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The Impact of University Students' Perception of Mathematics on their Curriculum Choices: A Case Study of the University of KwaZulu Natal –Howard College Campus.

By

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DECLARATION

I hereby declare that this dissertation entitled 'The Impact of University Students' Perception of Mathematics on their Curriculum Choices: A Case Study of the University of KwaZulu Natal – Howard College Campus', except where otherwise indicated, is my original research, prepared under the supervision of Prof. Bheki, R. Mngomezulu. This dissertation has not been submitted in any other university for the award of any degree or diploma.

ABSTRACT

Mathematics is one of the most important subjects in ensuring the stability of the country's economy. There is a general perception that mathematics is a difficult subject, this perception has led to a decline in the number of students taking mathematics and pursuing careers related to it. The South African science industry is highly affected by poor performance in mathematics by learners and poor mathematics education delivered to students. The aim of this study is to present the key factors shaping the general perception of mathematics being difficult in South Africa, focusing particularly on the introduction of mathematical literacy learning subject. The key objective of this study is to assess how the students' perception has landed them to where they are today, in terms of studies. This is a survey research study; the researcher used interviews and distributed survey questionnaires to collect qualitative and quantitative data. The main population of this study was the students from the University of KwaZulu Natal. They were randomly selected from the College of Agriculture, Science and Engineering and College of Humanities. This study found that many students intended to or left mathematics for mathematical literacy. This study also found that teachers exert the most influential role on students' perception, attitude and performance in mathematics. Students' perception of mathematics has been explored showing that it is affected by various factors including the school capacity to deliver - that covers up for the teachers' competency and level of qualification- , the availability and unavailability of resources and education policies related to mathematics curriculum.

This study recommends that mathematics and science teachers should be screened thoroughly before their appointment. In addition to that, they should be trained continuously to improve the standard of their competency in teaching subjects of this nature.

Key words: Apartheid, Curriculum, Mathematics, Mathematical literacy, Perceptions, Performance, Self-efficacy, Students.

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ABBREVIATIONS/ACRONYMS

ANC	African National Congress
IEA	International Association for the Evaluation of Educational Achievement
PISA	Programme for International Student Assessment
RSA	Republic South Africa
SCCT	Social Cognitive Career Theory
TIMMS	Third International Mathematics and Science Study
UKZN	University of KwaZulu Natal

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CHAPTER ONE
INTRODUCTION AND BACKGROUND

"Perception is strong and sight weak. In strategy it is important to see distant things as if they were close and to take a distanced view of close things"

Author: Miyamoto Musashi

1.1 Introduction

Perception is influenced by attitude and attitude is influenced by thoughts while thoughts are influenced by the society. It is for this reason that one can conclude to say that socialisation is the birth giver to perception. Often perceptions are distanced from current reality. This is the reality which is meant to drive us through to our destined land of comfort, prosperity and to becoming effective citizens of a country. It is unfortunate that the decisions we make are mostly influenced by the way we perceive the basis of our supposed channels to prosperity. Education being that highly recognised basis faces numerical attitudes and perceptions to its acceptance as the alpha and omega to success. Drawing from this trajectory, the subjects which have been associated with intelligence, career variability and availability hence proper living standards, are science subjects and mathematics.

Mathematics is highly perceived by the society as a difficult subject and people who do mathematics are claimed to be intelligent (Van der Berg, 2007). Students' perceptions of mathematics are not the same; they vary depending on the context which shapes their attitude towards this subject. This means that different learners will have different experiences and different stories to tell about their encounter and relationship with mathematics (Osborne, n.d). Mathematics is a very rare subject in most schools in South Africa and there are also very few teachers who have the required skills to teach it thus leading to the feeling that mathematics is a difficult subject.

Teachers have been the focus of many studies that seek to understand the learning outcomes of learners in different subjects. According to Spaull (2013), the quality of teachers in a country is intimately related to the quality of its education system. This is also supported by Barber & Mourshed, (2007: 12, 41). The deficiencies in teachers who are well-trained in

mathematics and science in South Africa is a result of the apartheid legacy. The imbalances of inequality in education in South Africa have not been fully addressed to-date. The transition of opening mathematics curriculum for all learners (Post-apartheid) regardless of their race when these were limited to the white minority meant that the black child will receive an incompetent teacher. Therefore, the perception of mathematics being difficult can be well understood when one looks at the factors that shape students' 'perceptions of mathematics' and taking into account what affects their performance. Another factor that contributes to low performance in mathematics is the issue of the language of instruction (English) which is not a mother-tongue language for most of the pupils. According to the Zenex Foundation (2007) poor language skills among teachers and learners are amongst the discernible key factors that impact negatively on mathematics achievement in South Africa.

The department of basic education came up with a mathematics curriculum that aims at ensuring all learners who complete Grade 12 leave school with numerical skills applicable to social contexts. This is mathematical literacy; learners from Grade 10 have a choice to do mathematics or mathematical literacy. Mathematics being generally argued to be difficult has been neglected by most learners as mathematical literacy presents itself as a basic numerical skills subject which does not require strained efforts as mathematics.

According to Spaull (2013) it has been uncovered that within the period of four years (2008-2011), the number of pupils taking mathematics as opposed to mathematical literacy has fallen from 56 per cent to 45 per cent, as more of the learners see mathematical literacy as the easier option of the two. According to the Centre for Development Enterprise (2014), the trends in the number of candidates writing mathematics and mathematical literacy shows that in the year 2010, 263 034 learners wrote mathematics for the National Senior Certificate and in 2013 this number dropped to 104 033. Conversely, the numbers of students writing mathematical literacy shows an inclining trend of 280 241 in 2010 and 324 097 in 2013. This directly shows that the number of students enrolling for university courses in science, technology, medical and engineering fields is declining and consequently the country will continue to face the skills deficit in these areas.

Above that, the performance of those that enroll for mathematics is not so good. It is worth mentioning that the factors that underlie the low performance rate and declining numbers of students in mathematics are vast and differ in context. South Africa has been ranked one of the worst performing countries in mathematics. The Trends in International Mathematics and Science Study (TIMSS) revealed that South African learners are the lowest performers among all 21 middle-income countries that participated (The Center for Development and Enterprise, 2013); this is a serious concern.

According to the Centre for Development Enterprise (2014), the constraints affecting learner performance in mathematics are complex, intertwined and often structural. It is further stated that amongst others, these include: lack of facilities and resources at schools, large class sizes, inadequate teacher education, poor learner commitment and discipline and inadequate parental involvement. These constraints are a reflection of the country's history; they represent the apartheid regime which promoted inequality in education through the Bantu Education Act of 1953. When learners are exposed to these challenges, they translate into their perceptions and views on the subject. These tend to shape their subject choices and at a later stage their career choice. Furthermore, there is an indication of a decline in the enrolment of students into higher education courses in mathematics, science, technology and engineering noted in South Africa, where negative views of mathematics (and science) are often cited as contributory factors (Fry, 2006 cited by Mutodi and Ngirande, 2014).

This poses the question: Does the perception of mathematics being a difficult subject inform the number of students enrolled in the College of Humanities as compared to the College of Agriculture, Science and Engineering at the University of KwaZulu Natal (UKZN)? This research is interested to test the assumption that the researcher has which basically argues that students' perceptions (perceptions manipulated by various individuals and groups in the society) on mathematics has an influence on their curriculum choices at the University.

This study maintains that there is a variety of factors that contributes to students' perceptions of mathematics. As previously mentioned, it is also noted that these factors vary with each student. The interests of this study are set in position of the mathematical literacy policy. From a policy point of view, it is important for this study to explore the extent to

which mathematical literacy has influenced students' perceptions of mathematics hence career choices at the University. This will enable us to question the amount of attention given to the implementation of this subject and the resources directed to its implementation. However, recommendations on the way forward will be given for further studies on this field of study and the policy itself.

1.2 Problem Statement

South Africa is currently faced with skills inefficiencies, particularly in mathematics and science. These skills are the cornerstone for economic development as they drive technical innovation and production. Having less than average performance in mathematics in South Africa has a profound negative impact in the mathematics and science industry and in the development of the country as a whole (Mathematics Report, n.d). Such deficiencies in these subjects need to be addressed because they form the basis of the country's socio-economic development.

As posited in the background of the study, there is a variety of factors that inform inefficiencies in mathematics education. This study is driven towards exploring the extent to which students' perceptions of mathematics (which are also influenced by other societal factors) impact on school subject choices and consequently career choices. Studies conducted to understand students' perceptions of mathematics and the influential factors to those, have not related this to how it affects students' choices at the tertiary level. These studies had their sample chosen from preparatory schools, primary schools and high schools (Gebremichael, Goodchild and Nygaard n.d; Domino, 2009; Farooq & Shah, 2008 and Osborne n.d). This limited them to ascertain how students perceive mathematics when they were still at high school and how that perception has changed after having seen the demands of the real world. Another important aspect to take note of is the introduction of mathematical literacy as a subject in South Africa. This contradicts what the government says about the importance of mathematics. Could it be that the government has twisted students' minds on the importance of mathematics by offering mathematical literacy? This study assumes that the government has played a significant role in the decline of students doing mathematics through the introduction of mathematical literacy as a subject. This assumption too will have to be tested. This study assumes that a large number of students

who have the potential to excel in mathematics have been lost in the pool of mathematical literacy subject. This study has been designed to clarify the contributors to lack of proficiency in mathematics in South Africa, thereby providing a basis for understanding the rate of students who pursue social science related courses at the university. The argument is that, this situation is highly related to the high unemployment rate and slow economic development of the country.

1.3 Reasons for choosing the topic:

After being exposed to the literature from leisure reading I came across a variety of articles which presented the mathematical crisis in South Africa. One of the authors, Sunasse et al (2009) stated that South Africa's economy and technological innovation is looking bleak considering the number of students at the tertiary level who are doing mathematically related courses. This gave me questions and assumptions around the policy of mathematical literacy. Consequently, these assumptions have led me to do a systematic inquiry to get answers and to test the suppositions.

There is also a gap in research conducted in South Africa in relation to looking at other factors which influence students' perception of mathematics besides social persuaders like family, peers and parents. This study seeks to bring forward that among other things government policies play a pivotal role in shaping students' perceptions.

In as much as previous studies have found that the way in which students view mathematics determine their performance, there is a gap of not exploring extensively and comprehensively the impact of these perceptions in students' career choices. These are the motivations for this study which account for its significance to the body of knowledge.

1.4 Aim of the study

The aim of this study is to present the key factors shaping the general perception of mathematics being difficult in South Africa, focusing particularly on the introduction of mathematical literacy as a subject. This is done in order to contextualize the disparities in students that opt for social sciences and science/mathematically related course at tertiary level.

1.5 Key research questions

The key research questions to which this study hopes to find answers are the following:

- How has the society influenced the students' perception towards mathematics?
- Does the capacity of the school in terms of having proper resources and teachers have an impact in the way that they perform and the way their students perceive mathematics?
- Is the importance of mathematics emphasized in schools or does a person only get an eye-opened at varsity?
- To what extent does the government and the parents influence a students' choice of career?
- Are curriculum choices by students in the humanities influenced by the personal choices or the perceptions they had or have on mathematics?
- Which type of self-efficacy is displayed from the perception that students have on mathematics? Does it reflect low self-efficacy or high self-efficacy?

1.6 Key research objectives:

The research objectives which guided this study were the following:

- To ascertain the influence which the society has on the way university students perceive mathematics.
- To do an assessment of how the students' perception of mathematics has landed them to where they are today, in terms of studies.
- To establish other factors that influence students' curriculum choices.
- To recommend amendments in the mathematical literacy (as a subject) policy.

1.7 Chapter Outline

This dissertation has six chapters which are organized as follows:

Chapter one: **Introduction and Background**

This chapter has adopted the style of other research projects at this level which basically provide an overview of the topic, the background and problem statement. It further-more outlines the key research questions and the objectives set out by the researcher. This chapter sums up by presenting an outline of the entire dissertation in a chronological order which will be followed in the presentation of the following chapters.

Chapter two: **Literature review**

A literature review is one of the most important chapters as it gives the background and presents the point of entry for the writer in the identified research area. This is done by reviewing existing literature systematically, thoroughly and comprehensively to ensure a well-grounded study. In line with this conventional practice, Chapter Two of this dissertation will review existing literature on the theme of the study with the view of making a case for the present study.

Chapter three: **Theoretical framework**

This chapter will present the theory which guided this study. The theory on which the study is predicated is the Social Cognitive Career Theory. This theory will be discussed in relation to the study. The chapter will further-more explore the applicability of this theory to the study with the view to demonstrate its relevance.

Chapter four: **Research methodology**

This chapter will present the research methodology of this study. It will report on the different research methods used in this study and the approaches used to collect data and to analyse such collected data.

Chapter five: **Findings and Discussions**

This chapter will present the findings of the study as the study's contribution to knowledge. The discussions of the findings will be presented thematically; the statistical data collected will be presented together with qualitative findings thereby justifying qualitative findings. This will create a platform for possible answers to the devised research questions.

Chapter six: **Conclusion and Recommendations**

This chapter will give the summary of the dissertation with the emphasis on distinguished results. It will furthermore make recommendations for future studies and also provide necessary policy recommendations on the theme of this dissertation.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

A well-informed man is the most effective and useful man on Earth (Whitehead, 1967). Education can be defined as "a life-long process of learning, action and reflection involving all citizens" (Huckle & Sterling, 1996: XIII). Some authors hold the view that with education we are equipped to fit in the offices and sustain them, and to be active in the endearments of domestic and social life (Bancroft, 1806). From a general perspective the subject matter of education is constituted of bodies of information and of skills that have been explored in the past. The responsibility of the school is therefore to transfer these bodies of information and skills, to the new generation (Dewey, 2007). The main aim of education is then to prepare young people for future responsibilities, through enhancing their capabilities and capacities by means of acquisition of the organised fullness of information.

Van der Berg (2007), states that education enhances the employment opportunities for the poor that could escalate their earnings for improving their living conditions or standards. Thus it can be presented as one of the measures of combating poverty. However the types of subjects taken during the schooling phase have significant influence on the tertiary career choices. The choice of these subjects is however influenced by various factors in the society. Mathematics and science are the subjects that have received a high rate of being perceived difficult (Van der Berg, 2002). The literature that has been reviewed has been organised to cover all the suppositions presented in the first chapter. This is to ensure that there is a room for this study in the body of knowledge and that it can create an argument line that will enable other authors to consider some of the findings and areas of interest in their further studies.

A review of the existing literature on students' perceptions of mathematics, contributing factors to those perceptions and current status of mathematics worldwide and in South Africa has revealed encapsulating themes. This has created a bigger room for this study and what it aims to achieve. Premised on this literature review is to look at the introduction of mathematical literacy as a subject in South Africa. This drives the main policy question of

this paper as the study is interested to explore the extent to which this subject has influenced the decreasing rate of learners doing mathematics and how it has influenced students in choosing their career paths at the University level.

This literature review will trace the education system during the apartheid era. This is done in order to build a foundation for discussing the extent to which that system has impacted upon contemporary education, particularly on mathematics and science. It will furthermore look into research conducted with regards to the importance of parents, educators and language in education policy and school resources. The importance of the exploration of the aforementioned rests on its potentiality in shaping students' perceptions and attitudes towards mathematics. This literature review also discusses the international status of mathematics. This is done to give the reader an overview of what is happening in other countries, this could also be useful for further studies to explore some of the elements to help restore and build the mathematics culture in South Africa for a better future. Discussing the above mentioned is pointless if one does not understand the importance of mathematics in a state. This chapter will further draw on some evidence to highlight the importance of mathematics in a country's economy and sustainable living.

2.2 International, Continental and National Status of Mathematics

Third International Mathematics and Science Study (TIMMS) is an international test model for assessing the students' achievements in mathematics and science. It is directed by the International Association for the Evaluation of Educational (IEA). This test is done across countries to help improve the mathematics and science teaching and learning processes (Thomson, Hillman & Wernert, 2012).

The TIMMS results in 2011 revealed that Korea, Singapore, Hong Kong, Japan and Chinese Tapei were marked top performing countries in mathematics and science. Although the scores were not the same but the results were significantly ranging at the same level. The international mathematics tests such as Programme for International Student Assessment (PISA) and Third International Mathematics and Science Study (TIMMS) have led many states to question their curricula. Evidence shows that in the 2003 TIMMS South Africa scored the lowest performing country in both science and mathematics (UNDP, n.d). According to English and Kirshner (2008) countries like the United States have created a

division to decide on the mathematics curricula and how it should be administered to the learners. There have been arguments and debates around the issues of knowing less about the Programme for International Student Assessment (PISA) and thus, this has signalled a concern to look into the mathematics curricula of the United States and other international countries as well (English and Kirshner, 2008). The European participating countries – their 2007 TIMMS results showed a correlation between students' attitudes and their achievement in mathematics. The Education, Audiovisual and Culture Executive Agency (2011) presents that at fourth grade students who had positive attitudes achieved a 20 score point higher than those that had negative attitudes.

The Education and Training 2020 strategy for Europe puts forward the importance of providing adequate and quality education and strengthening mathematics. Developing and maintaining young people's interest in mathematics and science related subjects is essential for cultivating their career paths along those fields of study. Increasing and sustaining high-level skills in those fields is important for the economy and hence European countries aim for a high achieving proportion of students in Mathematics, Science and Technology studies.

Contemporary Nigeria places emphasis on Industrial and Technological development (Tella, 2007) and in attaining this, it advocates for adequate education in mathematics and science subjects, thereby improving the performance of students in these fields of study. It is presented that Nigeria need nothing lower than good performance in mathematics. However, it appears that the performance of learners in mathematics has not been good in the previous decade (Tella, 2007). A number of authors cited by Tella (2007) present different reasons attributed to this performance status in mathematics. They state that among other reasons students' lack of self-motivation, feeling inadequate, poor facilities and equipment for effective teaching and learning, shortages of qualified teachers and mathematics phobia play a huge role on their performance in mathematics (Callahan, 1971; Ohuche, 1978; Ale, 1989; Oshibodu, 1984; Akpan, 1987 and Georgewill, 1990). Tella (2007) presents that person's intelligence, self-motivation, high self-esteem play an important role in influencing one's achievement in mathematics. In relation to the above statement, Aremu (1998) states that the attitude that students have towards a subject affects

the way they react and listen to the teacher. This elevates to having an effect in their understanding of the subject which could result in them performing poorly.

Case (2006), states that there is a decline in the number of students who study towards engineering studies at the tertiary level in South Africa. Sunassee et al (2012) agree by stating that South Africa seems to have a bleak future in its technology innovation. This is because of the fact that the number of the students with mathematics, of course with quality of results is very negligible. He presents that "75% of all schools in South Africa are able to produce 13% of science passes at grade 12 level". What influences this is basically the capacity of the schools to deliver to learners for instance the needed resources. In the 2011 global assessment of the grade nine learners, South Africa was in the bottom six countries that performed badly falling below Botswana in maths and below Botswana and Honduras in science (TIMSS, 2011). World Economic Forum (2014) reported that South Africa is ranked the worst in the world and according to the 'skills' sub-category, South Africa comes in the last. Fricke et al (2008) hold that there is a low rate of the black learners doing maths and science which then justifies the limited number of students doing engineering at the tertiary level hence the shortages in the science field.

2.3 Education during apartheid in South Africa

It is important to understand and reflect on the history of education in South Africa when trying to address the apartheid legacy and footprints in the current status of the South African education. During the apartheid era access to quality education was determined by race which was a proxy for economic class. According to Fiske & Ladd (2004) the education system under the apartheid era was informed by the Nationalist theory which mainly advocated for the separation of the four ethnic groups; namely, Whites, Indians, Blacks and Coloreds. Hence separate education systems were established for each racial group. It was stated that people from different racial groups should live and develop independently. Accordingly three Acts were developed for administration of education in South Africa based on racial groups (Fiske & Ladd, 2004). It was The Colored Person's Education Act of 1963 which set up a separate department for colored students; the Indian Education Act of 1965 which also took the same step and the National Education Act of

1967 which regulated Bantu Education and placed the African schools under the control of the Department of Education and Training (Fiske & Ladd, 2004).

Prior to the introduction of Bantu Education there was "Native" education which was for the African/Black nation. This Native education was characterised by the niggardliness with which governments of the Union financed it. This system of education did not seek to inculcate a different set of values and outlook for both learners of the European origin and the Black learners and the curriculum was the same for everyone (Sihlali, n.d). But according to Dr Hendrik F. Verwoerd this was not suitable for the black child because it paved a passage for them to walk in greener pastures of the European society which they were not allowed to graze on. Therefore native education was abolished for black people (Sihlali, n.d).

Bantu Education Act was introduced in 1953 which meant that the schools were to be under absolute control of the government as previously there were Church and Missionary schools. It is argued that the Bantu Education Act has been one of the racist acts which extended apartheid to black schools (Michigan State University, n.d). This act ended the autonomy of the Missionary and Church schools as there were conditions which were laid by the state for the schools, for instance government funding was limited for the black schools as a result many black missionary schools closed (McConkey, n.d & Gilliomee, 2012). It is stated that the education disparities in funding among the whites and the black people adversely affected the quality of education received by black learners. The white government made it clear that education for black learners was to be driven along the lines of making the white society richer, for instance, teaching them to be hewers of wood and drawers of water (Michigan State University, n.d). The minister of Native Affairs Hendrik Verwoerd was quoted asking, "What is the use of teaching a Bantu child Mathematics when it cannot use it in practice" (Jansen, 1990:200). Giliomee (2012), states that the Bantu education policy deliberately discouraged the teaching of mathematics and science to black schools.

Christie and Collins (1986) argue that education in the apartheid era was designed to ensure that the white people take on managerial positions and be dominant in the economic, political and social arenas of South Africa. While black people were provided with education which allowed them to take on inferior positions in the economy that only

required them to be menial/semi-skilled. This was to serve the white people's supremacy. The Minister of Native Affairs, Dr. Verwoerd, explained the government's new education policy to the South African Parliament:

> There is no space for him [the "Native"] in the European Community above certain forms of labor. For this reason it is of no avail for him to receive training which has its aim in the absorption of the European Community, where he cannot be absorbed. Until now he has been subjected to a school system which drew him away from his community and misled him by showing him the greener pastures of European Society where he is not allowed to graze (Kallaway, 1984 : 185).

This points out that there was no point in educating a black child because either way they were not going to occupy higher offices or professions as they were not allowed to be with the Europeans (Gilliomee, 2012). According to Dr Hendrik Verwoerd, the government was rectifying a mistake of having allowed black learners to get education in missionary schools which provided irrelevant education to the black children's future labour services. Basically, education provided by the Bantu education system limited the black South African learners from reaching out to their abilities and aspirations. Black learners were denied access to the resources enjoyed by the white South Africans (Michigan State University, n.d). As a consequence, the quality of education received by African learners deteriorated and was of lower standard in comparison to their white counterpart.

It is argued that the quality of the education received by black learners was very poor such that even the learning environment was not conducive for teaching and learning to take place efficiently and effectively. A journalist, Allister Sparks cited by Fiske & Ladd, (2004) quoted a black learner saying that they were faced with a system which stifled their ambition.

> Our young boy will be going to a dilapidated building with filthy and inadequate toilet facilities, broken windows, too few desks, not enough books and a hundred or more to a class. The teachers, likely as not, will have no more than an elementary-school education… (Fiske & Ladd, 2004: 78).

Higher education was also impacted by the National Education Policy, colleges for black people did not offer quality of education, and as a result teachers produced from those

colleges were not well educated (Fiske & Ladd, 2004). In the mid-1990s it is said that a person was deemed qualified to be an educator in white schools if he or she had a senior certificate and three years of training. However, in the black schools, a person with only a senior certificate could teach without any training. This indicates the paucity of well-trained educators in black schools which was mainly a result of the strands laid by the Bantu Education system. This also weakened leadership in black schools (Fiske & Ladd, 2004).

2.4 The impact of apartheid on the contemporary education system of South Africa

The inequalities and challenges that persist in today's education system are highly influenced by the above discussed historical background of South Africa (Van der Berg, 2008). Although at present it is not about race but it is more about economic class, the legacy of apartheid still affects mainly the previously disadvantaged schools (Van der Berg, 2008). Studies have shown that students' quality of education is still dependent largely on their parents' income which in turn is mainly determined by the level of education of these parents. Children who had parents with tertiary qualifications are argued to receive quality education and thus have greater opportunities to be absorbed by the labour market (Van der Berg, 2007; Van der Berg, 2008). According to Van der Berg (2002), the needs of economy in terms of type rather than level of education should consider for instance, the importance of mathematics and science, because a person may have a degree in social sciences and another one have a degree in the science field, the one who stands higher chances of getting a job is the one with the science degree and most likely to earn higher income. According to Van der Berg (2007) and Sidoropoulos (2008), the legacy of apartheid in South Africa continues to dwell in education. Apartheid which was responsible of inequitable funding, resources and access to mathematics and science left its footprints which are observable in the low performance rates in these subjects.

Due to the imbalances caused by the apartheid era, mathematics and science subjects suffer especially in disadvantaged schools, since not much attention is paid to them (Van der Berg, 2007). The apartheid education system allowed only white people to benefit from the teaching of mathematics and science hence the black people were deprived of such subjects and as a result they were not proficient enough. This has rubbed off onto the post-apartheid

South African education (Van der Berg, 2007; Organisation for Economic co-operation and Development, n.d). What is evident is that the black schools are struggling to make it out to the science field and this is informed by the lack of resources which the government is failing to provide whereas the schools in the urban areas, previously known as model C schools have more capacity in increasing the performance standards in mathematics and science, hence they contribute vastly in the science field (Tachie & Chirese, 2013; Howie & Scherman, 2008). According to Zuze & Reddy (2014: 25) in South Africa "children attending the richest 20% of schools achieve results that are incomparable to the rest of the school population". This is also prevalent in Australia, it is presented by the study done by Thomson, Hillman & Wernert (2012) that students from affluent urban schools perform better than the students from disadvantaged rural schools. They further argue that in that regard, it is important to note the impact of economic makeup of school on students' performance.

Fiske & Ladd (2004) opine that there are low levels of numeracy literacy among the black learners. Black learners tend to receive limited or rather minimal training in mathematics and science and perform better in humanities and social sciences. It is further stated that the black students enrol in humanities and social science courses more than in the science courses in the Universities. Such patterns reflect both the poor mathematics and science education for black people under the apartheid system as well as the labour policies which directed black people to semi-skilled or non-skilled jobs (Fiske & Ladd, 2004).

The impact or effect of Bantu education system produced damage which will take decades if not generations to revamp. The factors which underlay the Bantu education policy being: reservation of jobs, inadequate or limited resources for black schools, lack of funds for black learners and denied acc in achieving certain skills which would have equipped the black people in dealing with the challenges of globalisation in the 21sts century (Wilson, 2001).

According to Howie (2002), 50% of the mathematics teachers are not qualified to teach mathematics. A study done in Gauteng presented that low performances in mathematics is related to lack of qualified teachers in schools for teaching mathematics (Mji & Makgato, 2006). Black colleges during the apartheid era were established under the quotation of Dr Verwoerd; which stated that there was no need for educating a black child in mathematics. This suggests that black people were deprived of mathematics and some of the key subjects.

This also explains why there is a great number of unqualified or less qualified teachers for mathematics and science in many rural, semi-rural and township schools (Fiske & Ladd, 2004).

According to Van der Berg (2002), the inequalities in education continue to shape the earnings distribution in South Africa. He further states that matriculation is not a standard certificate to get employment and that even if one has their matriculation certificate the quality of the marks and the choice of the subjects on it matters the most for one to get up the economic ladder with high employment chances. This involves going to the university and eventually securing a proper job. Van der Berg (2002) argues that few mainly black schools offer adequate and quality education of mathematics and science. The inequalities that persist in nowadays are highly influenced by the historical background of South Africa (Van der Berg, 2008).

2.5 Parental involvement in children's education

Literature on the factors which contribute to learners' low performance and the way they view mathematics has also focused on the learners' parents' views on mathematics (Mansour & Martin, 2009; Moorman & Litwack, 2007; Jeynes, 2011). Thomson, Hillman & Wernert (2012) report that past studies of the TIMSS present a strong correlation between students' achievement and parental involvement in children's education. Research done in Australia and North America suggests that children who have parents with positive attitudes towards education also hold positive attitudes towards education and they perform well (Mansour & Martin, 2009). However there is mounting research suggesting that the parents' attitudes and beliefs in education are impacted highly by the cultural background, socio-economic status and geographic regions (Lansford & Bornstein, 2011). In as much as parental involvement in children's education and school is encouraged to be enforced by the parents, it is important not to overlook some of the factors which may be a stumbling block to some of the parents from playing that role.

There is a correlation between the socio-economic status of the parents and their level of involvement in their children's education (Boethel, 2003; Thomson, Hillman & Wernert, 2012). It is argued that parents in families with lower socio-economic status are most likely not to have attained education, or maybe had fewer years of schooling and possibly had not

so good experiences in school (Berthelsen & Walker; 2008). The key findings of a research done by Rammala (2009) discloses that some of the homes of learners are not educationally supportive due to low standards of living which mainly includes factors like poverty, parent's low level of education, child-headed households and high unemployment rate.

A number of studies done conclude that many of the learners who come from well-educated and authoritative families tend to perform better in their studies (Dornbusch, Ritter, Leiderman, Roberts & Fraleigh, 1987; Lamborn, Mounts, Steinberg & Dornbusch, 1991). This is argued to be highly associated with the parents' involvement in school activities and engaging in their children's school work and more encouragement of success. The study showed that parental authoritativeness could also be found in line of helping with course selection, school attendance and monitoring student progress (Steinberg, Lamborn, Dornbusch & Darling, 1992). This study conveyed that, the more homes for learners are strict and well established, the more their parents will become involved in their children's education and this is said to assist learners to perform even well in their studies. Thomson, Hillman & Wernet (2012) also report that the TIMSS results found that parents who are educated tend to have high expectations of their children's performance or achievements at school. This pushes the children to study harder and achieve great results.

It is also important to recognise the role of cultural and ethnic backgrounds before judging the parents' level of involvement in their children's education. The language of instruction stands as another barrier that affects student performance in mathematics. According to Berthelsen & Walker (2008) language sometimes becomes a barrier to parents because in as much as they may want to be involved and influence their children's education, the languagee used by the teachers and the study materials may be hard for them to grasp or rather foreign to them. It is clear that there are numerous factors which hinder parents from getting involved in their children's education other than their lack of concern in playing their role. A study done in the United Arab Emirates suggests that students who perceived their parents' attitudes being positive towards mathematics tended to have significantly high performance rates (Areepattamannil, Khine, Melkonian, Welch, Nuaimi & Rashad, 2015).

The South African Schools Act of (1996) stipulates that there must be parents in school governance bodies more than the other external members (South African Constitution,

1996). This presents the crucial role of the parents in the decision making and governing of their children's education. However, according to Fiske & Ladd (2004), Cynthia Mafuya a principal of Lukhanyisweni Senior Primary school - a rural school in Eastern Cape of South Africa - said that the school struggled to get the parents involved in the school affairs; school is seen by parents as the place where children go to attain education and the teachers know everything. Theta Suthole, principal of the Nomlinganiselo Primary School in the Crossroads township of Cape Town, placed part of the blame on the sense of dependence imposed on Africans by the apartheid system as she was quoted saying "We need to educate parents to move beyond a culture of handouts and to start taking ownership. The majority of our parents never went to school, and none of the members of the governing body have done matric. But some parents are learning…" (Fiske & Ladd, 2004).

Singh & Mbokodi's (2004) state that there is a pivotal role of parents in ensuring that their children succeed in their education. However it has been argued that black parents seem to be laid back when it comes to managing their children's education. Vassalo (2001) explains that parent's involvement in their children's education is one of the factors which contribute to their level of performance. He further states that once the parents start taking an initiative to be part of their children's education it will lead them towards forming partnership with the educators and creating a better learning experience for their children. Singh & Mbokodi (2004) study mentioned above conducted in the historically disadvantaged area and school in South Africa, shows that children do not get enough support from the parents because when they come back from school they have to do house chores. Teachers complained that parents are not playing their role in ensuring that their children do their work and study after school hours. Whilst the parents presented that they do not understand some of the material taught at school because the curriculum has changed from what they used to study. Gathering from the study, it is clear that parental involvement in children's education is limited in the black communities.

2.6 The influence of teachers in learners' performances in mathematics

The importance of teachers' abilities in teaching mathematics is central to the students' perceptions and performance. The knowledge possessed by the educator in school is partly

the prerequisite of a teacher taking a mathematics class. One should note that teachers are responsible for the safety of their students in the classroom, for their moral, aesthetic and social growth as well as their intellectual development (Noddings, 2013). In addition, they prepare learners for the next grade ensuring long-lasting learning outcomes; by creating an environment that does not kill the joy of learning. Also creating new activities and improving on style of teaching suiting the learners in order to restore their desire to learn and be successful in their studies (Noddings, 2009). The aforementioned is highly embedded on the teachers' abilities and capacity to deliver to the learners. Shulman (1986) points out that content knowledge is one of the main significant and substantial characteristics of an effective teacher. Ponte & Chapman (2008) states it as a cornerstone of efficient and effective teaching as it influences the style of teaching and also the content of what is to be taught.

Conversely, Ponte & Chapman (2008) also argue that the fact that the teacher has knowledge of the subject does not guarantee that they will be experts or effective in delivering the information to the learners. Consequently, this might hinder the teacher to help the students to develop a relational and conceptual understanding of mathematics (Ponte & Chapman, 2008). Noddings (2013) argues that teachers have standards which entails that they have a particular expectation from students. With these standards they expect good work from certain students whom they believe in for performing well all the time. The capacity of the educators plays a very important role in the performance of the learners in the maths and science (Howie & Scherman, 2008). However studies indicate that some educators do not even have the required qualifications or adequate majors in their degrees that complement what they are teaching in class (Tachie & Shireshe, 2013).

Aremu (1998) cited by Tella (2007) argues that in as much as teachers influence learners' performance in mathematics, learners also have an influence on how teachers deliver the subject to them. Aremu (1998) presents that the negative energy expressed by the learners could lead to a teacher being demoralised in teaching because the learners also do not take cognisance of the importance of the subject and their performance per se. Aremu (1998) states that this could lead to him/her using the easy method to teach "chalk and talk" without dwelling much on the instructional material. A study by Domino (2009), on the 'teachers' influences on students' attitudes toward mathematics'; outlines that the learners'

attitudes, performance and perception towards mathematics is highly influenced by the teacher character, competency and their style of teaching. This is consistent with Meece, Wingfield & Eccles (1990) as they argue that teachers have a crucial role in shaping students attitudes towards mathematics and valuing mathematics in the classroom. The findings from Domino's study show that some learners dropped mathematics in their next grades because of the previous experiences with their educators, and subsequently they develop that negative attitude towards mathematics (Domino, 2009). Three themes were formulated in the study in the analysis of data. These were centred in the way students perceived the style of teaching by their educator and their commitment in helping them to perform well in mathematics, the time taken or dedicated by the teachers in ensuring that the learners understand the content in class and the personal attributes of the teachers towards teaching mathematics. Students reported that when teachers fail to make the lessons fun and meaningful it affected their performance and their general perception of mathematics (Domino, 2009).

In relation to this study, Anderson & Tate (2008) note that numerous studies done indicate that teachers' qualification and certification status are highly correlated to the students' achievement in mathematics. The significance of having qualified teachers was further emphasised. Fetler (1999) in California found that the students' achievement after controlling the poverty and other distracting issues, teachers' qualification, experience and preparation took a significant position in students' achievement. Studies conducted by (Sanders & Rivers, 1996; Wright, Horn & Sanders, 1997) indicate that the students assigned to a less effective teacher demonstrated low performances and it was not only prevalent in that period but this impacted on the following grade as well even if they were moved to an effective teacher.

According to Adler et al (2009) achievements in mathematics and science lay highly on teachers' competencies in teaching these subjects. They argue firmly that South Africa will not witness high performance rates in mathematics and science until teacher education is given intensive attention. There is also evidence that teacher education should not only focus on what they need to teach but also on how they need to deliver to the students and to enhance students' interests in the subject. There is a great need to realise that equipping teachers in mathematics and science is central to obtaining quality in teaching these subjects

(Adler et al, 2009). There is evidence presenting that teacher education programmes in South Africa is impacted by the post-apartheid reforms and restructuring of the curriculums and policy changes in the education sector (Adler et al, 2009) though this is done to remedy the situation where subjects like mathematics and science were only eligible to be taken by the white minority.

2.7 Introduction of Mathematical literacy as a subject in South Africa

Mathematical literacy finds itself having two definitions in the world. This can be attributed to the fact that South Africa is the only country that has introduced mathematical literacy as a subject in schools. According to Christiansen (2006), internationally mathematical literacy is described as the level of competency of an individual in mathematics. With this definition the level of competency is judged according to the aspects of using mathematics as a tool to apply mathematics in everyday activities. Further to that, it can also be judged according to the person's ability to apply mathematical models in the society (Christiansen, 2006). Here, an argument can be drawn to say that mathematical literacy internationally is defined as a competency, behaviour or a practice. Whilst in South Africa, mathematical literacy refers to a school subject, it is claimed that the subject's legitimacy can be seen through its deliverance of utility in the mathematical field. It is also claimed that the subject will/provide pupils with an understanding of the role played by mathematics in the modern world. According to the DoE (2003) cited by Bowie & Frith (2006) mathematical literacy is mainly driven by the applications of its models in life-related situations. It is further presented by Bowie & Frith (2006) that it enables learners to develop numerical skills which allows them to have the ability to interpret and critically analyse everyday situations and to solve problems.

Though it is also clearly indicated that mathematical literacy is not the same as basic mathematics. It is even claimed by other authors that it is not even close to basic mathematics (Johnston & Yasukwa, 2000) as it creates the ability for one to interpret, critique and use mathematics in a particular context. It is also presented by Christiansen (2006) that Mathematical Literacy is part of a larger program for improving social justice, democracy and the living standards of the people in South Africa. This is to be obtained

through the skills which will be possessed by the learners that will pass mathematical literacy and in turn apply those models and skills in the societal activities and tasks. According the DoE (2003: no pg),

> To be a participating citizen in a developing democracy, it is essential that the adolescent and adult have acquired a critical stance with regard to mathematical arguments presented in the media and other platforms. In the information age, the power of numbers and mathematical ways of thinking often shape policy. Unless citizens appreciate this, they will not be in a position to use their vote appropriately.

Mathematical Literacy alongside Mathematics makes a mathematically-orientated course compulsory for all learners (Perry, 2004). This aims to remedy a situation in which just over 40% of all the FET senior certificate candidates nationally took no mathematics courses at all in the FET phase when it was still optional to choose mathematics (DoE, 2003 and Perry, 2004). According to Christiansen (2007) and Bowie & Frith (2006) the Department of Education, through the introduction of mathematical literacy also aims at reducing the high number of learners who leave Grade 12 without having obtained the numerical skills and the group of learners who fail mathematics. According to the DoE (2003), it is asserted that those that fail mathematics should be catered for the mathematics that will suit their learning capacity and their intellect. Mathematical Literacy came into effect in the year 2006 to run across the Further Education and Training (FET) phase – grade 10 - grade 12, in 2008 it was phased for examination for the first time. It is further stated that mathematical literacy is meant to equip learners with the skills that they need to be able to deal with their everyday life problems (DoE, 2003; Sidoropoulos, 2008).

However, children who possess a mathematical literacy in the National Senior Certificate will only be eligible to proceed onto courses at higher education level that do not have a mathematical content (Venkatakrishnan & Graven, 2006). The significance of this subject can be traced in the problems faced by the innumerate, who are seriously disadvantaged in their employment possibilities (Bynner & Parsons, 1997). Innumeracy has also been presented as one of the hindrances in the economic and social growth which is why a mathematically oriented course was developed to ensure that the concerns of the economy and the social aspects are not compromised (Bynner & Parsons, 1997).

It has been presented that a learner cannot do physical sciences and life sciences when doing maths literacy at high school which then further limit their choice of studies at the university level (DoBE, 2003). This means that a learner can lose a lot more than only mathematics if they choose to do mathematical literacy. When a learner chooses to do mathematical literacy they are basically shutting down all the other science subjects. According to (Ventakakrishnan & Graven, 2006), the body representing the vice-chancellors in the universities and technikons in South Africa have devised that the introduction of mathematical literacy will have disastrous consequences such as that the learners who opt to do mathematics will decrease and this will impede the learners from doing science, health sciences and commerce degrees. Accordingly, this lowers the rate or the enrolment of the students doing the aforementioned degrees. This entails that if mathematical literacy is easy, mathematics will be viewed as being difficult, because the learners have a subject which is related to mathematics which they can compare with (Ventakakrishnan & Graven, 2006). Bowie & Frith (2006) argue that in as much as the purpose of the introduction of mathematical literacy is clearly defined in the curriculum statement; it is also important that one does not only look at the brighter side that has been highlighted but also consider the enormous potential challenges which come along the introduction of this subject.

A study done by Ventakakrishnan & Graven in 2007 revealed that some students do not like mathematical literacy because of the stigma that is associated with doing that subject. Learners stated that if one is doing mathematical literacy they are viewed as being slow, dumb and stupid. However, those who are doing it find it very easy and fun to understand and the study revealed that learners find mathematical literacy very easy to apply in everyday situation rather than mathematics. Whereas Van Schalwyk (2006) presents that the society view mathematics as a difficult subject and a person who does mathematics is respected for their intelligence. Students who do mathematics are viewed as being smart and gifted.

2.8 Language in Education Policy

Language in education has been presented as the underlying factor to high and low performances of the learners in school. Dampier states that education in mother-tongue language is more effective than education transferred in a foreign language (Mail &

Guardian, 2013). He argues that in lower primary, children are expected to learn in English which they barely understand and they are then taught mathematics, science and other subjects in English which they hardly even grasp. How then are they expected to pass and excel (Mail & Guardian, 2013)? It is also interesting to find that South Africa is not the only country that has challenges with the language of instruction in schools. A study done in Australia revealed that learners who have English as a home language did better than those that have English as a second language (Thomson, Hillman & Wernert, 2012).

The problem of English proficiency has a significant impact o the results of the other subjects, 54% of learners obtained 39% and below for English in grade twelve. A few learners understood or passed well English which means that a few learners could understand the other subject's concepts and literature (Mabogoane & Crouch: 2001). Most of the township schools face the issue of English proficiency. And with subjects like mathematics and, only English (and Afrikaans in affluent schools) can be used and other indigenous languages cannot be used because of the complexity of the scientific terms and concepts. So before a learner could understand algebra they need to understand English (Mabogoane &Crouch: 2001). This indicates that it is not only the resources that act as a barrier to good quality of education but also the language impacts on the success of teaching and learning.

Multilingualism in South African education has been a policy on paper since 1996 "language in Education policy", which clearly states that "being multilingual should be a defining characteristic of being a South African" (Mail & Guardian, 2012). There have been a number of provincial initiatives with regards to raising the status of African Languages running for some time. In the Eastern Cape, for instance a pilot project is testing the introduction of Xhosa as the language of learning and teaching at the intermediate phase in 74 schools (Daily Maverik, 2013). Language in Education policy aims at having education delivered in people's indigenous languages for proficient learning. The formation of this policy is embedded in the manifesto made by the ANC (Daily Maverik, 2013) and the new constitution which has Section 6 requiring that "all official languages must enjoy parity of esteem and must be treated equitably, and the South African Bill of Rights which provides for everyone to receive an education in the official language of their choice" (RSA Constitution, 1996). Children all over the world have the

same potential for mathematics when they enter school, but South Africa is not harnessing this latent capability because of shortcomings in its policy on language in education.

There has been no success in the implementation of this policy. It seems very feeble especially in provinces like Gauteng where there are people from various cultural backgrounds and with different mother-tongue languages (Mail & Guardian, 2012). It then becomes a problem to decide as to which language can be utilised as the language of instruction. Many learners are excluded from performing well because of their challenges with the language of instruction. Therefore language in education policy is failing the black learners (Mail & Guardian, 2012). Mr Essien, a lecturer at the University of Witwatersrand in the school of education was cited in the Mail & Guardian (2013), saying that a transition from teaching mathematics in English to teaching it in an indigenous language is a critical step. He stated that there should be appropriate training of teachers to manage the transition into different linguistic contexts. To him the strategy which could work is the use of English [as a second language] in the foundation phase and the use of a learner's home language as a second language in higher grades to develop mathematical concepts (Mail & Guardian, 2013).

2.9 The importance of mathematics in the economy and the society

According to Gowers (n.d), mathematics enables creative and logical reasoning about problems in the physical and social world and in the context of Mathematics itself. It is a distinctly human activity practiced by all cultures. An understanding of mathematical sciences is constructed through the establishment of descriptive, numerical and symbolic relationships (Gowers, n.d). Mathematics is based on observing patterns; with rigorous logical thinking, this leads to theories of abstract relations. Mathematical problem solving allows for an understanding of the world and to make use of that understanding in our daily lives (Gowers, n.d).

In an ever-changing society, it is essential that all learners passing through Further Education and Training band acquire a functioning knowledge of the Mathematics that empowers them to make sense of society (Mathematics Report, n.d). A suitable range of mathematical process skills and knowledge enables an appreciation of the discipline itself. It also ensures access to an extended study of the mathematical sciences and a variety of

career paths. Mathematical competence provides access to rewarding activity and contributes to personal, social, scientific and economic development (Mathematics Report, n.d). Individual and collective engagement with Mathematics will provide valuable opportunities for the development of a variety of values, as well as personal and interpersonal skills.Vast improvements in the public schooling of South Africa are vital for addressing the socio-economic issues and the development of the country as a whole (Bernstein, McCarthy and Oliphant, 2013). Not only is mathematics essential for everyday living (as taught in mathematical literacy) but it also contributes vastly in the economy and development of the country.

> Each day, we hear of the critical skills shortage in our country. The water sector is faced with a challenge of dwindling technical skills as many technicians and engineers are aging and will soon be retiring… We therefore need more of our children to study science and mathematics and go in these areas of work. (former minister of Water and Environmental Affairs, Edna Molelwa, 2012:)

If South Africa is to bring balance in the socio-economic status of the country, there has to be significant focus in mathematics and science subjects because this impacts on the economic growth and the development of the country (Krige, 2013). Krige (2013) further states that there is a relationship between the countries with high-debt rate and the low mathematics literacy standards. China for instance has a low debt rate and has highest score in mathematics literacy. Van der Berg (2002) agrees by saying that the development and economic growth of the country lies on the efficiencies in mathematics and science and technology studies; as they form the basis of the technical skills which are mainly the foundation of the country's development.

According to Collin (1971) there is a correlation between the educational level and the level of the economic development of the country, the higher the level of economic development the higher the proportion of quality of education in the primary, secondary and high schools. Tella (2007) asserts that mathematics plays a fundamental role in a country's economic development. Collin (1971) states that the demand for educational requirements entails that there is high demand of skills in the labor market due to the technological changes. In addition, the process of globalisation has meant that countries be technically

well informed otherwise they will have a lot to lose as they will always be importing the needed skills from other countries. This mainly means that the economy of the country and its development will depend on foreign skills. Due to the shortages of engineers and qualified professionals in science and technology industry, the government has signed an agreement with China to help the country closing this gap (Sunday Times, 2014).

2.10 Other Studies conducted

A study conducted in Australia in elementary schools for mathematics and science found that students' attitudes towards mathematics varied with their level of performance in this subject. Those that perform well in mathematics tend to like mathematics and they enjoy it whilst those that fail mathematics dislike the subject. This study also analysed the findings according to gender, it was found that males enjoyed mathematics and had greater achievements in mathematics than females. It was also indicated that the females had no aspirations of continuing with mathematics in Secondary schools and tertiary (Thomson, Hillman & Wernert, 2012). This study also indicated that students' goals and future plans are also impacted by the level of their performance in mathematics. It was found that those that wanted to go to the University after completing their secondary education had greater achievements in mathematics than those that anticipated on going for other post-secondary activities (Thomson, Hillman & Wernert, 2012).

Studies conducted in the Free State, Gauteng and Northern Cape have shown that overcrowded classes, English as medium of instruction, truancy and shortages of textbooks were the critical challenges impeding the quality of education and proficiency in mathematics and sciences (Masitsa 2004; Crouch and Mabogoane 2001). These studies highlight issues of lack of resources and mismanagement of the available resources in the schools which tend to affect the progress in schools. The shortages of school buildings and appropriately qualified educators are a few of the problems.

According to Farooq & Shah (2008), it is important that the student's confidence is enhanced in the mathematics education for increased enrolment and performance. Farooq & Shah (2008) further state that majority of the students enjoy mathematics but the minority that do not are basically the ones that usually dropout and they have a different view and consider the subject as difficult.

It is highlighted by Malloy (2008) that mathematics is usually a child's favourite subject in early stages and their dream career is usually associated with a degree having a prerequisite of mathematics. However, this changes as they enter the elementary school (Grade 5) and they tend to remove themselves or dislike mathematics at the secondary school (Malloy, 2008). Reasons attributed to that are inclusive of teacher/societal perceptions ability, poverty, financial issues, low expectations from teachers and influences of parents (Tate & Rousssea, 2000) cited by Malloy (2008).

A study by Cheung (1988), highlight that the findings showed that the learners' attitudes towards mathematics mainly rested on their level of performance. A learner who performed well in mathematics tends to like mathematics and their perception of mathematics differs from the one who fails it. An efficient school capacity to deliver proficient mathematics will lead to producing best results because the learners will have a positive attitude towards mathematics which highly influences the learners' performance.

The existing literature shows that there is a connection between students' perceptions on mathematics and the value that they place on the subject. A study done by Meece, Wingfield & Eccles (1990) found that students' ability to perform well in mathematics perceptions directly influenced students' appreciation and valuing of mathematics as well as having mathematics as the basis for their higher education studies. Both studies by Feather (1988) and Meece, Wingfield & Eccles (1990) found that the amount of value placed on a particular subject, produces the level of performance to attain reputable results from it. This could also be related to the concept of self-efficacy from social cognitive career theory which argues that a person's behavior is influenced by factors which include social persuasion, personal performance and accomplishments (Lent, Brown & Hackett, 1994). Thomson, Hillman & Wernert (2012) report that students' attraction to mathematics could increase if they place more value and realise the importance of mathematics for their future. It was further reported that 60% of Australian students placed a high value on mathematics this is also comparable with Ghana where it was also found that there is a high number of students (78%) who place high value on mathematics this is also consistent with their good performance in mathematics. However, in countries like Korea, Chinese Taipei and Japan; only 15% percent of the survey students presented that they value mathematics and perform greater than the other group of students (Thomson, Hillman & Wernert, 2012).

This study therefore assumes that the value which is put by students' in mathematics is influenced by the way in which the society has presented mathematics. The social world comprises of the peers, family, media and the government itself. It is also argued that lack of role models in field of mathematics and science has meant that students do not have enough reference to inform their positive perceptions towards mathematics (Roberts, 2002 & Rasekoala, 2001).

Many schools in South Africa especially in rural areas have shortages in resources like textbooks, library and laboratory (Mabogoane & Crouch, 2001). Two or even more learners have to share a book and this result in learners not having enough time with the book to them for learning outside the classroom (Masitsa, 2004). Also the problem of not having laboratory in the school premises is a huge problem and one of the causes to low performance rates in the science subjects by the learners. Learners cannot only learn theory in the science subjects they also need to be exposed to practical work so that they can better understand the phenomena (Sedibe, 2011).

Thomson, Hillman & Wernert (2012) aver that in as much as Australian education system does not have challenges on shortages of resources; there is a significant relationship between students' achievements and the availability of resources. Schools that were not affected by the shortages in mathematically related resources had average scores that were higher than those of the schools with shortages of resources (Thomson, Hillman & Wernert, 2012).

A number of researchers and psychologists have been trying to find a solution to manipulate the factors that make students uninterested in mathematics and science related subjects (Tella, 2007 and Tella, 2003). Psychologists believe that motivation could be the best remedy for students' lack of interest in learning mathematics both from the teachers and learners (Tella, 2007).

2.11 Students' Motivation for doing mathematics

Before getting into the details of this sub-heading, one should understand the meaning of motivation in the context of this study. Ryan and Deci (2000: 54) state that "motivation means to be moved to do something". Thus a person who feel no muse to do something can

be termed unmotivated. Present literature provides a breakdown of this concept – intrinsic and extrinsic motivation (Deci and Ryan, 1985). Intrinsic motivation entails doing something out of love and enjoyment and extrinsic motivation means doing something to impress others and to gain reward from the results of doing it. According to Ryan and Deci (2000) intrinsic motivation emerged as important phenomena for educators - a wellspring of learning and achieving great results. It is evident that students who enjoy mathematics tend to increase their intrinsic motivation and perform well in the subject (Nicolaidou & Philippou, 2003 cited by Education, Audiovisual and Culture Executive Agency, 2011). It is stated that if students are motivated to learn mathematics they spend most of their times solving mathematical problems. They also seek to pursue careers related to mathematics. This reflects how motivation of students impact on their achievements and dedication in mathematics. Reverting back to extrinsic motivation, according to Ryan and Deci (2000) "…extrinsic motivation has typically been characterized as a pale and impoverished (even if powerful) form of motivation that contrasts with intrinsic motivation." An example is given by Ryan and Deci (2000: 60)

> …a student who does his homework only because he fears parental sanctions for not doing it is extrinsically motivated because he is doing his homework in order to attain the separable outcome of avoiding sanctions. Similarly a student who does the work because she personally believes it is valuable for her chosen career rather than because she finds it interesting.

However, it appears that there a various types of extrinsic motivation some which "represent impoverished forms of motivation and some of which represent active, agentic states". Ryan and Deci (2000) presents that, teachers should be able to stimulate the extrinsic motivation if intrinsic motivation lacks. This could be a successful strategy for teaching and achieving good performance through motivation. Ryan and Deci (2000) state that, this is confronted with the supposition that usually learners are not interested in some of the subjects, some do not even enjoy the subject. So with this, teachers should take it upon them to motivate learners. According to Tella (2007), students' motivation in education plays a significant role in their academic performance. Hall (1989) emphasises that it is important to arouse and sustain students' interest in learning mathematics.

Tella (2007) suggests that teachers must develop and use methods which stimulate students' interests in learning mathematics. He recommends that there should be game activities designed to contain mathematics problems varying from easy to difficult this could stimulate learners' enthusiasm in learning mathematics (Tella, 2007). Teachers themselves may find it enjoyable to teach mathematics and thus instil positive attitudes to the learners.

2.12 Chapter Summary

The reviewed literature has revealed important information on the theme of this study. This gives an enlightenment of this study's point of entry. There is also a gap in research conducted in South Africa in relation to looking at other factors which influence students' perception of mathematics besides social persuaders like family, peers and parents. The reviewed literature presents it blurry that there is a correlation between the change of curriculum in mathematics through the introduction of mathematics and students' perceptions of the difficulty in mathematics. This sets out that among other factors government policies play a pivotal role in shaping students' perceptions. In as much as previous studies have found that the way in which students view mathematics determine their performance, there is a gap of not exploring extensively and comprehensively the impact of these perceptions in students' career choices. The existing literature also pointed out that there are also personal factors embedded in students' perceptions in mathematics. This was highlighted by stating that the level of confidence in performing well in mathematics affects students and tends to shape the way they view mathematics. This was also elaborated through the exploration of self-contentment on doing well in mathematics. However, this will be explored and discussed in detail in the next chapter as it presents the theory which underpins this study, quoting the alignment of the theory to the current study. In a nutshell, this study will use empirical data to expound on the causal factors behind students' lack of interest in mathematics.

CHAPTER THREE
THEORETICAL FRAMEWORK

3.1 Introduction

The previous chapter (Chapter two) presented the discussions on various topics relating to the current study through the review of existing literature on the theme of the study. This has provided an enhanced background and the necessity of this study. The previous chapter has made it clear that from a broader perspective, the students' perceptions on mathematics are highly reliant on various factors. Sources indicated that these perceptions could stem out from personal influences and societal influences. Having presented what other authors say on the matters around students' perceptions on mathematics, it is also important that a theoretical background for the study is also discussed in order to give this study strong grounding. This chapter will present Social Cognitive Career Theory, which is the theory that underpins this study with the aim of providing the reader with an enhanced understanding of what this study sought to achieve.

The chosen theory is the base of this study as it informs the choice of the research methodology and the questions to be asked. This theory will allow testing the suppositions presented by the study as well as assist to answer the identified research questions. This chapter will take off by discussing the history of Social Cognitive Career Theory as its roots can be found in the work of Bandura 1989. It will further more provide a synthesis of the concepts of this theory. The concepts to be discussed are Outcome Expectation, Personal Goals and Self-Efficacy. These concepts are the driving components of this theory which fabricates the meaning and an understanding of the theory and its critical application to the study. The discussion of these concepts will unpack the various components to consider when trying to comprehend the differences in people's career development. This study is not oblivious to the criticisms which might have been levelled by other authors against this theory. Consequently this study will present the criticisms that have been directed to this theory; this will lead to the discussion of the applicability and relevance of this theory to the current study. This is the most important section of this chapter as it provides a synopsis of

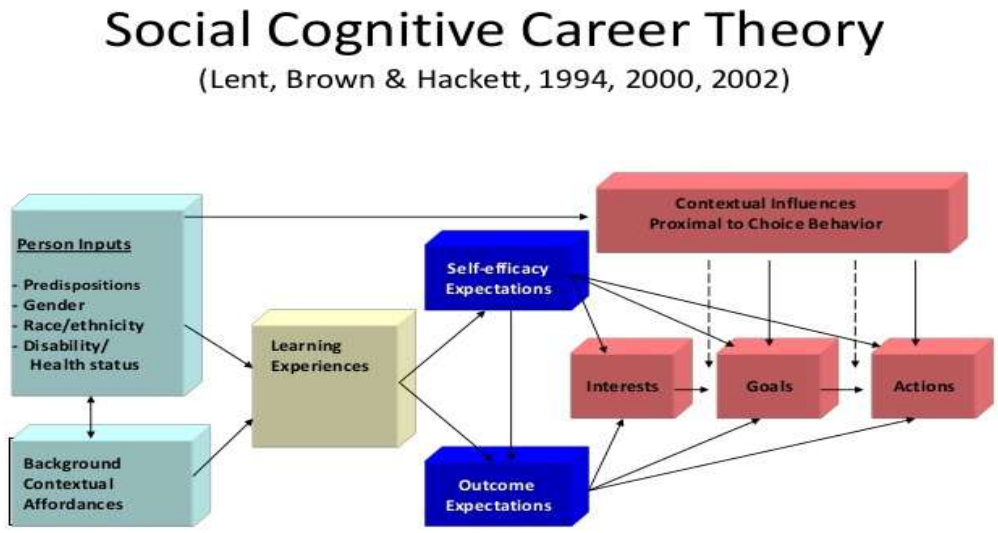
the following chapters, through the discussion of the theory in relation to the study. It connects the dots from Chapter one to Chapter seven.

3.2 Social Cognitive Career Theory

From a historical point of view, the development of the Social Cognitive Career theory is highly influenced by vocational psychology and other psychological and cognitive sciences (Brown and Associates, 2002). Brown and the Associates (2002) are of the view that career development which involves the type of career, choice, change and growth is susceptible to external and internal factors. This will be explored further in this chapter to outline in detail these factors.

Figure 1 below shows how the Social Cognitive Career Theory operates.

Figure 1: Social Cognitive Career Theory Model



Source: (Lent, Brown & Hackett, 1994, 2000, 2002)

3.3 Background of the Social Cognitive Career Theory

This theory was founded on the grounds of social cognitive model by Albeit Bandura (1986) which provides that; the environment in which a person is found, has a substantial influence on the person's behaviour (Bandura, 1989). There is a reciprocal causation which has modified the way in which socialisation can be observed, the recurring functioning is a result of an incessant interaction between contextual, cognitive and behavioural factors (Bandura, 1989 and Denler, Wolters & Benzon, 2014). According to Brown and Associates (2002) there has been a considerably healthy pace over the decades in career development theories and research in the field of career development. This has in turn led to a number of authors realising the commonalities in these theories (Borgen, 1991; Hackett, Lent, & Greenhaus, 1991; Osipow, 1990). It is from this realization that the authors (Lent & Savickas, 1994) argue that theory integration can be used to obtain a more coherent and organized theory for career development. Social Cognitive Career Theory stems from this idea, as it is a construct of a conceptual bridge which draws on a mass of variables which produce an explanatory system to cognitive career development. It is also an expansion of Bandura's work drawing in the career implications by the person's personal influences and environmental or social influences (Kelly, 2009). The social cognitive theory has been highly utilised by those who are interested in studying processes in social learning, classroom motivation and students' achievement (Parajes, 1996; Schunk & Zimmerman, 1994 cited by Denler, Wolters & Benzon, 2014). It has also been highly used by the researchers interested in understanding the influences of students' achievements in mathematics and science (e.g Hackett & Betz, 1989).

Social Cognitive Career Theory provides an overview of the processes through which people develop dislikes and interests which contribute vastly in the choices that they make regarding educational choices and career pursuits (Lent, Brown and Hackett, 2000). Bandura's social cognitive theory focuses on self-efficacy, outcome expectation and goals. This theory further shows how these variables interacts with other social factors like social supports, economic status, gender and barriers in shaping one's career development (Lent, Brown and Hackett, 2000).

3.4 Theoretical Constructs

The Social Cognitive Career theory is constructed by three concepts, namely, self-efficacy, outcome expectation and personal goals. The concept of outcome expectation- is explained as a set of beliefs in relation to the results or outcomes of performing a particular task. Personal goals are defined as key to an individual's behaviour as they form the basis of a person's performance and they inform the future plans. These two concepts are closely related to self-efficacy as they stem out of it. All the aforementioned concepts are said to predict the behaviour of a person in executing tasks. These constructs are interrelated and they all influence behaviour.

3.4.1 Personal Goals

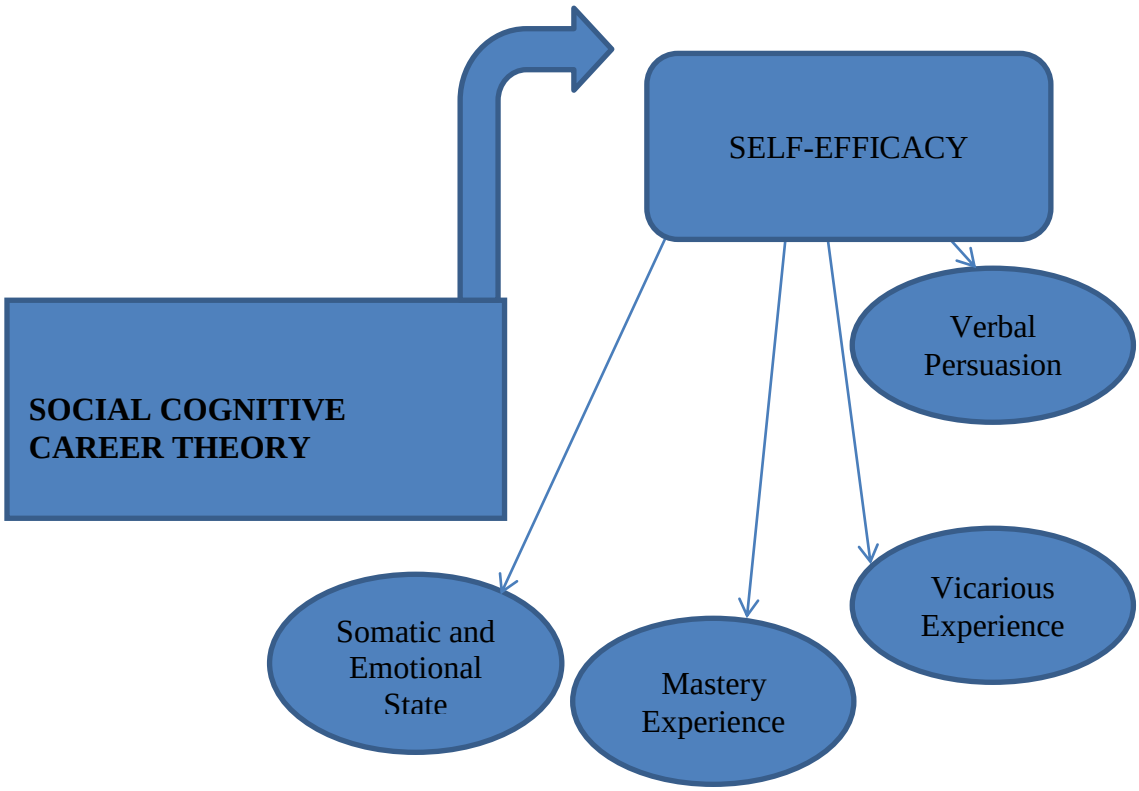
Goals set by an individual also play an important role in one's career choices. Whilst people may be driven by the possible outcomes of executing a particular task; what they want to achieve may also drive them to perform in that task. Bagozzi, Baumgartner & Yi (1989) speculate that goals are also predictors of one's behaviour. According to Segal, Borgia & Schoenfeld (2002) they [goals] help to direct an individual towards their desired career. According to Bandura (1986) goals become a person's determination of achieving a proposed outcome. Lent & Brown (1994) posit that one's goals and choices could be affected by the society's bad perception on those goals. This entails that if the person is disregarded with the goals they set for themselves they could end up losing interests in performing well towards attaining those goals. Therefore one can strongly argue that the society plays a vital role on what people perceive as important and set as goals.

3.4.2 Self-efficacy

This is one of the key constructs of the social cognitive career theory derived from Bandura's theory of social cognitive development. It has also been found to stand alone as a theory (Bandura, 1977).

Figure 2 below presents the factors that inform the level of a person's self-efficacy.

Figure 2: Factors influencing self-efficacy



Source: This figure has been modified from Bandura cited by Discroll (2004).

According to Brown, Malouff & Schutte (2005:15) "self-efficacy is the belief in one's own ability to successfully accomplish something and to execute certain tasks with a positive end-result". This gives a distinction of people who will attempt things that they know they will be successful in them and people that won't attempt things that they think they will fail. This moves one to a view of segregating self-efficacy into two parts, these being, low self-efficacy and high self-efficacy. Those that have high self-efficacy have a strong belief in obtaining good results on something and those that have low self-efficacy doubt their abilities in succeeding in that particular task. They also give up quickly if they do not accomplish good results after doing a particular task whilst the people with high self-efficacy are presented by Brown, Malouff & Schutte (2005) as efficacious people.

According to Bandura (1994) cited by Brown, Malouff & Schutte (2005) and Lent, Brown & Hackett (2000) these people are able to stand above tasks that are perceived as being

difficult and take them as challenges rather than as threats. However, self-efficacy cannot be efficiently described on its own, as it is influenced by various factors. It must be noted that self-efficacy varies with the context (Bandura 1977, 1986 cited by Kelly, 2009), this entails that these factors also vary with the environment in which the person is situated in. They are presented by Bandura (1994) as follows:

3.4.2.1 Verbal persuasion

Social persuasion always results in a person doing that particular task or not doing it, depending on the nature of persuasion. So if a person is told that they cannot achieve whatever they are aspiring to achieve they are most likely to not believe in themselves and they may even perform badly.

3.4.2.2 Vicarious experience

This factor is embedded in a person's observation of others' success and failures in the same field as one's self. Failure of the people that a person looks up to could have a negative effect on how they perceive their possible success in that task or activity. But if one watches a person of their same calibre accomplishing a particular task it increases their self-efficacy (Bandura, 1994). It is also theorised that if the person does not have previous experience with executing a similar task that they are meant to execute, seeing others fail takes charge of decreasing one's self-efficacy and enthusiasm of executing that task.

3.4.2.3 Somatic and emotional state

Physical and emotional state of a person also plays a vital role on a person's anticipation of their success or failure. According to Bandura (1994) stress, anxiety and fear affect the person's level of self-efficacy and could lead to a person being convinced that they cannot achieve something.

3.4.2.4 Mastery experience

Mastery experiences are experiences that are made of tasks that a person mastered at one stage. This promotes hope and belief in one's self of achieving great results even in the next related tasks (Bandura, 1994).

3.4.3 Outcome Expectation

Outcome expectation also forms part of the Social Cognitive Career theory. People's dedication and enthusiasm in good performance is always associated with the expectation of a good end result. According to Lent, Brown & Hackett (2000) these are personal beliefs about the consequences of undertaking a particular task (What will happen if I do this?). A person not well informed about the importance of mathematics might not consider doing it in high school because they are not expecting something fruitful out of doing it. But a person with a high self-efficacy in mathematics and well informed of the opportunities that come along with doing mathematics would perform even better in the subject and consider pursuing a mathematically or science related course at the university or college (Lent, Brown & Hackett, 2000). Another side that one could look into is of expectations after putting all your effort in studying and preparing for tests, exams and assignments (Fouad & Gillen, 2006). It is expected that if a person studies hard for something they will obtain good results. Students get demoralised if they study hard and still fail to perform well. This could therefore decrease their self-efficacy hence a decreased interest in doing that task (Mills, 2009). This entails that the consequences of doing something plays a vital role in ones choice of doing it and excelling in it.

3.5 Relevance of the Theory to the Current Study

The relevance of this theory can be found in the interests of this study of exploring bluntly the relationship between students' perceptions and their choice of curriculum at the University for their career. It is also a point of interest for the researcher to have hypotheses and suppositions that are most similar to those of the theory. This made it easy and possible for the researcher to outline a relationship between the study and the theory driving this study. This theory explains forcefully the social factors which influence students in choosing their career path. However, this study was interested in testing the possible impacts of the society on students' perceptions on mathematics and how that shapes their choice of career path at the University level. This theory provides that there are self-imposed and externally imposed influences to one's choices of career; which is also assumed by this study.

Due to the fact that this study does not only seek to ascertain the perceptions of students on mathematics solely, but goes to an extent of trying to understand the impact of these perceptions on students' career development; the social cognitive career theory made it possible to test the validity of the set-out hypothesis.

Furthermore, this theory helped this study to obtain data on whether the government is undermining the students' capacity in mathematics justifying a decreased number of students doing mathematics (Sunasse et al, 2009). This was done through the application of the self-efficacy concept which introduces social persuasion as one of the factors contributing to a person's behavior. As self-efficacy has been defined as a construct that is susceptible to verbal persuasion, this study also had an assumption that social persuasion family, peers, teachers impacts the students perceptions of mathematics. If students are likely to hear horrific stories on other people's experiences with mathematics they are more likely to perceive mathematics as a difficult and a monster subject. This further pulls them off from pursuing mathematics at high school which basically shuts the door of doing a mathematically or science related course at the university.

This study has a research question which aims at ascertaining information on whether students were/are aware of the importance of mathematics or they only found out about its importance when they got to university. This research question aimed at ascertaining whether the schools, family, media and the society at large deliver the message of the significance of mathematics or not. Lent, Brown & Hackett (2000) speak of outcome expectation which is also influenced highly by the society. Students who are influenced by the society or who hear and see the success of the people who studied mathematically related courses are more likely to strive for choosing mathematics and maximizing their interests in pursuing a mathematically related course.

Numerous studies have focused on familial factors which affect students' academic performance and career choices. Literature does not explore how the governmental policies may also contribute to the choices that are made by the students when choosing subjects and curriculum. This study used this theory to test amongst other suppositions, the influence of the introduction of mathematical literacy -as a subject in South Africa - on students' perceptions on mathematics hence their curriculum choices at the University. Therefore I

consider this theory as relevant to this study. The fact that there have been no criticisms to this theory thus far makes it to stand as an applicable and most appropriate theory for studying social connections to career development, considering its subsistence period of development.

The applicability of this theory has also been seen on research domain of mathematics, science and art (Smith & Fouad, 1999; Fouad, Smith & Zao, 2002) and in the engineering field (Robbins, Sawyer, & Hovland, 2004; Lent et. al., 2005; Lent, Singley, Sheu, Schmidt, &Schmidt, 2007). There has been no criticism on this theory, studies that have tested its hypotheses have obtained related results and it has made many researchers to understand career choices, interests and goals (e.g Mills, 2009; Kelly, 2009; Segal, Borgia & Schoenfeld, 2002; Gore and Leuwerke, 2000; Swanson & Gore, 2000; Cummings, 2008). Kelly (2009) posits that Social Cognitive Career Theory has a good deal in the body of research through its applicability and unseen limitations.

3.6 Chapter Summary

People are most likely to do things they are efficacious about and at times they would do things with the hope of achieving goods results as their counterparts. It was asserted in this chapter that people's interests in performing particular tasks could also be informed by their competence in undertaking them. This was made clear in the discussion of the mastery experience; arguing that people who have mastered a particular task usually have positive attitude in doing a closely related task on the previous one because they have an experience of mastering that field. However, some develop their interest where they see or anticipate good outcomes although they may have not previously excelled in that field. The outcomes of a particular task can be seen from other people's success stories displayed in the media, social network groups and/or informal community story telling. This was also related to the concept of self-efficacy, when it was stated that people's self-efficacy could also be informed by what people see from those that they look up to.

This chapter also presented a construct of personal goals which informs the way people behave and the choices they make educationally and or occupationally. These were also presented to be highly dependent on environmental factors (peers, family and other social

groups).This theory makes it very clear that people's decisions on career choices are largely centered on the social environment they interact with. The relevance of this theory has been presented in relation to the hypotheses of this study. This theory was predicated to help unpack and test the hypotheses made by the researcher at the beginning of the study. This was done successfully with the discussed Social Cognitive Career theory constructs. A strong relationship between the constructs has been outlined to be highly influenced by the internal (personal) and external (societal) factors. The idealism of this theory in career related studies has proven its appropriateness on this one. The next chapter presents the methodology used to collect and analyse data for this study. It presents the processes undertaken to answer the research questions and to address the aim of the study.

CHAPTER FOUR
RESEARCH METHODOLOGY

4.1 Introduction

The aim of this study was to assess students' perceptions of mathematics and how these have influenced their choice of curriculum at the tertiary level.

The hypothesis of this study was that learners' perceptions of mathematics is usually-informed by various elements such as social, economic and political factors. These factors have profound implications in shaping their attitude towards mathematics as a discipline. As such, it influences their decision in choosing a particular curriculum path at the university and their future career. This chapter presents the methodology used in undertaking this study. It will present the research design, sampling techniques and the limitation of the study.

4.2 Research Approach

The study uses a mixed-method design which combines both the qualitative and quantitative methods. According to Fitch (1994a:32) cited by Jablin & Linda (2001:162), qualitative research method "examines the quality…communication phenomena, data tends to be continuous rather than discrete, and the emphasis is on description and explanation more than on measurement and prediction"; whereas the quantitative method according to Newman & Benz (1998), is mainly used to test the hypothesis that the person already have, for confirmation or disconfirmation of that hypothesis. Hence even the most reliable approach for data collection for this method is a survey questionnaire. Here the hypothesis was tested whilst the qualitative research method questions allowed for open ended responses which provided comprehensive information to enrich the study.

The use of these two methods in one study enhances the weight and variability of information and when these two methods are combined in one study they complement one another and enhance the quality of the findings. Teddie & Ashakkori (2009:13) states that a mixed research methodology is defined as a "research which the investigator collects, analyses, integrate findings and draws inferences using both qualitative and quantitative

methods in a single study". According to Fitch (2001) during data analysis qualitative and quantitative methods can help by validating, interpreting, clarifying and illustrating quantitative findings. The qualitative method helps to explain in detail what the quantitative data has put forward whilst the qualitative data may come even with new unexpected findings and enhance the scope of the study. Hesse-Biberf (2010), states that with the mixed methods the researcher looks for a convergence of the data collected by all methods in a study to enhance the credibility of the research findings and it also allows for triangulation of information which fortifies and enriches the quality of the study.

4.3 Research paradigm and type of research

A research paradigm can be presented as the conceptual framework, guiding the type of tools to be used and the type of questions to be asked hence it is important that it is well related to the hypothesis. The research paradigm which this study employed is the interpretive theory paradigm. According to Thomas (2010), the interpretive theory paradigm presents that there is no single truth to a research phenomenon or to knowledge; there are a lot of aspects and individuals, perceptions, ideas and beliefs that need to be considered in addressing a particular issue or wanting to prove something. It bases its foundation on the subjective meaning of the individual about a particular phenomenon therefore there are no right or wrong theories in this paradigm. As such the researcher managed to make a meaning out of the data collected.

This research interpreted the data with the aim of finding answers to the research questions and testing the validity of the hypothesis presented. This study used content analysis to sort the qualitative data into patterns and themes. The Statistical Package for Social Sciences (SPSS) was used to sort and analyse data obtained through questionnaires.

This study initially explains the relationship between the variables of how the availability of the resources (teachers, books and equipment) in the high schools impacted on the performance of the learners and how this had influenced their perception of mathematics their current studies and the type of employment they might secure in the future. The relationship between parents and their children's education attainment and performance which directly leads to the type of course they enrol for, at the University level. To

ascertain this, data was collected using semi-structured interviews and survey questionnaires. Interviews were conducted in English, tape-recorded and transcribed before analysis.

4.4 Sampling

Sampling comes into place to allow for selection of the representative population so to make generalisations to the whole population about a particular phenomenon. Gliner and Morgan (2000:144) state that "sampling is the process of selecting part of the large group of participants with the intentions of generalising from the smaller group called the sample, to the population, the larger group". In as much as it would have been interesting to study the whole population, the study was constrained by time and resources.

The population of this study were university students. This study was based at the University of Kwa-Zulu Natal (Howard college campus). The students - whom were the participants-, were selected from the two colleges; College of Humanities and College of Agriculture, Engineering and Science. The sample size of the study can be numerically stated as sixty. This was to be divided evenly between the two colleges selected. Twenty-five surveys questionnaires were planned to be distributed to each college, which makes up fifty survey questionnaires and ten semi-structured interviews were also planned to be conducted evenly between the two colleges. Since the researcher was a tutor she had an advantage of distributing the surveys after the tutorial sessions. This was done for the students in the Humanities College, the researcher was aware of the ethical issues in using work position to obtain data, in addressing that, the researcher attached the consent form to be signed by the participants which clearly stated that students are not forced to participate, but it is voluntarily. The students from the other college were randomly selected after attending their lectures and at their LANs. The participants were asked if they are South African prior participation and reasons to that were explained by the researcher to avoid any negative misinterpretation of the study by the students. The sampling procedure used was probability sampling and the technique utilized was the random sampling technique, as it gave each element a chance of being selected and this eliminated biasness. The choice of these sample groups from both colleges enabled the researcher to compare and cross-analyse the responses from the colleges and see how they differ and relate to the available

literature with a supposition that students from College of Humanities are likely to have not enjoyed mathematics as the compared to the students from the College of Agriculture, Engineering and Science.

4.5 Theoretical validity

Theoretical validity of this study was measured by the application of the Social Cognitive Career Theory. The theory, together with the existing literature was used to analyse raw data. The nature of this study made the findings to be generalisable internally which is presented by Onwuegbuzie and Leech (2005) cited in Faulk et al (n.d) as generalisability of the studied sample group.

4.6 Ethical Issues

Although this study does not explore sensitive issues, principles of voluntary participation, informed consent, and confidentiality were observed. Participants were informed of their rights to withdraw at any time from participation to the study if they needed to do so.

4.7 Limitations

This study would have included the view of educators from selected high schools. Moreover, it would have been beneficial for this study to have a view from the learners who are still in high school and parents. However, this was not done due to financial and time constraints.

4.8 Chapter Summary

This chapter presented the research methodology employed in the study, which was stated as a mixed methodology. This was done by the researcher in order to complement each method's disadvantages thereby obtaining data that is viable and more useful in terms of explicating the key issue addressed in the study. This was obtained through the usage of survey interviews and survey questionnaires. The interpretation of findings enabled the researcher to ascertain the answers to this research, as the research questions were seeking interpretive approach. The population size of this study is numerically stated as sixty.

However, one of the distributed questionnaires has a college not marked, this made it hard for the writer to locate the questionnaire, and this was left out for analysis. Therefore from the College of Agriculture, Engineering and Science only 24 survey questionnaires were distributed. Ethics of research were observed and maintained when the study was conducted. The limitations of this study as highlighted above did not interfere with the objectives set for this study and its suppositions and hypothesis; nonetheless it would have been more interesting and beneficial for this study if it interviewed the persons presented as the key influencers to students' perceptions on mathematics. The next chapter will present the application of what the current chapter has outlined and what chapter two and three presented. It will present the findings obtained in the field from the interviews, survey questionnaires, the identified colleges and analyse it using chapter two and three and the researcher's insights and views on the matter.

CHAPTER FIVE
FINDINGS AND DISCUSSION

5.1 Introduction

The previous chapter introduced the methodology used to conduct this study. It also highlighted the limitation of this study and this brings us to the findings and analysis chapter. This chapter basically presents the findings obtained from the field. This is the chapter that brings forth the results of the hypothesis since the findings enable us to test the validity of the theoretical framework used and the suppositions of this study. The theory driving this study clearly states that career development involves the type of career, choice and change which depends mostly on the internal (personal) and external factors (society). This chapter will discuss these factors by drawing in the participants' views on the set out questions and the scrutiny of those views with the existing literature as well as the Social Cognitive Career Theory. A total of 56 per cent of the participants surveyed were from the College of Humanities while 44 per cent were from the College of Agriculture, Engineering and Science. The initial plan of the research with regard to the sample size was supposed to be equal but two participants in the survey questionnaire did not indicate the college. This explains the discrepancy in the number of participants. These findings also include those of the ten participants interviewed.

5.2 The influence of teachers in students' perceptions of mathematics

Many researchers have found that the role of teachers is very significant in the learners' choice of subjects, performance and attitude towards a particular subject. Domino (2009) found that learners' attitude, performance and perception towards mathematics is highly influenced by the teacher character, competency and their style of teaching. Some students dropped mathematics in their next grades because of the previous experiences with their educators which have caused them to develop a negative attitude towards Mathematics (Domino, 2009). This constitutes what Lent, Brown & Hackett (2000) stipulates in the Social Cognitive Career Theory when they say that people's likes and dislikes in relation to career choice or studies could be shaped by their previous experiences and some characters in the society. In the study conducted by Domino (2009) this is evident when he presents

that some learners drop mathematics due to their bad experiences with teachers which automatically make them not to perform well in mathematics. It is therefore important that the teachers are made aware that they play a crucial role in students' academic career and their future career choices are shaped by their subject selections at schools. The course choices made at the university are a reflection of what happened at the high school and the attitudes developed during a person's schooling career.

Teachers are responsible for safety of their students in the classroom, for their moral, aesthetic and social growth as well as their intellectual development (Noddings, 2013). Teachers should create new activities and improve on their style of teaching suiting the learners in order to restore the learners' desire to learn and be successful in their studies (Noddings, 2009). This study agrees with Noddings (2009) study because 70 per cent of the students surveyed have observed that their good performance in mathematics was highly influenced by their teachers while 30 per cent of students said otherwise. 63 per cent is a high percentage which one can rely on and take a stand to say that teachers do contribute to the learners' performance and can contribute to the positive of negative perception and attitude toward mathematics. One of the participants said this: "the teachers motivated us enough by telling us how our future will look if we take mathematics and the opportunities one can get. So by the teachers telling us that, it made more people to do maths than maths literacy". This illustrates how the teachers can influence and bring about change in the state of the decreasing number of learners doing mathematics and instill a positive perception and attitude to learners for mathematics. A study by Domino (2009) supports this by stating that learners' attitude, performance and perception towards mathematics is highly influenced by the teacher character, competency and their style of teaching. The role of teachers seems to be essential for learners' positive attitudes towards mathematics and also for an increased enrolment of learners doing mathematics. It is important that teachers ensure that the learners are made aware of the important subjects that will enrich them in the society and also the society as a whole.

5.2.1 The effects of teachers' expectations from students

This study found that teachers fail to treat the students equally and this is informed by the performance of the learners. Those that perform below average are neglected and treated as inferior from the others. This is consistent with Noddings (2013) who argues that teachers have standards which entails that they have a particular expectation from students. With these standards they expect good work from certain students whom they believe in for performing well all the time. As highlighted by one of the participants:

> Our teacher had favorites in class and those were the ones that passed her subject (mathematics) really well. She had like 11 students out of 30 whom she liked… I was very discouraged… if you did not meet her standards she would shout that you did not get anything, even if you improved from the previous test, so that how bad she was.

This affected their performance and interest in going to class or even studying mathematics. Nodding (2013) observes that teachers should create an environment which suits the learners' needs and which does not kill their enjoyment of the subject. Tella (2007) also suggests that teachers must develop and use methods which stimulate students' interests in learning mathematics. This will help alleviate cases where students feel unwelcome in mathematics classes and escalate their interests in doing exceptionally well in mathematics.

5.2.2 Lack of well trained teachers

This study found that some learners became part of the staff in their school through assisting their teachers with teaching mathematics because they were good. This is a result of lack of skill in mathematics. It was also highlighted by one of the participants that in her school they only had three mathematics teachers resulting in them having fewer periods for mathematics because these teachers had to teach five grades. A participant had observed that:

> what killed maths particularly in black people is that teachers were not trained well they were trained in bantu colleges which did not give them proper skills to teach black learners mathematics that is why we ended up having a problem of learners who could not grasp maths because teachers themselves did not understand maths.

This is in-line with what was presented by Fiske & Ladd (2004) that higher education was also impacted by the National Education Policy, colleges for black people did not offer quality education, and as a result teachers produced from those colleges were not well educated (Fiske & Ladd, 2004). It was suggested as a remedy that government should intervene by ensuring that every school has tutors which will work part time assisting the educators. One of the parrticipants highlighted that private schools have private tutors and their performance are way better than the government funded school.

5.3 Resources from the school

This study found that resources have a profound impact on the performance of students and influence their perception of mathematics. A relationship between the performance of the learners and the amount of resources they had at school was explored. It showed 12 students out of 17 students who indicated that they did poorly were from the under-resourced schools. This contrasted with students who indicated that they were from well-resourced schools where 30 out of 43 indicated that they performed very well in mathematics. According to Legotlo et al (2002), if a school has inadequate resources like textbooks it results in low morale and lack of commitment of learners, which are the factors contributing to their underachievement. This is supported by the responses in this study which show low performance of learners from under-resourced schools. This is also substantiated by the above findings of a high number of students who performed well because they were from well-resourced schools.

5.4 Parents' influence in students' perceptions of mathematics

This study found that a number of students understand the importance and the role that should be played by parents in their education, especially with regard to mathematics. It was also found that most of the well-educated parents influence their children choice of pure mathematics rather than mathematical literacy. One of the participants indicated that her father works for the department of education and did not see the value of mathematical literacy. To that end he encouraged her to opt for mathematics, this is the same participant who indicated that she did well in mathematics and knew the importance of mathematics although she was not accepted for a mathematically related course.

The above student's choice of mathematics as a subject was influenced by her parents mainly because they are educated and her father understands the value of mathematics than mathematical literacy. This is also supported by a number of studies which demonstrate that many of the learners who come from well-educated and authoritative families tend to perform better in their studies and are wise in their subject choices (Dornbusch, Ritter, Leiderman, Roberts & Fraleigh, 1987; Lamborn, Mounts, Steinberg & Dornbusch, 1991). Her statement is consistent with what Bandura (1994) presents under the concept of Outcome expectation. Bandura (1994) states that a person with a high self-efficacy and well aware of the opportunities that come along with mathematics is likely to perform well and pursue a mathematically related course.

Black parents who were previously disadvantaged have a minimal role which they can play in their children's education (Fiske & Ladd, 2004); in relation to this, one of the participants commented: "in grade 10 when I had to decide whether I will do maths or maths literacy, my family was not really supportive at that point because I had to make the decision on my own and I chose maths…". This shows how some students might have independently taken a decision to opt for mathematics. She further noted her bold decision and independence in choosing mathematics was motivated by her educator who highlighted the economic benefits associated with skills in mathematics which then goes back to what was stated previously, that the teachers also play a vital role in students' choices of subjects. .

This study has displayed how teachers influence students' choices. At least if the parents are not involved in learners' education because they don't have any clue of the subject, the education system should make sure that teachers play an effective role in influencing positively learners' attitude and perception of mathematics. When asked what parents should be doing to improve the number of learners opting for mathematics and improve its proficiency, one of the participants had this to say:

> parents can shape the education of their children, but in South Africa we have a problem because we are not yet in a position of seeing our parents playing an important role in our education particularly black parents… our parents have been deprived of proper education which makes them oblivious of the type of education and courses that are important; to them it is all about going to school and getting your degree to better the situation at home…

This is supported by a study done by Singh & Mbokodi (2004) conducted in the historically disadvantaged school which allows that, children do not get enough support from the parents. Some parents are uneducated and cannot even assist their children with home-works and other activities to be done at home. Teachers complained that the parents are not playing their role in ensuring that their children do their work and study after school hours. This stems from the education imbalances which occurred in the apartheid era.

5.5 Perceptions of students

5.5.1 Mathematics viewed as a subject done by learners with high intellect levels

This study found that learners view mathematics as a subject for selected people. Mathematics has been presented as a subject which cannot be done by everyone and that has even made the society to accept those who fail to do well because it is assumed that it is for certain people. According to Van Schalwyk (2006) the society perceives mathematics as a skill which is limited to certain people who are either gifted or have inherited it through genes. This has led to the acceptance of low performances in mathematics while overlooking or refusing to interrogate the causes of lack of proficiency in mathematics. This perception was reflected by a participant who argued that "it has been instilled in me that mathematics is a difficult subject, mathematics is hard". Another participant showed how he managed to challenge this mainstream perception and that he never wanted to change mathematics because it was also associated with status. "If you were doing mathematics you were regarded as a clever person and I wanted to maintain my record of being a clever person at high school". As such the way society perceives mathematics might impose a positive effect on the learners' choice of mathematics who might want to challenge it. People who like to be recognised in the society are keen to do mathematics because they want to prove themselves as smart people; while the society's view of mathematics as being hard may also drive the students away from choosing mathematics. This can be associated with extrinsic motivation, where the student strives to do well because they want to be recognised by the society.

With the surveys distributed, the findings show that only 19 per cent of the students from the College of Agriculture, Engineering and Science agree that mathematics is a difficult

subject contrary to 60 per cent in the College of Humanities. A study by Cheung (1988) is consistent with this as it highlights that the findings showed that the learners' attitudes towards mathematics mainly rested on their level of performance. A learner who performed well in mathematics tends to like mathematics and their perception of mathematics differs from the one who fails it. 65 per cent of the surveyed sample indicated that their negative attitude affected their performance in mathematics hence the studies they are pursuing now. 95% of the participants from the Humanities College highlighted that the choice of courses they are doing now at the university were influenced by their attitude towards mathematics and the low grades they obtained at high school for mathematics. One of the participants said this:

> I did not care about mathematics because failing just made me lose interest in studying for it, I only realised that I had wasted time when the University of Pretoria did not accept my application for biotechnology course which had a requirement of 50 per cent in mathematics and I only had 23 per cent. I then had to settle for Geography and Management studies.

This entails that some students do what they are doing in Humanities not because they love to, but as a result of not meeting the minimum requirements of the agriculture, engineering and science courses. Farooq & Shah (2008) advocate that in such cases it is important that student's confidence is enhanced in the mathematics education for increased enrolment and performance in mathematics and related courses.

5.6 A relationship between perception and performance in mathematics

There is a relationship between how the students perceive mathematics and their enjoyment of the subject. The surveys shows 70 per cent of the participants who said they enjoyed mathematics also reported that mathematics is not difficult, while 100 per cent of the participants who indicated that they did not enjoy mathematics reported that mathematics is difficult. This relationship was also explored in the study by Cheung (1988) when the findings revealed that learners who enjoyed mathematics and performed well in mathematics tends to like mathematics and their perception of mathematics differs from the one who fails it. This is coherent with self-efficacy concept, as it outlines that people with

high self-efficacy like what they do and they succeed in it and even if they do not succeed they take it as a challenge to push harder; whilst those with the low self-efficacy will dislike what they are unable to achieve which leads to them not making it a priority or performing well in it.

It was also interesting to find that some students perceived mathematics as a subject that could be passed by anyone provided they put their all in it. One of the participants stated that:

> I loved mathematics at high school, I would practice it all the time and even go for extra classes but I never performed well in it. I really think that with maths, it is either you have it or you don't. I would practice it to a point where I am convinced that I will get a good symbol but I always got disappointed when the results came back.

Bandura (1994) presents the concept of outcome expectation as one of the components shaping one's choices and likes in career development. One can therefore conclude to say that outcome expectation plays a significant role in ones aspirations and efforts in achieving those. However, it was highlighted that if one has an expectation of doing well in a task but fail to do so they become demoralized and it decreases their self-efficacy level this could even result to a somatic and emotional state where a person believe that there is something they cannot do in life.

5.7 Students' perceptions on the importance of mathematics

This study found that 96% of the surveyed students from the College of Agriculture, engineering and Science agreed that mathematics is an important factor for the country's economic prosperity, whereas 77% of students from the College of Humanities agreed. This is a good indicator of how students of the sample surveyed perceive the role of mathematics and its importance to the country's economic prosperity. As indicated by Van der Berg (2002), the development and economic growth of the country lays on the efficiencies in mathematics and science and technology studies; as they form the basis of the technical skills which are mainly the foundation of the country's development.

5.8 The influence of language in students' perceptions of mathematics and underachievement

Language has been argued to be a barrier to learning of an African child. The language of instruction which is used in South Africa is English yet the majority of the citizens are Africans and their home languages are South African indigenous languages. All subjects are taught in English at school; a black learner is introduced to English in grade one and is expected to master all the other subjects taught in English, which has just been introduced to them. To make things worse there are no special courses or extra hours or days catered for the learners whom English is not their mother-tongue. One of the participants highlighted that:

> Mathematics is not alpha and omega. If people are able to understand what is being done and how it is being done through well articulation of their language, we can witness effective teaching and learning which will improve the proficiency of the other subjects, so the proficiency of mathematics in the black child is partly embedded in their level of understating the language of instruction.

Dampier a lecturer in the department of childhood education at the University of Johannesburg - cited in the Mail & Guardian newspaper (2013) supports this as he argues that Children all over the world have the same potential for mathematics when they enter school, but South Africa is not harnessing this latent capability because of shortcomings in its policy on language in –education. The use of English as a language of instruction in schools is only beneficial to the minority. It is important that language skill is prioritised before any other subject, to ensure proficient and effective teaching and learning.

This participant recognises that languages are the roots of education for information to be passed and received; both persons must have an understanding of the language spoken. This is aligned with the quote from the late world icon Nelson Mandela: "If you talk to a man in a language he understands, it goes to his head, if you talk to him in his language, it goes to his heart". Although South Africa has taken an initiative to embrace all the languages in education through the Language in Education policy, its success is still to be evaluated through pilot projects (DoE, 2014).

5.9 Students' perception of the policies related to mathematics

None of the interviewed students showed a favourable attitude towards mathematical literacy. They argue that it is the government who has made mathematics to be feared this much by imposing policies which are in contradiction with what they say they want. Learners have been urged to do mathematics because of its high demand and decreased supply. Yet they impose mathematical literacy which is alongside mathematics. A number of students would leave mathematics in grade ten and opt for mathematical literacy because it is said to be easier. One of the participants when asked if she ever felt like changing from mathematics to mathematical literacy had to say this:

> Mathematical literacy was for the people doing subjects like, history, tourism and I was doing physical science and life sciences but I used to envy them because they would say that they are walking in a park (meaning that maths literacy is that easy), they would get distinctions and laugh at us who were failing mathematics, asking why we were still doing mathematics.

Mathematics is the only subject which has an easier option, you find mathematics and mathematical literacy. This on its own gives students an idea that mathematics is hard not everyone passes it; they get into grade ten with the mentality of seeing mathematics as the hardest subject. The government also plays a huge role in influencing students' perception of mathematics through the policies which are put in place as discussed above. One of the participants indicated that at one point she wanted to do mathematical literacy because it was presented as the easier version of mathematics. She believed that she could do much better in mathematical literacy than how she was performing in mathematics. She had also indicated that her sister did mathematics and was not performing well in it and opted for mathematical literacy which she did well in. This brings into place the point of self-efficacy as presented by Bandura (1994); he presents this concept as a person's belief in achieving something. In this view one also finds the point of vicarious experience, where failure or success of a person whose closer to other individual becomes their mirror of success. The failure of this participant's sister took charge of her decreased interest in continuing with mathematics and also seeing her sister do well in mathematical literacy made her to long for changing to mathematical literacy nonetheless the participant indicated that she did not change to mathematical literacy.

Therefore, in relation to the social cognitive theory, it is relevant for Bandura (1994) to state that the environment in which a person grows in, has a substantial effect on the choices they make and how they view things in the society.

5.10 The relationship between students' current courses at university and their perceptions of mathematics

There is limited research exploring the relationship of students' perceptions of mathematics and the degrees that they are pursuing currently. This study found interesting information which leads to the connection of mathematics perceptions and students' current studies. Two of the participants in this study indicated that the courses that they are pursuing were not their dream career paths. Their choice of mathematical literacy is a result of the courses they are pursuing now in the school of social sciences. They indicated that the reason why they chose mathematical literacy is mainly because mathematics failure was high at their school due to lack of skilled educators. Consequently, they chose mathematical literacy as from grade 10 because they thought they will not be able to perform well. This is the reflection of low self-efficacy where a person will not attempt undertaking a task because they feel that they will fail (Brown, Malouff & Schutte, 2005). At this point, participants' self-efficacy is influenced by vicarious experience and lack of mastery experience. The school itself is not a motivating environment and these participants' observation of high failure in mathematics distanced them from choosing mathematics. Which they indicated that they wish they had done it in high school because now they are exposed to the great opportunities associated with mathematics. The reviewed literature presented that there is a demanding need for teachers to enhance their motivating techniques to ensure that the students are kept interested in the subject. Ryan and Deci (2000) and Hall (1989) argued that since there is limited intrinsic motivation, teachers and parents should focus on promoting extrinsic motivation which is mainly effected by foreseen rewards or incentives. He argued that this could be the best way to win the students enthusiasm in longing to learn the subject and perform better thus impacting on the future students' decisions to take the subject.

5.11 Level of self-efficacy displayed by the participants

The findings reveal a significant high number of students who have low self-efficacy in mathematics from the College of Humanities. While the College of Agriculture, Engineering and Science shows a high level of self-efficacy. However, one of the participants from the College of Agriculture, Engineering and Science indicated that at one point he did not believe in himself for doing well in mathematics to a point where wanted to choose mathematical literacy in grade 10 for Further Education and Training phase. But he is grateful to his educator who saw a skill and believed in him and did not accept his choice of doing mathematical literacy. He was forced into a mathematics class where he excelled more than everyone. This is evidence that teachers play a vital role in helping students to make sound selection of subjects. This also exposes the great need and the success of motivation from teachers to students. Where there is low self-efficacy teachers need to intervene and motivate students this could result in increased numbers of students taking mathematics and this could also have a positive impact on students' level of self-efficacy.

5.12 Chapter summary

This chapter as one of the most important chapters has discussed critically the findings obtained by the researcher. This chapter has been able to answer the research questions presented in chapter one. A few of the significant findings were that some students are aware of the importance of mathematics from high school because of the environment created by the school to encourage learners to choose mathematics. It is also evident that students' self-efficacy in mathematics is determined by a variety of sources and these vary with the environment they come from. This chapter has made it clear that there are a number of factors contributing to one's career development. There is a clear indication that most of these influential factors are external, which entails that the society has a bigger role in shaping an individual's career. These factors include teachers, parents, peers and the school environment itself. The internal factors are usually triggered by the external factors. The following chapter will conclude the study and provide policy recommendations to address the issues pertaining to a decreased number of students doing mathematics while the demand increases and advice on what could be done to improve the learning systems and the society's input on learners' subject choices.

CHAPTER SIX
CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The foundation has been laid for concluding that there are various factors which contribute to learners' perception of mathematics and education as a whole. It is vital that appropriate and effective education policies and strategies are implemented to ensure that learners have the required support system to choose mathematics in schools as part of their chosen stream. This will enable the transformation of the negative perceptions of mathematics to positive ones, for learners to perform better in mathematics and pursue their studies in the courses which have low enrolments like science, medicine and economics. This study also showed that in trying to enforce parents' involvement in learners' education it is important to acknowledge the history of education in South Africa and its legacy on previously disadvantaged people. Greater change in parents' positive influence and involvement can be expected in the next generations to come based on the assumption that they would have received good education and have a better understanding of the importance and value of mathematics.

Learners' perception of mathematics has been explored showing that it is affected by various factors including the school capacity to deliver, that covers up for the teachers' competency and level of qualification, the availability and unavailability of resources and government policies related to mathematics. Teachers have a vital role in influencing learners' performance and the way in which they view mathematics. The capacity of the educators to deliver is embedded on their professional and personal attributes. The government has a role to play to ensure that the educators display the necessary competencies in their profession. A decreased number of learners who fail mathematics will encourage more learners to do mathematics. As this study has highlighted that low performances result in negative perceptions in mathematics by the learners, it is worth noting that this also affects the learners who are still to do mathematics because they look up to those who are ahead of them. Solutions to this trend of underachievement and deteriorating interests in mathematics should be devised to address the factors that

impede a positive perception and attitude of mathematics. It is amazing that in the twenty years of democracy the country is still far from reaching its goals of quality and equality in South African education. It as though the attainment of proper education now is mainly in connection with the economic status rather than race. If a black parent is able to afford the fees of private schools where resources are abundant, the black child will get the best education. Findings of this study are consistent with the existing literature.

It appears that there is no single factor determining the students' perceptions about mathematics. The society at large plays a significant role, as it shapes the views of students on mathematics. Motivation has been explored as a phenomenon which needs a considerable attention if the country is serious about making a change in mathematics education. There is a need for teachers and other role players in children's education development to motivate students. This could be in a form of incentives or awards as this gives the students an interest in performing well in the activities that they undertake. The suppositions that this study had were tested and were proven to be accurate as per the findings of the study. The use of the Social Cognitive Career Theory of Lent, Brown and Hackett as a theoretical framework driving this study, enabled this study to answer the research questions presented in chapter one. The achievement of this can be traced from chapter six where the theory was tested and validated with the data collected from the identified sample. The study makes the following recommendations for the improvement of learners' perceptions and attitudes toward mathematics.

6.2 Recommendations

- It was revealed that a number of students who do well in mathematics opt for science related courses at the university rather than taking a career path in social science which include teaching degrees; hence there is a lack of well qualified or competent teachers to teach mathematics. For these reasons, this study recommends that the government particularly the department of education – should consider increasing the remuneration of the teachers specializing in mathematics and science. This will encourage a number of those that do well in mathematics and science to pursue a career in education since a number of students who do well in mathematics would rather pursue in a mathematically related course because of the high level of remuneration.
- Although there are NGOs assisting in mathematics and science education, they seem to be more based in urban areas and townships. The government alone cannot deliver all the services. There should be assistance from the private sector because they are also affected by the inefficiencies in mathematics and science. A call needs to be made to the NGOs and other private organizations to stretch their hands even in the rural schools because it is there that the crisis is acute.
- It is important that the screening of mathematics and science educators is done thoroughly to ensure that the learners are in good hands with regard to their education and continuous refresher training courses are essential. It should not end with the degree that the teacher has but the government needs to ensure that the educators are well trained and well capacitated to deliver the content of the subjects. This will ensure an effective teaching and learning environment that will be beneficial for all learners and the society as a whole.
- The South African government should also consider creating projects where those who are interested and qualify to study towards a mathematics teaching career are taken to countries like China where there is high proficiency in mathematics to be trained and capacitated with the competencies to teach mathematics. They will bring those skills to South Africa and impact on mathematics education.
- Lastly, it is recommended that more and larger studies of this nature should be conducted in order to establish the applicability of the findings of the present study

to a wider context. This would assist in finding solutions to the negative perception held by different stakeholders about mathematics as a subject.

APPENDICES

A. Letter of informed consent and a declaration.

Informed Consent Document

Dear Participant,

My name is **Noxolo Madela**. I am a **Masters** candidate studying at the **University of KwaZulu-Natal, Howard College Campus**. The title of my research is: '**The impact of university students' perception of mathematics on their curriculum choices: A case study of the University of KwaZulu-Natal – Howard College Campus'**. The aim of the study is to understand the role played by the society and the government (through introduction of mathematical literacy as a subject) in shaping students' perception in mathematics which further impact on their curriculum choices at the University of Kwa-Zulu Natal. I am interested in interviewing you so as to share your experiences and observations on the subject matter.

Please note that:

- The information that you provide will be used for scholarly research only.
- Your participation is entirely voluntary. You have a choice to participate, not to participate or stop participating in the research. You will not be penalized for taking such an action.
- Your views in this interview will be presented anonymously. Neither your name nor identity will be disclosed in any form in the study.
- The interview will take about (*20 minutes*).
- The record as well as other items associated with the interview will be held in a password-protected file accessible only to myself and my supervisors. After a period of 5 years, in line with the rules of the university, it will be disposed by shredding and burning.
- If you agree to participate please sign the declaration attached to this statement (a separate sheet will be provided for signatures)

I can be contacted at: School of Social Sciences, University of KwaZulu-Natal, Pietermaritzburg Campus, Scottsville, Pietermaritzburg. / Howard College Campus, Durban. Email: 211506951@stu.ukzn.ac.za; Cell: 0725250295
My supervisor is Dr Bheki Mngomezulu who is located at the School of Social Sciences, Pietermaritzburg Campus / Howard College Campus, Durban of the University of KwaZulu-Natal. Contact details; email: mngomezulu@ukzn.ac.za Phone number: 0723511947

The Humanities and Social Sciences Research Ethics Committee contact details are as follows: Ms Phumelele Ximba, University of KwaZulu-Natal, Research Office, Email: ximbap@ukzn.ac.za,Phone number +27312603587.

Thank you for your contribution to this research.

DECLARATION

I…… *(full names of participant*) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire. I understand the intention of the research. I hereby agree to participate.

I consent / do not consent to have this interview recorded (if applicable)

SIGNATURE OF PARTICIPANT DATE

……

B. INTERVIEW QUESTIONS

Interview schedule

1. How do you generally feel about mathematics?
2. Do you think maths is important in life, in terms of employment security and advancement of the country? Explain.
3. What performance expectations have you always had when writing mathematics exams and assignments?
4. How was your relationship with your mathematics teacher at school?
5. How do you generally feel about mathematical literacy as a subject?
6. Was there a point where you decided to change to mathematical literacy subject or even thought about changing to it? Explain
7. At your high did you have any programmes or activities which aimed at stimulating your interests towards mathematics and motivate you? If so how was their impact?
8. What influenced your current choice of study?
9. How do you think the society influenced your perception towards mathematics?
10. What do you think can be done by the government and parents to improve the number of learners doing mathematics and to improve its proficiency?

Thank you!

C. Survey Questionnaire

Survey questionnaire

This is a study on the assessment of learners' perceptions and attitudes towards pure mathematics. This study seeks to understand the learners' perspectives on this subject matter and how this could be related to the careers they are pursuing now at the University. The success of this study will require your input as my study population. You are therefore requested, to please participate in this survey. Please note that participation is voluntary and that you are free to withdraw from participating should a need arise to do so.

- **A demographic data**

1. I am student in the college of:

   □ Humanities □ Agriculture, engineering and science

2. Age bracket: □ less than 20 □ 21-24 □ 25-30 □ More than 30
3. Gender: □ Female □Male
4. Description or type of high school attended:

   □ Under-resourced □ Moderately resourced □ Well resourced

- **Please tick the best option describing your perception towards mathematics:**

5. How well did you perform in mathematics at school?

   □Poorly □Not so good □Good □Excellent
6. I have siblings/older peers who did mathematics □Yes □No

The following section comprises of two tables. The first table is to be completed by the participants who enjoyed mathematics and the second table is to be completed by the those who did not enjoy mathematics:

I enjoyed mathematics at school □Yes □No (**If 'Yes' please fill Table 1 Only, if 'No' skip to Table 2**).

Table 1 (For those who enjoyed mathematics at school)

	Disagree	Neutral	Agree
I performed well because my school was well resourced			
I performed well because I had a good teacher			
My performance would not have been the same if my school was not well resourced			
My positive attitude towards mathematics affected positively my performance			

I did not enjoy mathematics in school:

Table 2 (For those who did not enjoy mathematics)

	Disagree	Neutral	Agree
I did not perform well because my school was under-resources			
I did not perform well because my teacher was not good enough			
My performance would have been different if my school was well resourced			
My negative attitude towards mathematics affected negatively my performance			

This section should be completed by everyone

	Disagree	Neutral	Agree	Not Applicable
Mathematic is a difficult subject				
Mathematic is an easy subject				
I was not aware of the importance of mathematics in high school				
I knew the importance of mathematics in high school				
I think the maths teachers play a major role in shaping learners' attitudes towards mathematics				
My friends and family influenced my perception of mathematics				
Family and friends play a critical role in my perception of mathematics				
If I was well informed about the importance of mathematics I would have chosen it at school.				
I would choose mathematics if I had to go back to high school				
Mathematics is a strong factor for economic prosperity				
Students in the mathematics and science field have the highest chance of earning better				

income				
I am proud to have chosen mathematics in high school				
I regret not having chosen mathematics in school				
Learners should be encouraged to choose mathematics at schools				
Mathematical literacy as an easy mathematics version made me to view mathematics as a difficult subject				
My choice of curriculum was based on my performance abilities in mathematics				

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