to pursue a career in ICT. Upon consolidation of the five criteria, it was found that social influences explain significant variances in students' choice of a career in ICT. Correlation tests (Table 4.18), t-tests (Table 4.19), non-parametric tests (Tables 4.21 and 4.22) and the main multiple logistic regression model (Table 4.25) all confirmed the influence of society on career choice. In addition, results of all statistical tests showed that social influence derived from career

motivation and career relevance + positively and significantly influence students' ICT career choice. Factor analysis also showed that social influence is a strong variable which loads well in explaining career choice with the other variables, career motivation and career relevance (Table 4.28). Results on social influence corroborate the findings of Babin, Grant & Sawal (2010a) as well as Shumba & Naong (2012) who all found that social influences explain students' career choice. Meanwhile, studies such as by Puertas, Arósquipa & Gutiérrez (2013) note that the social environment can act as either a 'facilitator' or 'barrier' to students' career choices. For instance, with generally low reach of reliable computer infrastructure in numerous schools in Zululand and across South Africa, the desire to pursue an ICT career might never cross most students' minds. Figure 5.1 utilises the study's theoretical framework to summarise findings of the study. On the diagram, 'ρ' represents Pearson's correlation coefficient while 'β' is the beta value for each variable and '**' represent the level of significance of each beta and Pearson's correlation coefficient.

Figure 0.1: Overall results as per study framework



As shown on Figure 5.1, findings on the factors influencing ICT career choice from statistical tests can be summarised as follows: According to the Pearson's correlation coefficient, all six factors explored are significantly positively correlated to ICT career choice, thus students' choice of ICT career may be influenced by their computer self-efficacy, cognitive load, confidence, career relevance, career motivation and social influence. In addition, according to the multiple logistic regression model, computer self-efficacy, cognitive load and confidence do not significantly explain students' ICT career choice. Meanwhile, career relevance, career motivation and their interaction (social influence) all significantly explain students' ICT career choice. Moreover, both the correlation coefficient and logistic regression model show that computer self-efficacy is a stronger explainer of ICT career choice than cognitive load. Furthermore, in both tests, career motivation is a stronger explanatory variable for ICT career choice than career relevance and social influence. Career motivation has the largest beta value of +1.153, which is significant at the 99% level on individual factors, but the interaction of career motivation and career relevance produced the highest beta value of 1.607. Lastly, when comparing social influence with confidence, social influence is a stronger explanatory variable using both correlation analysis and regression. This shows that external factors have a stronger link to students' ICT career choice than internal/ personal factors.

5.3. Summary of findings from literature

To contextualise this study, an in-depth literature review was conducted on the background information relating to the ICT career in South Africa. Various theoretical formulations employed in the assessment of factors influencing career choice as well as empirical findings on the factors that influence career choice among students were examined. A review of published documents, reports and official websites in South Africa revealed that even though ICT careers were among the DHET's scarce and critical skills list, computer reach is still minimal across the country especially in schools located in rural areas of South Africa, such as most schools in the Zululand region. Added to this, the low reach of ICT infrastructure in the country exacerbates the uptake of ICT-related courses at university by matriculants. Worse still, SA's ICT policy does not articulate any solid plans towards improving ICT reach in all schools in the country, but rather articulates a more abstract view of ICT-related issues and challenges facing South Africa. Furthermore, ICT access in remote areas was reported to be further hampered by widespread

theft and vandalism of installed equipment, such as desktop computers, resulting in new schools that would have received ICT infrastructure, losing it.

A review of theoretical frameworks for understanding career choice among students showed that theories such as the Social Cognitive Career Theory (SCCT), Keller's ARCS Motivational Model and the Cognitive Load Theory are among the keys to explaining the decisions taken by students in their choice of a career. The empirical literature review conducted established that there are several factors that affect students' choice of careers. These factors can be divided into two major groups which are, intrinsic and extrinsic factors. Intrinsic/personal factors include individual self-efficacy, cognitive load and confidence which were viewed to be key in explaining individual motivations that drive choices of careers (Edokpolor, 2018; Smith, 2015; Bozgeyikli, *et al.,* 2009; Reddan, 2015; Ogutu*et al.,* 2017). On the other hand, extrinsic factors arise from the influence of the students' environment such as parental influence, peer pressure, teacher influence, influence of the media, ICT infrastructure availability and reliability in school as well as other mitigating social factors (Dickison*et al.,* 2017; Mtemeri, 2017; Naz *et al.,* 2014; Puertas*et al.,* 2013).

5.4. Limitations of the study

While the study managed, with some success to explore the various factors influencing ICT career choice as well as interactions among them, more can still be done to provide further information. For instance, the fact that this study only targeted students already pursuing ICT subjects means that results were somehow skewed and one-sided. As a result, the underlying research problem (why less matric students seem to be taking up and pursuing ICT programmes at university) was not fully resolved. Since participants in this study were already pursuing ICT subjects, it can be deduced that they already preferred ICT, hence provide mostly positive feedback about ICT. Future studies can therefore include non-ICT studying matric students in their sample to obtain further information on the reasons why there is low uptake of ICT.

This study presents a 'snapshot' of student views at a single point in time and does not provide a longitudinal view of career choice among matric students. The study therefore lacks an exploration of how preferences at matric translate into pursuing of tertiary studies in ICT and subsequently unlocking an ICT career. There might be a need to conduct a longitudinal exploration study to establish the evolution of career preferences among high school students,

and how entrants into tertiary institutions act as enablers or as hinderances to these preferences and aspirations.

5.5. Recommendations

This section presents recommendations arising from study findings, and it is divided into different stakeholder groups namely teachers/schools, the Department of Basic Education (DBE), employers and higher education institutions. Recommendations developed in this study target the improved access to computer infrastructure in high schools, improved access to ICT career advice for high school students, the introduction of university ICT programmes that accommodate students with minimal ICT background at matric and the introduction of interventions to boost analytical skills among matric students in South Africa as a way to enhance their ICT proficiency.

Teachers and schools

Teachers in schools should introduce interventions which boost confidence in analytics among matric students. While results of the regression model found confidence to be an insignificant explainer of ICT career choice, results of correlation analysis, t-test analysis and non-parametric tests in section 4.6 established that confidence does affect students' ICT career choice. As a result, it is important to ensure that students, whether at home or at school, are given an opportunity to sharpen their computer skills. In schools, practical lesson delivery should be emphasised to enhance students' computer self-efficacy. Where an individual student doubts his/her knowledge and ability in computer operations, it is likely that this will cascade into their career choice, driving them away from the field.

The Department of Basic Education

The DBE should work towards improving students' access to reliable computer infrastructure for study. In section 4.6,the study found a significantly positive relationship between an enabling social environment and students' ICT career preference. With the findings further showing that social influence has a stronger influence on career choice than confidence of a student, it is necessary for government to ensure that computer infrastructure is available in all schools, including the high schools in the Zululand region. With better computer infrastructure, students have more time to learn and to improve their ICT skills, become more acquainted with computers and possibly develop a passion to pursue an ICT career. Passion for ICT alone will not be sufficient to increase the number of students from Zululand high schools pursuing ICT

qualifications with higher learning institutions since an enabling environment is necessary. In schools where computer infrastructure is present, there is a further need for schools to re-orient their teaching material to local universities' standards. This improves career relevance of ICT to students since they would be able to chart a better career path, knowing that their matric course in ICT is sufficient to enter into the ICT field at universities

Universities and other tertiary institutions

Higher education institutions should consider introducing programmes which accommodate students with minimal ICT background from matric. Considering the current low ICT reach and limited computer infrastructure, local universities should consider admitting students interested in studying ICT programmes even though they had little to no ICT exposure at matric. Similar to what is conducted in mathematics courses and languages across numerous universities over the world, local universities should consider introducing bridging programmes for students interested in ICT degrees, but whose background on the subject is insufficient to warrant immediate acceptance. Such bridging programmes can focus on capacitating students with sufficient background to meet minimum requirements; and be at the same NQF value as an ICT course in matric which is acceptable at that respective higher learning institution.

Employers in the ICT industry

Institutions that recruit individuals in the ICT industry should ramp up access to ICT career advice to students in high schools countrywide. With limited career advice, most matric students will remain unaware of the demand for ICT professionals in the country (refer to section 4.5). With the Department of Higher Education and Training (DHET)'s critical skills list containing several ICT careers, matric students need to know they have several career options they can pursue in the field. This can be achieved through partnerships among employers, government agencies such as the KwaZulu-Natal Department of Education and local universities, whilst schools in the Zululand region should stimulate discussions on the topic of ICT as a career, and motivate matric students to consider pursuing it.

5.6. Suggestions for future research

In exploring complex fields of study such as career choice among students, it is essential to conduct more robust studies that combine multiple variables, varied participant groups and mixed methodologies. For instance, a study on factors influencing ICT career choice can encompass the views of matric students, their local schools, local universities as well as local

government. By collecting views from multiple participant groups, future researchers will be in a better position to ascertain a more accurate nature of the problem and suggest robust interventions to improve ICT enrolments in local universities, fuelled by students from local schools in the Zululand region. This will be contrary to findings of this study (refer to sections 4.5 and 4.6) which are based on students' views only without encompassing broader stakeholder views.

Secondly, while a snapshot study is easy, economic and timely to conduct, it limits the scope of information received and conclusions made by the researcher. Future studies could however utilise this study as a baseline with which to track the students' journeys to tertiary institutions, to understand how their matric background in ICT prepares them for tertiary studies in the field, and ICT employment. It is possible that numerous students may be highly willing to enter into the ICT field by completing first degrees, only to find themselves unable to enter due to their limited matric qualifications. The existence or inexistence of such a problem can be investigated by future researchers.

Finally, there is need to incorporate a different dimension by investigating ICT career choice among both students who are studying ICT subjects in high schools and those who are not. Such studies could be customised to prompt the students' level of awareness of ICT, the critical skills in the field and potential careers. Instead of studying only students already studying ICT, unique perspectives could be obtained on how matric students possibly have passion and motivation to study ICT, but do not have an enabling environment that allows them to do so.

5.7. Summary

The research's purpose was to investigate factors influencing the choice of a career among students, based on a case study of 190 students in selected high schools in the Zululand province. Based on studies by Hamid (2014), Calitz et al., (2015) and JSCE (2018), the primary research problem for this study was noted to be the diminishing uptake of ICT- related programmes at universities in South Africa. Literature showed that this low uptake often originates from the matric level, and there were several inhibitors to matric students' ability to pursue ICT subjects. Emanating from the literature review of studies such as Puertas *et al.,* (2013), Naz *et al.,* (2014), Smith (2015) and Bozgeyikli *et al.,* (2009), six key variables namely: computer self-efficacy, cognitive processing, confidence, career motivation, career relevance and social influences that determine career choice were identified. Using the adopted conceptual structure through

quantitative analysis, the study established varied results based on a number of parametric and non-parametric analyses conducted. Through correlation analysis (Table 4.18), independent samples t-tests (Table 4.19) and non-parametric tests (Tables 4.21 and 4.22), it was established that both self-efficacy and cognitive load were positively related to confidence while career motivation and career relevance were positively related to the social influence variable.

For the greater part, results from correlation analysis, t-test analysis, Mann-Whitney U tests and Kolmogorov-Smirnov Z tests established that all factors, personal and interpersonal, significantly affect ICT career choice among students. However, investigations through the multiple logistic regression model, the main model of the study, found that personal factors of computer self-efficacy, cognitive processing and confidence do not explain significant variances in ICT career choice. Rather, external factors which are career motivation, career relevance and social influences significantly determine career choice among students.Findings were found to be in line with previous studies that found that low levels of self-efficacy and confidence significantly affect their likelihood to pursue a career in ICT (Alexander *et al.,* 2010; Johnson *et al.,* 2008; Galpin *et al.,* 2003; Seymour *et al.,* 2005). These results also appear to corroborate current reality trends where numerous people are pushed into career options which are not their choice/ which match their cognitive abilities because of the influence of their environment such as parents and mainstream media. Further, it was seen that even if a certain student has a passion for ICT, is confident and can learn computer courses very well, that student's ICT career dream may easily be crushed once the school ICT infrastructure becomes inadequate, since he/she will have no access to learning enabling facilities. Therefore, interventions that enhance individual students' abilities to pursue an ICT career will be inadequate without ensuring that the environment enables students to pursue their own passions. Appropriate recommendations which seek to improve students' access to ICT at matric were therefore suggested to different groups of stakeholders (teachers/ schools, the DBE, higher education institutions and employers in the ICT industry).

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APPENDICES

Appendix A: Information sheet and participant to participant consent form

UKZN HUMANITIES AND SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE (HSSREC)

APPLICATION FOR ETHICS APPROVAL
For research with human participants

Information Sheet and Consent to Participate in Research

Date: 19/1/2019

Greetings,

My name is Pakama Pamela Mkabile, from the University of KwaZulu-Natal, School of Management, IT, and Governance. My contact number is 0793317849 and my email address is 216077037@ukzn.ac.za. My research supervisor's contact number is 0 33 260 5643 and his email address is Prabhakarr@ukzn.ac.za.

You are invited to participate in a study titled ***Exploring factors influencing the choice of ICT education among matric students in selective rural high schools in Zululand.*** The purpose of this research is to investigate the reasons behind student's choice of ICT education and to further explore the role society plays in student's choice of career education.

In this study, the target population is in Zululand, where there are 65 matric students on average per school. The targeted population for the study will be focused on the five most under-developed public High Schools in the Zululand Region and these schools are scattered in different rural areas within the Region. The study establishes a target population of approximately 350 students.

If you volunteer to participate in this study, it will take you an estimated 10-15 minutes to complete.

By the time when the study is complete, the target is that they will bring the following benefits:

- It will provide the opportunity for your experience to be given appropriate consideration in future policy; and
- It will increase the knowledge held by the researchers, schools, Department of Education, and relevant local government authorities.

The research instrument for this study was reviewed and approved for ethical standards by the UKZN Humanities and Social Sciences Research Ethics Committee.

For any challenges, concerns/ questions you may have, feel free to contact the researcher at 0793317849 (216077037@ukzn.ac.za) or the UKZN Humanities & Social Sciences Research Ethics Committee, using the following contact information:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION
Research Office, Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban 4000 KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604557- Fax: 27 31 2604609
Email: HSSREC@ukzn.ac.za

Your participation in the study will be entirely voluntary and by participating, you will be granting the researcher permission to aggregate your responses with others and produce a research report. You are free to refuse to take part; or withdraw from taking part at any time with no negative consequences to you. There will be no monetary gain accruing to you as a result of your participation. Your anonymity is guaranteed by the researcher and the School of Management, I.T. & Governance and your responses will not be used for any other purposes outside of this study.

All data collected, hard copy and both electronic, will be securely stored during the study and archived for 5 years. After this time, all data will be destroyed.

If you have any questions or concerns about participating in the study, please contact the undersigned or my research supervisor at the numbers listed.

Thank you for your willingness to participate!

Sincerely
(Researcher name and signature)

CONSENT TO PARTICIPATE

I _____ have been informed about the study entitled *Exploring factors influencing the choice of ICT education among matric students in selective rural high schools in Zululand* by (Pakama Pamela Mkabile).

I have read and understood the purpose of the study.

I have been provided with a chance to ask questions about the study, am satisfied with the answers that I have received.

I declare that I am taking part in this study entirely voluntary and that I am allowed to withdraw participation at any time without any negative consequences.

Where I have any further questions, concerns or queries related to my participation, I understand that I am able to get in touch with the undersigned.
If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION
Research Office, Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604557 - Fax: 27 31 2604609
Email: HSSREC@ukzn.ac.za

_____ _____

Signature of Participant **Date**

Parental Permission for Children Participation in Research

I _____ the parent of _____ have been informed about the study entitled **E*xploring factors influencing the choice of ICT education among matric students in selective rural high schools in Zululand*** by (Pakama Pamela Mkabile).

I understand the purpose and procedures of the study.

I have been given an opportunity to ask questions about the study and have had answers to my satisfaction.

I do not object to my child's participation in the study.

Where I have any further questions, concerns or queries related to my participation, I understand that I am able to get in touch with the undersigned.
Where I have any additional questions or concerns about my rights as a participant, or if I am concerned about any aspect of the study or the researcher then I may get in touch with:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION
Research Office, Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604557 - Fax: 27 31 2604609
Email: HSSREC@ukzn.ac.za

_____ _____

Signature of Participant **Date**

Appendix B: Letter of Permission to conduct the study

education

Department:
Education
PROVINCE OF KWAZULU-NATAL

Enquiries: Phindile Dume Tel: 033 392 1063 Ref: 2/4/8/1727

Ms PP Mkabile
1135 Francis Baard
Hatfield
Pretoria
0001

Dear Ms Mkabile

PERMISSION TO CONDUCT RESEARCH IN THE KZN DoE INSTITUTIONS

Your application to conduct research entitled: **"EXPLORING FACTORS INFLUENCING ICT CAREER CHOICE IN EDUCATION AMONG MATRIC STUDENTS IN SELECTIVE RURAL HIGH SCHOOLS IN ZULULAND"**, in the KwaZulu-Natal Department of Education Institutions has been approved. The conditions of the approval are as follows:

1. The researcher will make all the arrangements concerning the research and interviews.
2. The researcher must ensure that Educator and learning programmes are not interrupted.
3. Interviews are not conducted during the time of writing examinations in schools.
4. Learners, Educators, Schools and Institutions are not identifiable in any way from the results of the research.
5. A copy of this letter is submitted to District Managers, Principals and Heads of Institutions where the intended research and interviews are to be conducted.
6. The period of investigation is limited to the period from 18 February 2019 to 20 July 2021.
7. Your research and interviews will be limited to the schools you have proposed and approved by the Head of Department. Please note that Principals, Educators, Departmental Officials and Learners are under no obligation to participate or assist you in your investigation.
8. Should you wish to extend the period of your survey at the school(s), please contact Miss Phindile Dume at the contact numbers below.
9. Upon completion of the research, a brief summary of the findings, recommendations or a full report/dissertation/thesis must be submitted to the research office of the Department. Please address it to The Office of the HOD, Private Bag X09137, Pietermaritzburg, 3200.
10. Please note that your research and interviews will be limited to schools and institutions in KwaZulu-Natal Department of Education.

Zululand District

[redacted]

Dr. EV Ndama
Head of Department: Education
Date: 19 February 2019

Appendix C: Ethical Clearance form

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

25 June 2019

Ms Pakama Pamela Mkabile (216077037)
School of Management, IT & Governance
Westville Campus

Dear Ms Mkabile,

Protocol reference number: HSS/0357/019M
Project title: Exploring factors influencing the choice of ICT Edcuation among matric students in selective rural high schools in Zululand

Approval Notification – Expedited Application

In response to your application received on 12 April 2019, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a Period of 1 Year from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

[redacted]

Dr Rosemary Sibanda (Chair)

/ms

Cc Supervisor: Dr Prabhakar Rontala Subramaniam
cc Academic Leader Research: Professor Isabel Martins
cc School Administrator: Ms Angela Pearce

Appendix D: Questionnaire for Matric Students of Rural Zululand District

EXPLORING FACTORS INFLUENCING THE CHOICE OF ICT EDUCATION AMONG MATRIC STUDENTS IN SELECTIVE RURAL HIGH SCHOOLS IN ZULULAND.

RESEARCHER: PAMELA PAKAMA MKABILE
SUPERVISOR: DR PRABHAKAR RONTALA

DISCIPLINE OF INFORMATION SYSTEMS AND TECHNOLOGY
SCHOOL OF MANAGEMENT, IT AND GOVERNANCE
COLLEGE OF LAW AND MANAGEMENT STUDIES
UNIVERSITY OF KWAZULU-NATAL

Please complete this questionnaire on the CHOICE OF ICT education. Note that participation in this study is voluntary. Your anonymity is assured, and all responses will be treated in the strictest confidence. Please note that there are no correct/incorrect answers.
Should you have any queries please do not hesitate to contact me:
Telephonically:0793317849 or per e-mail: 216077037@ukzn.ac.za.

Thanking you in anticipation of your response**.**

SECTION A: DEMOGRAPHIC BACKGROUND

Please respond to the following questions by ticking the most appropriate box that fits your specific answer.

1. Age of respondent

Age group	**Please Tick Appropriate Box (X)**
15-16 years	
17-19 years	
20 or more years	

2. Gender

Gender	**Please Tick Appropriate Box (X)**
Male	
Female	

3. Ethnic Background

Ethnic background	**Please Tick Appropriate Box (X)**
Black African	
Indian	
White	
Asian	
Coloured	
Any Other (Specify)	

4. Home language

Home Language	**Please Tick Appropriate Box (X)**
Zulu	
Xhosa	
Sepedi	
Sotho	
English	
Tswana	
AnyOther (Specify) (Specify)	

5.Name of the School

Name of the School	Please Tick Appropriate Box (X)
School 1	
School 2	
School 3	
School 4	
School 5	

6.

Areyou studyingICT currently	Please Tick Appropriate Box (X)
YES	
NO	

SECTION B: SURVEY QUESTIONNAIRE GUIDE

6. Self-Efficacy

On a scale of 1 (Strongly disagree) to 5 (Strongly agree) to what extent do you agree with the following statements:

I can	1. SD	2. D	3. N	4. A	5. SA
6.1. learn theoretical topics about computers well					
6.2.learn practical topics about computers effectively					
6.3.remember all that I learn about computers.					
6.4. effectively perform all tasks or exercises in my computer module					
6.5. perform well in my computer assessment					

6. Cognitive Load

*On a scale of **1 (**Strongly disagree) to 5 (Strongly agree**)** to what extent do you agree with the following statements*

I can	**1. SD**	**2. D**	**3. N**	**4. A**	**5. SA**
7.1. recall all that I learn about computers					
7.2.relate to topics that I learn about computers					
7.2.understand computers well through computer learning					
7.3.apply what I learnt about computers					
7.4.follow instructions/ explanations during IT learning very effectively.					

8. Confidence

*On a scale of **1 (**Strongly disagree) to 5 (Strongly agree**)** to what extent do you agree with the following statements*

I can	**1. SD**	**2. D**	**3. N**	**4. A**	**5. SA**
8.1.learn operating computers from my failures					
8.2.help my friends to learn computers					
8.3.answer questions in my computer assessment without much thinking					
8.4.understand computer topics through self-study					
8.5.respond to my teachers' questions in front of the whole class					

9. Career Motivation

On a scale of 1 (Strongly disagree) to 5 (Strongly agree) to what extent do you agree with the following statements

I prefer	**1. SD**	**2. D**	**3. N**	**4. A**	**5. SA**
9.1.IT career as it is my passion					
9.2.IT career as it is highly paying.					
9.3.IT career as it is a job of convenience					
9.4.IT career because I want to be updated with new technology					
9.5.IT career as there are many job opportunities					

10. Social Influence

*On a scale of **1 (**Strongly disagree) to 5 (Strongly agree**)** to what extent do you agree with the following statements*

I choose	**1. SD**	**2. D**	**3. N**	**4. A**	**5. SA**
10.1. to study IT because my family encourages me to do so					
10.2. computer studies because is what my friends chose					
10.3. computer studies because my teacher makes it easy to understand in class					
10.4. computers studies because government supports IT education by offering bursaries.					
10.5. to study IT because my school has very good facilities					

11. Career Relevance

*On a scale of **1 (**Strongly disagree) to 5 (Strongly agree**)** to what extent do you agree with the following statements*

I prefer	**1. SD**	**2. D**	**3. N**	**4. A**	**5. SA**
11.1computer studies because it is a requirement for Computer Science program at university					
11.2IT career for the development of my country					
11.3 An IT career because I can get a job by influence					
11.4 An IT career because there are different types of IT jobs, for example, developer, business analyst, project manager, data scientists, etc.					

12 Career education choice

*On a scale of **1 (**Strongly disagree) to 5 (Strongly agree**)** to what extent do you agree with the following statements*

I prefer	**1. SD**	**2. D**	**3. N**	**4. A**	**5. SA**
12.1 studying IT to get settled in an IT job					
12.2.An IT career rather than IT education.					
11.3 to study computer studies because it prepares me for self-employment.					
11.4neither IT education nor IT career.					

Thank you for taking your time to complete this questionnaire.

Appendix E: Declaration by Language Editor

ASOKA ENGLISH LANGUAGE EDITING
45 Vausedale Crescent, Escombe, 4093

CELL NO.: 0836507817

DECLARATION

THIS IS TO CERTIFY THAT THE FOLLOWING THESIS HAS BEEN ENGLISH LANGUAGE EDITED

Exploring factors influencing the choice of ICT education among matric students in selective rural high schools in Zululand research

Candidate: Mkabile PP

[redacted]

DISCLAIMER
Whilst the English language editor has used electronic track changes to facilitate corrections and has inserted comments and queries in a right-hand column, the responsibility for effecting changes in the final, submitted document, remains the responsibility of the client and the editor cannot be held responsible for the quality of English Language expression used in corrections or additions effected subsequent to the transmission of this certificate on 09//10/2020.

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