Choosing mathematics education as a career: narratives of three different cohorts

by

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Declaration

I declare that the dissertation, which I hereby submit for the degree Magister Educationis (General) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

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31 March 2020

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Dedication

I dedicate this research to my children, Ntiyiso, Ntwanano, Xongotelo and Xiluvelo Kubayi and my lovely wife Khombomuni Julia Mavasa-Kubayi, guys this is for you ‘dyondzo a yi lumi’. Thank you very much.

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- Last, but not the least - Hlengani and your beloved wife Muhlava Kubayi (Josefa) for posthumously encouraging me.

Abstract

Teachers are motivated by different factors to choose teaching, including mathematics education as a career. Before 1994 career guidance was not often used to inform career choice, especially in the rural schools of South Africa. During that period, a shortage of mathematics teachers was prevalent. After 2007, the government introduced the Funza Lushaka Bursary to recruit mathematics teachers.

The purpose of this study is to investigate the factors that influence teachers to choose mathematics education as a career. An explanatory sequential mixed methods approach was utilised to collect quantitative data through a survey and then qualitative data through interviews. To achieve this, this study was framed by a pragmatic paradigm.

Two theoretical lenses, the existence, relatedness and growth (ERG) theory and Factors Influencing Teaching Choice framework (FIT-CF), were blended to guide the study and to address the research question, "Why do teachers choose mathematics education as a career?" Convenient sampling was used to select participants (n=57) for the survey, from whom 9 participants were later interviewed using stratified random sampling. The sample was constituted by three cohorts of mathematics teachers who started teaching on or before 1994; after 1994 to 2007; and after 2007.

The conclusions drawn from the small sample were that teachers were mainly influenced by *altruistic factors*, followed by *intrinsic factors*. In addition, female teachers were influenced more by *altruistic* and *intrinsic* factors than their male counterparts. Variation in terms of the influence of *altruistic, extrinsic* and *past events factors* across the three cohorts was revealed. Generally, altruistic factors were the most influential factors across the three cohorts. Understanding the factors that influenced the teachers to choose mathematics education as a career could provide insight on how recruitment, retention and effectiveness of mathematics teachers could be optimised in South Africa.

Key Terms: Mathematics education, intrinsic factors, extrinsic factors, altruistic factors, “fall-back” career, career choice

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TO WHOM IT MAY CONCERN

This is to confirm that the dissertation titled "Choosing mathematics education as a career: narratives of three different cohorts " by Moses Langutani Kubayi has been proofread and edited for language by me.

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Kind regards

Anna M de Wet

BA (Afrikaans, English, Classical Languages) (Cum Laude), University of Pretoria.
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List of abbreviations

ACT	Advanced Certificate in Teaching
AMESA	Association for Mathematics Education of South Africa
ANA	Annual National Assessments
CDE	Centre for Development and Enterprise
CPD	Continuing Professional Development
CRF	Contribution toward retirement funds
DBE	Department of Basic Education
DHET	Department of Higher Education and Training
ERG	Existence, Relatedness and Growth
FET	Further Education and Training
FIT-CF	Factors Influencing Teachers Choice Framework
FLB	Funza Lushaka Bursary
GET	General Education and Training
IBM	International Business Machines
IQMS	Integrated Quality Management System
ITT	Initial Teacher Training
LoLT	Language of Learning and Teaching
LTSM	Learning and Teaching Support Material
MMR	Mixed methods research
MOE	Ministry of Education in Singapore
NIE	National Institute of Education
NPPPPR	National Policy Pertaining to the Programme and Promotion Requirements
NSC	National Senior Certificate
OECD	Organisation for Economic Co-operation and Development
QUAL	Qualitative
QUAN	Quantitative
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Educational Quality
SP	Senior Phase
SPSS	Statistical Package for the Social Sciences
STEM	Science, Technology, Engineering and Mathematics
USA	United States of America
VIP	Very important person

Description of Keywords

Intrinsic Factors

Intrinsic motivation means the self-determination to discharge a certain activity or take part in a certain activity (Boulhrir, 2017). Lin (2007) defines intrinsic motivation as the excitement that emanates from people's performance of their duties at work. Intrinsic factors can be predictors of a career choice. For the purpose of this study, intrinsic factors are the factors coming from within of a particular respondent guided by the items on intrinsic factors in the questionnaire.

Extrinsic Factors

Extrinsic factors are factors that focus on what an individual receives as incentives for performing some activities exceptionally at work (Lin, 2007). For this study, extrinsic factors are the factors coming as rewards and benefits that the participants receive or get awarded by the relevant items in the questionnaire.

Altruistic Factors

According to Palta (2019), altruism, that is "living for others", was first advocated by Auguste Comte in 1851. Batson (2008) defines altruism as a motivational state with the ultimate goal of increasing another's wellbeing. Altruism is said to be embedded in altruistic traits such as prosocial behaviour (Lam, 2012), empathy and self-less giving without reward (Friedman, 2016). For this study, altruistic factors are the factors that come when the participants contribute positively to the community and society without considering the benefits or rewards.

Past events or experiences

Past events or experiences are all the things experienced by the participants in this study in the past especially during their schooling years that might have had a bearing on their choice of mathematics education as a career.

Existence needs

Existence is the fact or state of living or having objective reality. Existence level refers to the need of an individual to stay alive and safe at present as well as in the future. Existence needs include needs that were satisfied by material substances or conditions, namely food, shelter, pay, and safe working conditions.

Relatedness needs

Relatedness needs are needs that give the individual a sense of identity and acceptance, and thus, the individual experiences a sense of belonging within his/her immediate society. For this study, relatedness is defined as the need for being accepted and also belonging to a particular society.

Growth needs

Growth needs include self-actualisation as well as esteem needs that rely on intrinsic rewards. For this study, growth is defined as the need to be fulfilled in one's career.

"Fall back career"

In this study "fall back career" is defined as a career choice opted for by participants after their intended career choices are not available.

Hidden curriculum

In this study hidden curriculum is defined as the unwritten, unofficial and often unintended lessons, values and perspectives that are provided by role models to their admirers without uttering a word, e.g. the way a role model dresses, talks, walks, conducts themselves and become a lesson to admirers.

Mathematics education

Mathematics education is utilised in two different contexts; firstly, the teaching of mathematics in the classroom and secondly, the practice of teaching and learning mathematics. For the purpose of this study, mathematics education is utilised as the practice of teaching and learning mathematics as a career except in the survey questionnaire, whereby it is referring to the teaching in the classroom.

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CHAPTER 1: OVERVIEW OF THE STUDY

1.1 INTRODUCTION

Education is seen as the fundamental foundation of development in the whole world, and the teacher is the “most important element of achieving social progress and preparing a generation with spiritual, ideological, emotional and moral values in the light of the goals and aspirations” (Al-Hothali, 2018: 47) of the society. The ruling party of the South African government had put the betterment of education as one of its priorities. The economic emancipation of the countries of the world and South Africa (SA) in particular won’t come about without quality mathermatics teaching and learning.

Puncreobutr and Rattanatumma (2016) assert that mathematics is a basic subject to expand people’s structured and rational ideas. This resonates well with Du Preez (2018) when stating that global communities prioritise the recruitment of suitable, competent mathematics teachers for the development of all the Science, Technology, Engineering and Mathematics (STEM) streams and also to enhance the quality of the teaching of mathematics in schools. SA, like the rest of the global community, is concerned with enticing people into becoming mathematics teachers and keeping them longer in the education system (Ngoepe, 2014). It is imperative to recruit and retain suitable mathematics teachers to minimise the shortage of mathematics teachers and poor mathematics performance by learners in South African rural areas.

In this study, the question, “Why do teachers choose mathematics education as a career?” was examined utilising mixed methods (quantitative and qualitative) research. The previous studies conducted about the factors that contributed to teachers’ choice of mathematics education as a career pointed out several factors that can be classified as *intrinsic*, *extrinsic* and *altruistic* factors (Ngoepe, 2014, Mudzielwana, 2015, Akkoc and Yesildere-Imre, 2017 and Du Preez, 2018).

This study aimed to examine the question, “Why do teachers choose mathematics education as a career?”; the issue was important for policy-making because the factors might become the guiding instruments of choice for design and implementation of policy changes. This study examined the reasons for Further Education and Training (FET) mathematics teachers for choosing to teach. The 57

FET mathematics teachers completed a survey, and nine of those teachers were selected for follow up interviews. The findings might be of help to determine which factors contributed the most to their choice of mathematics education as a career and the effect on others at rural secondary schools .

1.2 PROBLEM STATEMENT AND RATIONALE

It is presumed that teachers are motivated by different factors to choose teaching as a career (Balyer & Ozcan, 2014). In the rural schools of SA, career guidance was not taken into consideration before 1994. The knowledge about different mathematical related career choices was minimal. Our black young people were predominantly pursuing teaching, nursing and policing. They knew little about medicine, engineering, aviation and other mathematical related career choices. They were also discouraged from studying mathematics as it was regarded as a difficult subject (Mji & Makgato, 2006; Taylor, Fleisch & Shindler, 2007) and very few studied mathematics. During that period (before 1994), there were far too few mathematics teachers (Pretorius, 2008).

After 1994 in SA, career exhibitions started to reach young black people in rural areas. They were exposed to different mathematical related career choices and funding. Seemingly it was realised that the teaching profession was bloated, colleges of education were then closed. A lot of teachers produced did not get employed. According to Parker (2002), a huge pool of jobless teachers (estimated to be about 50 000) existed in SA, although this data is almost two decades old. However, not enough mathematics teachers were produced. The shortage was dire in South Africa's rural areas.

After 2007, the government established the Funza Lushaka Bursary (FLB) Scheme to recruit more mathematics teachers to address the shortage. In the meanwhile, foreign nationals were recruited to address the shortage issue. In this study, there were five foreign nationals among the population of 62 FET mathematics teachers at the secondary schools of the selected cluster in the Vhembe District. The five foreign nationals among the population were not sampled since this research was only focusing on South African FET mathematics teachers. The primary research question was, "Why do teachers choose mathematics education as a career?" According to the previous studies, teachers

seemed to have chosen mathematics education as a career for various factors that can be grouped as *intrinsic factors*, *extrinsic factors*, *altruistic factors*, "prior teaching experiences", "the influence of others" and as "fall back career". Various factors found in the previous studies somewhat affected the state of mathematics education. SA has been experiencing various challenges for quite some time for teaching quality mathematics to learners in schools (Centre for Development and Enterprise [CDE], 2013); the same was echoed by the Department of Basic Education (DBE) (2013). According to Luneta (2015), while the outline of mathematics teaching seemed to be shocking in South African schools, the startling facts pointed to the self-satisfaction of the huge number of mathematics teachers about their potential and expertise to teach mathematics. It was, therefore, envisaged that exploring the factors that influenced teachers' choice of becoming mathematics teachers would be a starting point to understanding the nature of the teachers we have in the education sector in SA. Through this knowledge, the dire state of mathematics education in SA would be understood in a better perspective, thereby optimising the interventions for redress.

1.3 PURPOSE AND SIGNIFICANCE OF THE STUDY

This study aimed to answer the question, "Why do teachers choose mathematics education as a career?" This study contributed to the knowledge on the topic by identifying the factors that influenced FET mathematics teachers' choice of mathematics education as a career at the secondary schools of the selected cluster in the Vhembe District. The significance of conducting this study was underscored by the shortage of quality mathematics teachers and disappointing academic achievements in mathematics by learners in rural areas in particular.

The importance of quality education and teachers cannot be overemphasised. A quality teaching force is required to overcome the country's challenges, especially in the scarce skills subjects such as mathematics. Mathematics teachers were recruited using different kinds of profiles, which, among other things, emanated from the teachers' motives to pursue teaching as a career. Previously few similar studies have been conducted globally, for instance Markovits and Kartal (2013) in Israel and Turkey, Yu and Bieger (2013) in the United States of America, Balyer and Ozcan (2014) in Turkey, Mudavanhu (2015) in Zimbabwe, Low, Ng, Hui and Cai (2017) in Singapore, and Ngoepe (2014) and Du Preez (2018) in SA.

Therefore it was necessary to conduct this study and to focus on the factors that influenced FET mathematics teachers the most to customise the interventions for redress in disadvantaged rural areas of the Limpopo Province. Further, it could assist in recruiting suitable candidates in mathematics education for the FET to address the dire shortage of mathematics teachers and the perilous state of mathematics teaching in rural areas.

1.4 RESEARCH QUESTIONS

The primary research question is:

Why do teachers choose mathematics education as a career?

The secondary research questions are :

- What are the *intrinsic factors* that influenced teachers to become mathematics teachers?
- What are the *extrinsic factors* that influenced teachers to become mathematics teachers?
- What are the *altruistic factors* that influenced teachers to become mathematics teachers?
- What *past events* or *experiences* influenced teachers to become mathematics teachers?
- Who influenced teachers to become mathematics teachers?

1.5 THEORETICAL FRAMEWORK.

This study utilised both the existence, relatedness and growth (ERG) theory by Alderfer (1969) and the Factors Influencing Teaching Choice framework (FIT-CF) by Richardson and Watt (2006) as the guiding theoretical framework.

The ERG theory was developed by Alderfer (1969) because of his perception that a sufficient apprehension could be attained by the types of events which Maslow's hierarchy of needs addressed.

The FIT-CF was developed by Richardson and Watt (2006) and empirically validated by Watt and Richardson (2007) of Monash University in Melbourne, Australia. The FIT-CF would yield the motivational factors (*intrinsic, extrinsic,*

altruistic), *prior teaching experiences* and “fall back career”. The theoretical framework is discussed in detail in Chapter 2.

1.6 LITERATURE OVERVIEW

A significant number of existing studies such as Low et al. (2011); Ebru, (2012); Markovits and Kartal (2013); Yu and Bieger (2013); Yuce et al. (2013); Balyer and Ozcan (2014); Massari (2014); Ngoepe (2014); Baran, Maskan and Baran (2015); Mudavanhu (2015); Mudzielwana (2015); Akkoc and Yesildere-Imre (2017); Amengual-Pizarro and Garcia-Laborda (2017); Charalambos (2017); Low et al., 2017); Sayed and McDonald (2017); Du Preez (2018); Kecici (2019) were consulted to gain insight into the research topic framing this study. Since a comprehensive Literature Review will be addressed in Chapter 2, this section only provides the overview thereof. The main themes framing the Literature Review are the international perspectives on the teaching profession, the state of mathematics teaching and learning in SA, and; the possible factors that sway teachers to choose teaching as a career.

1.6.1 The international perspectives on the teaching profession

The broad aim of this key area was to explore the different aspects of the teaching profession that directly or indirectly influenced teachers’ choice of mathematics education as a teaching profession. In addition, it was to explore the theoretical and empirical global trends of teachers’ motivations to pursue the teaching profession, especially mathematics education, as a career.

A robust education system in any nation is the most important factor for developing a progressive society. Supporting this view, the literature demonstrates how countries such as Sweden, Finland and Singapore, to mention a few, place a high premium on developing their teachers. According to Bakar, Mohamed, Suhid and Hamzah (2014), teaching is considered a noble profession that enlightens the global community. Education is seen as the most important foundation of development in the whole world, and the teacher is the most critical component of attaining communal development and adapting a procreation with core values in the light of the objectives and desires of the community (Al-Hothali, 2018). The teachers and the teaching profession affect and develop the learners through the knowledge and shared and imparted experiences. According to Salifu (2013), the

whole world's desires cannot be achieved without the meticulous participation of teachers. The teachers are required to carry this significant responsibility on their shoulders during their professional life. Based on the unique and pivotal role played by the teacher in the educational system, the teacher should be in the profession for the right reasons and/or motives.

1.6.2 The state of mathematics teaching and learning in SA

The broad aim of this key area was to explore the quality of mathematics teaching and learning, performance and the possible implications on influencing teachers to choose mathematics education as a career.

According to Mogari (2014), the mathematics teaching and learning in SA do not make sure that learners think mathematically and are competent to solve problems, despite being entrenched in the current curriculum. They were taught how to respond to questions in the examination question papers and pass well. Therefore, the learners could not solve their everyday life challenges using mathematical problem-solving skills. According to Mogari (2014), the teaching of mathematics deviates from imparting proper problem-solving skills as it is confined to teaching for examination.

According to Tachie and Chireshe (2013), there was an uproar in SA that students' educational attainment in mathematics appeared not to be at an admissible measure due to an array of causes. Those causes included under qualified mathematics teachers, lack of resources and insufficient learning and teaching support materials (LTSM) such as textbooks for mathematics. Students associated their failing to teachers' delinquency such as truancy, insulting learners and not motivating them (Tachie & Chireshe, 2013).

The scarcity of mathematics teachers in SA necessitated the recruitment of foreign nationals by the DBE to address the problem. In addition, a campaign to recruit teachers was launched in 2007; the FLB Scheme was introduced in that regard. The subjects that were mostly taught by migrant teachers were English, Afrikaans, geography, life sciences and mathematics. Therefore, the DBE intended to train people within the country to address the problem and not to rely on foreign nationals (DHET, 2013).

1.6.3 Possible factors that influence teachers to choose teaching as a career

According to Yu and Bieger (2013), the key causal factors in the decision of becoming a teacher in the United States of America (USA) were observed teaching prowess, adoration for teaching, the communal value of teaching, and past experience of teaching and learning. The factors influencing the choice of teaching as a career could be classified as *altruistic*, *intrinsic*, *extrinsic* and the "influence of others". The conceptual and factual findings of the studies classified the factors that influenced teachers to choose teaching as *intrinsic factors*, *extrinsic factors*, *altruistic factors*, past teaching experiences, "the influence of others" and a "fall back career" *(*Balyer & Ozcan, 2014). These factors will be addressed in detail in Chapter 2.

1.7 RESEARCH METHODOLOGY

1.7.1 Research Paradigm

According to Creswell and Plano Clark (2011), a research paradigm is recognised as a research event composed of a perspective and researchers' ontological, epistemological and methodological presumptions. Virtually these presumptions express the essence of reality, how knowledge is built and the means of research reciprocally. The researcher's intention was to gain indepth knowledge and understanding of the topic and could not confine the study to one research method therefore pragmatic paradigm, which has the benefits of both qualitative and quantitative methods, was adopted in this study (Creswell & Plano Clark, 2011). A pragmatic paradigm perceives the research problem as captious; therefore it appreciates both the instinctive (qualitative) and impartial (quantitative) applications to contend with the research question (Creswell & Plano Clark, 2011). It is presumed that the factors that influence mathematics teachers to choose mathematics education as a career can best be revealed and understood through both subjective and objective practices.

1.7.2 Research Method

The mixed methods research (MMR) was utilised in this study. The MMR is an approach whereby the researcher integrates, in a particular way, both quantitative and qualitative data to bestow the consolidated apprehension of a research

problem (Creswell & Plano Clark, 2007). The research method is discussed in Chapter 3.

1.7.3 Research Design

This study utilised the “explanatory sequential design” (Creswell & Plano Clark, 2007: 71), where quantitative data was collected and analysed in the initial stage of the research; the second stage involved the collection and analysis of qualitative data developed upon the initial quantitative findings. The methods and instruments for collecting data were both quantitative and qualitative. The data in this study was obtained through a survey (quantitative) and interviews (qualitative).

1.7.4 Sampling

Two sampling procedures were adopted, namely the convenient sampling for the quantitative phase and the stratified random sampling for qualitative phase. Concerning the former, the participants in this study were 57 FET mathematics teachers that were conveniently accessible to the researcher, and they had vital information to enrich this study. Regarding the qualitative phase, the participants were 9 of the 57 FET mathematics teachers that were in three different strata that were then named cohorts.

1.7.5 Data collection

This section deals with the different types of data that were collected to realise the predetermined research goals and respond comprehensively to the research questions. This study utilised the questionnaires and the interview protocol sequentially, seeking to establish the responses to the research questions. The application of questionnaires in the study could be legitimised on the ground that they are devices through which participants can provide fundamental personal or demographic data about themselves (Creswell, 2008). The questionnaires were consequently used for gathering data mainly to the extent at which the teachers rate the question, “Why do teachers choose mathematics education as a career?”

Individual telephonic interviews were utilised. An interview protocol was prepared for this study. The telephone was utilised for capturing the data, and the conversations were recorded.

1.7.6 Data Analysis

For the quantitative data from the survey, the researcher used IBM SPSS Statistics version 25 to analyse the quantitative data. For the qualitative data from the interviews, the researcher utilised audio recordings and narrative analysis.

1.8 METHODOLOGICAL NORMS (VALIDITY AND RELIABILITY)

This study took validity and reliability into account. Validity is attained by probity, intelligence, opulence, and dimension of the data collected by the level of triangulation (William & Stephen, 2005) although neutrality of the researcher, judicious sampling and the participant attitude also add to attaining validity. The researcher and participants concurred on the elucidation or configuration of occurrences (member checking), particularly concerning the interpretations of the question, "Why do teachers choose mathematics education as a career?"

The survey questionnaire was piloted to determine its reliability; the Cronbach's alpha values of the motivational factors were above 0.7. Therefore, it could be concluded that the questionnaire was reliable. The necessary changes were made in that regard. The validity of the interviews was maintained by performing member checking, allowing the interviewees to read their respective manuscripts after the interviews.

1.9 ETHICAL CONSIDERATIONS

The researcher submitted the research application supported by the intended letters of invitation to participate voluntarily in this study, consent letters, the proposed questionnaire, and the letters requesting permission to do this study at the secondary schools of the selected cluster in the Vhembe District of Limpopo DBE, to the University of Pretoria Research Ethics Committee. The Ethics Committee granted approval before data collection and ethics clearance post data collection. The researcher then requested permission from the Limpopo DBE to conduct this study at the secondary schools of the selected cluster in the Vhembe District. All participants took part in this study voluntarily. The ethical considerations are discussed in detail in Chapter 3.

1.10 LIMITATIONS OF THE STUDY

The sample size was very small, making it impossible to generalise. If generalised, the findings might be misleading because smaller frequencies of observations could seem more significant in a small sample than in a larger one. The dearth of literature on the “factors influencing the choice of mathematics education as a career” prompted me gravitate towards literature covering “the choice of teaching as a career” when reviewing the literature. Although this provided me with some insight into the topic under investigation, it could have been more insightful if the literature on “the choice of mathematics education as a career” was abundant.

1.11 CHAPTER OUTLINE

Chapter 1: Overview of the study.

Chapter 1 presented the research problem statement, purpose and significance of this study, research questions, and a bird’s eye view of this study.

Chapter 2: Theoretical Framework and Literature Review.

Chapter 2 presents the theoretical framework and a review of the existing literature on the question, “Why do teachers choose mathematics education as a career?” The chapter discusses the theoretical framework and explores the diverse views emanating from theoretical and empirical findings of similar or equivalent studies globally, including the global practices that might have a bearing on teachers’ choice to pursue mathematics education as a career.

Chapter 3: The Research Methodology.

Chapter 3 explains the methodological approach as well as the research paradigm, research method and research design selected for this study. The data collection methods and instruments are presented and discussed for the quantitative and qualitative methods utilised in the MMR approach. The population, sample, data analysis, methodological norms, the role and reflexivity of the researcher and ethical considerations are also presented and discussed.

Chapter 4: The Research Findings.

Chapter 4 presents the findings of the pilot study, the quantitative research survey conducted in the first phase as well as the qualitative interviews in the second phase.

Chapter 5: The Research Discussions, Conclusions and Recommendations.

The discussions of the findings of the survey and interviews are discussed in the final chapter to share insights into their implications for mathematics teaching and learning. In addition, a reflection on the nexus between the theoretical framework and the entire study is done to demonstrate whether the latter was fit-for-purpose for this study. Finally, conclusions are made to bring this study to a logical conclusion and recommendations are made for future research.

1.12 CONCLUSION

This study aimed to investigate both the motivational factors and other pertinent factors that influenced teachers' choice of mathematics education as a career at the secondary schools of the selected cluster in the Vhembe District of the Limpopo Province. Although the issues pertaining to the factors that influenced teachers' choice of mathematics education as a career are explored in detail in the forthcoming chapters, Chapter 1 provided an overview of this study. In attempting to do so, a light was shed on the background to the research, the statement of the problem as well as the purpose and significance of this study, the research questions, the research design, the contribution to the research body, the structure of the entire work and clarification of the main terms utilised in this study.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

The purpose of this study was to investigate both the motivational factors and other pertinent factors that influenced teachers' choice of mathematics education as a career at the secondary schools of the selected cluster in the Vhembe District of the Limpopo Province.

The purpose called for an empirical understanding of research studies and literature on issues pertaining to this study, including factors that influenced teachers to become mathematics teachers. Therefore, this chapter explores the diverse views emanating from theoretical and empirical findings of similar or equivalent studies globally and the theoretical framework. In addition, this chapter explores the global practices that might have a bearing on teachers' choice to pursue mathematics education as a career. Further, the theoretical and empirical findings shed light upon whether the teachers' choices were influenced by *intrinsic factors*, *extrinsic factors*, *altruistic factors*, "past events or experiences" and "the influence of others". In this chapter, both the theoretical framework and the literature review are discussed. Further, the literature on issues pertaining to this study is explored with a primary focus on:

- The international perspectives on the teaching profession.
- The state of mathematics teaching and learning in SA.
- The possible factors that influence teachers to choose teaching as a career.

2.2 THE THEORETICAL FRAMEWORK

According to Saif, Nawaz, Jan and Khan (2012), there are three leading motivational theory classifications, namely *need-based motivation* theories, *cognitive-based motivation* theories and *contemporary motivation* theories. Therefore, of the three leading motivational theory classifications, this study adopted the *need-based* and *cognitive-based* motivation theories since they inform and embed the purpose of this study and can adequately assist in unravelling the problem statement and answering the research questions.

According to Reagan (2014), *need-based theories of motivation* consider motivation as the outcome of internal drives that compel people to act or move

towards the satisfaction of different needs. One typical example of a need-based motivational theory is the ERG theory by Alderfer (1969). Pertaining to the *cognitive-based* theories, Mayhew (n.d) contends that *cognitive-based* theories presume that there are two basic groups of motivational factors why humans engage in certain activities, namely intrinsic and extrinsic factors, which are well articulated in the FIT-CF. The *cognitive-based* motivational theories reveal the manner in which motivation emanates and guides the realisation of needs (Badubi, 2017). According to Garcia, Del Cerro Ramon and Herrera (2019) all these motivational theories have the contentment of needs as a common denominator, and according to (Badubi, 2017), they mainly discuss the connection with or impact of the needs establishing the results of people's job contentment at work.

The aim and the objectives of this study called for an empirical understanding of several theoretical frameworks and the selection of the most relevant ones to assist in examining factors that contributed to teachers' choice of mathematics education as a career. Therefore, to answer the primary research question, ("Why do teachers choose mathematics education as a career?") an essential supporting framework should be utilised. This study utilised a combination of the ERG theory by Alderfer (1969) and the FIT-CF by Richardson and Watt (2006) as the guiding theoretical framework. It was perceived that the utilisation of the two (ERG and FIT-CF) would allow this study to conceptualise the human behaviour based upon the individual's need preferences, motivations, perceptions and professional development.

The ERG is the cornerstone of any human behaviour. The ERG is a composition to acknowledge what interior outlooks force individuals to be swayed in a certain way. Hence, interior outlooks could sway individuals in a distinct fashion in reaction to the stimulants around them. Then individuals could be influenced by certain factors (such as intrinsic, extrinsic and altruistic) to make some choices, in this instance the choices to become mathematics teachers. The FIT-Choice of teachers to become mathematics teachers are triggered by the ERG as the needs could explain human motivation.

2.2.1 The ERG theory

The ERG theory was developed by Alderfer (1969: 144) because of the impression that "an adequate understanding could be achieved by the kinds of phenomena addressed by Maslow's hierarchy of needs". However, Maslow's hierarchy of needs does not always directly relate to real world situations. Alderfer searched for a more practical way to apply Maslow's hierarchy of needs in empirical research. He rationalised the number of hierarchy levels, grouping all five from Maslow into three newly imagined levels. In the process Alderfer used Maslow's theory as a departure point to create the ERG theory representing existence, relatedness and growth needs. According to Kaita and David (n.d):

> *..the ERG theory does not have some sort of hierarchy according to concreteness but it also allows for the order of needs to differ for different people; secondly, if a relatively more significant need is not gratified, the desire to gratify a lesser need will be increased; and third, a lower-level need does not necessarily have to be gratified for a higher level to become relevant* (Kaita & David, n.d.: 3)

According to Mykhailovska and Malpa (2016):

> *in ERG theory more than one need can occur simultaneously, and they have a unique frustration-regression character. If the gratification of the higher need is being blocked, the desire to satisfy a lower need increases. (*Mykhailovska & Malpa, 2016: 2)

The ERG theory provided more flexibility that allowed for a broader range of observed behaviours. According to Omollo (2015), ERG entails that to properly influence others, people should establish other people's various needs that drive them to behave in a particular way. According to the ERG view, "one is never sure of an individual's potential until one knows the individual's environment" (Mykhailovska & Malpa, 2016: 2).

The ERG theory (see Figure 2.1) assumed a human being had three core needs that they strived to satisfy:

- material "existence needs";
- interpersonal "relatedness needs" with significant other people; and,

- opportunities for their unique “personal development and growth needs” (Alderfer, 1969: 145)

These needs could explain human motivation. The ERG theory was backed by an empirical study by Schneider and Alderfer (1973) and Robbins and Judge (2008). Alderfer combined Maslow’s safety and physiological needs into existence needs, self-actualisation and esteem needs into growth needs and redefined the social needs as relatedness needs. The Maslow’s hierarchy made use of the hierarchical progression of needs, meaning that the first level of needs had to be realised first before the person could get to the next level. Instead, the ERG theory allowed for needs at different levels be pursued independently. It acknowledged that if a higher level of needs could not be fulfilled, an individual might attempt to redouble his or her efforts to satisfy lower level needs.

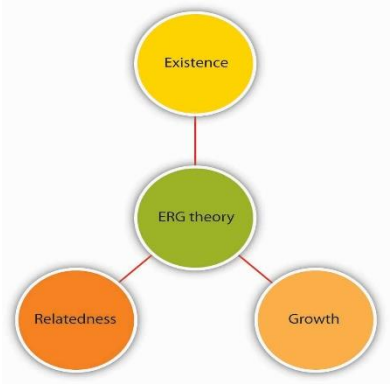

Figure 2.1: The ERG theory (Source: Lumen, n. d.)

Figure 2.1 shows the ERG theory which is made up of existence, relatedness and growth components. These components are discussed in the next sections.

2.2.1.1 Existence needs

According to Omollo (2015), existence needs mean people’s anxiety about their fundamental conditions such as hunger, thirst and a safe working condition. The existence level covers the first two needs in the Maslow’s hierarchy; these are the physiological and safety needs. According to Griffin and Moorhead (2013), existence needs mean an individual’s labouring and their somatic comfort in life. Existence needs comprise needs that could be achieved by physiological

conditions not by communal conditions (such as food, shelter, pay, and safe working conditions (Griffin & Moorhead, 2013).

2.2.1.2 Relatedness needs

According to Omollo (2015), relatedness needs mean inspirations possessed by people for sustaining their communal associations such as involvement with family, friends, co-workers and employers. The relatedness level is an amalgamation of the third and fourth levels of Maslow's hierarchical needs (social and esteem needs). According to Griffin and Moorhead (2013), relatedness needs mean an individual's household and their endemic comfort in life. Relatedness needs provide people with a feeling of recognition and they feel recognised in their communities (Griffin & Moorhead, 2013). The individual requires interaction with and endorsement from other entities or other members of the community to fulfil these needs. Therefore, the motivation is provided by a combination of intrinsic and extrinsic rewards (such as helpful and well-meaning feedback that might provide direction and advice instead of just wholehearted friendliness or endorsement).

2.2.1.3 Growth needs

According to Omollo (2015), growth needs mean the people's intrinsic aspiration for peculiar growth such as the desire to be creative, productive and to complete meaningful tasks, and the level comprise the highest level of the hierarchy [self-actualisation]. According to Griffin and Moorhead (2013), growth needs can be described as what people envy to achieve professionally and privately in life, and these could be attained by people's forceful engagement in different endeavours with the utilisation of their capabilities. They include the self-actualisation and esteem needs from Maslow's hierarchy that rely on intrinsic rewards.

2.2.2 The FIT-Choice framework

The FIT-CF was developed by Richardson and Watt (2006: 31), "to provide a comprehensive and coherent model to guide systematic investigation into the question of why people choose a teaching career" and empirically validated by Watt and Richardson (2007). Richardson and Watt designed the model by categorising repeating themes from the literature that had shown a lack of

connectedness and structuring these themes logically within the Expectancy Value Framework. It was also developed to provide insight on how early motivations influenced teacher recruitment, retention and effectiveness. This was viewed for various combinations and permutations of samples and settings, to provide a clear impression of the constituent parts, explain the interrelatedness and causal sequences in the themes, and the linkage with participants' motivations, perceptions and eventual career choices (see Figure 2.2).

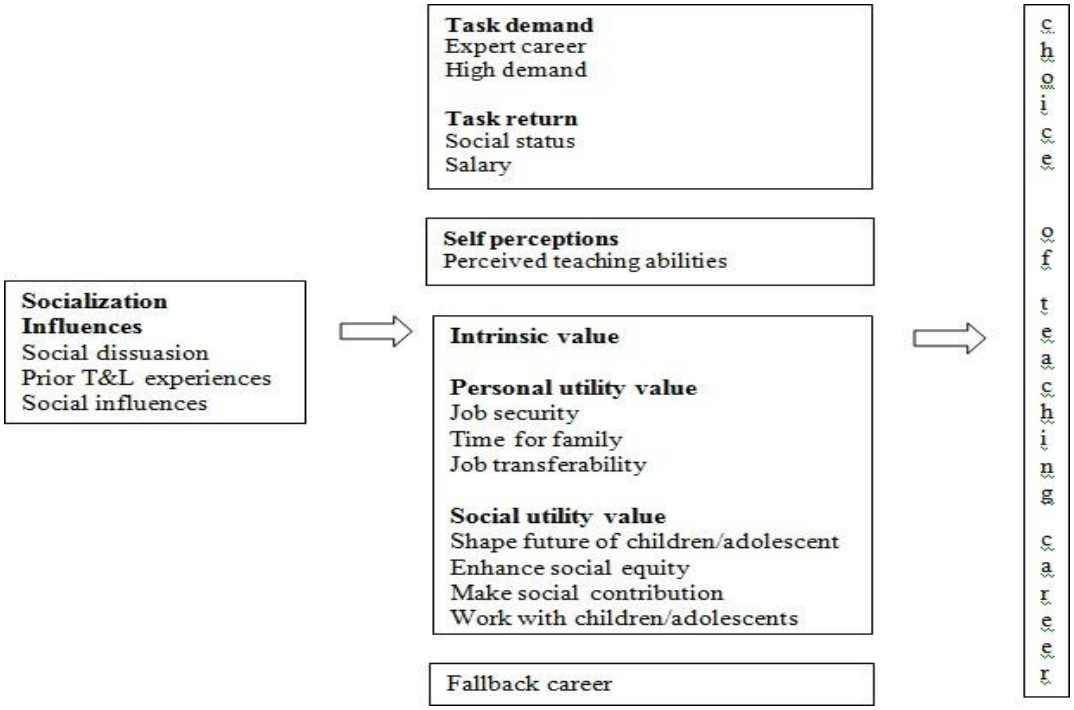

Figure 2.2: The FIT-Choice Framework (Source: Richardson & Watt, 2006)

Figure 2.2 shows the FIT-CF and its elements. The framework is discussed briefly below as per Watt and Richardson (2007):

- **Socialization influences** focus on "social dissuasion", "prior teaching and learning experiences" and "social influences".
- **Task perceptions** focus on [expert career] and [high demand] in "task demand"; and [social status] and [salary] in "task return".
- **Self-perceptions** focus on "perceived teaching abilities".

- **Values** focus on “intrinsic value”, “personal utility value” and “social utility value”; “personal utility value” contains [job security], [time for family], and [job transferability]; and “social utility value” contains [shape future of children/adolescents], [enhance social equity], [make social contribution] and [work with children/adolescents].
- “**Fall back career**”, is the element that seems to indicate when teachers choose to teach as maybe their last resort (Watt & Richardson, 2007).

The motivational factors of the FIT-CF from the *cognitive-based* motivation theory are categorised into three main groups: *intrinsic factors*, *extrinsic factors* and *altruistic factors*. In addition, “past events or experiences” and the “influence of others” are also revealed in the FIT-CF as the pertinent factors that could influence teachers’ choice of teaching as a career.

2.2.2.1 Intrinsic Factors

Intrinsic motivation means the self-determination to discharge a certain activity or take part in a certain activity (Boulhrir, 2017). According to Delgado (2017), intrinsic motivation in education is “a support tool to facilitate knowledge transfer between individuals, encourage the development of groups outside the formal school structures, allow rapid troubleshooting, transfer best practices and develop professionals to share experiences” (Delgado, 2017: 154). Lin (2007) defined intrinsic motivation as the excitement that emanates from people’s performance of their duties at work. Akhtar, Iqbal and Tatlah (2017) declare that admirable outcomes are attained by people’s genuine intrinsic motivation such as executing their duties, perception of perculiar virtuosity and the sense of delight at work. It is presumed that when a person is intrinsically motivated, the person will be influenced to perform for enjoyment or the challenge implied instead of external goods, pressures or rewards. The definition and empirical explanations of the intrinsic factors imply that when mathematics teachers are influenced by intrinsic factors, they would always be self-determined to perform well at work, thereby producing positive mathematics results.

2.2.2.2 Extrinsic Factors

According to Balyer and Ozcan (2014: 105), extrinsic factors could be defined as having some references to “economic factors as well as the conditions of service and social status”. Extrinsic factors are factors that focus on what an individual receives as incentives for performing some activities exceptionally at work (Lin, 2007). It includes benefits, social status, lack of interest and forced choice. It is presumed that the main objective driving the behaviour of such employees is to receive rewards or benefits from the organisation for achieving its aims or tasks. Therefore extrinsic outcomes are the gratuities awarded by some determinants in external structures such as the salary and bonuses that an employee receives for additional efforts at work, as well as ensuring job security, and receiving promotions. The definition and subsequent explanations of extrinsic factors imply that mathematics teachers influenced by extrinsic factors perform well only when the conditions of service are conducive and favourable; therefore, rewards should always be provided to cater for extrinsically motivated mathematics teachers. According to Gneezy, Meier and Rey-Biel (2011), in general, the motivation to discharge the duty without a stimulus offer might be lessened when the discharge was reward-driven. It is believed that extrinsically motivated mathematics teachers might not perform optimally when the incentives become scarce.

2.2.2.3 Altruistic Factors

According to Palta (2019), altruism, that is, *living for others,* was first advocated by Auguste Comte in 1851. Altruism is embedded in altruistic traits such as prosocial behaviour (Lam, 2012), empathy and self-less giving without reward (Friedman, 2016). Batson (2008: 3) defined altruism as “a motivational state with the ultimate goal of increasing another’s wellbeing”. He further said that the altruistic factor is “if you helped to gain a good feeling, to avoid guilt, or to reduce your aversive arousal caused by witnessing another’s suffering”. Therefore, altruistic factors might be understood as the desires to improve the well-being of others, and it is connected with the concept of pro-sociality and covers doing things intentionally to help other persons or groups of people. According to Onatir (2008), altruistic motives on choosing teaching as a career are not gender-dependent, therefore, the motives could be dependent on the types of teachers’ ERG needs. They include motives to work with children and youth and of pro-sociality. The definition and subsequent

explanations of altruistic factors imply that mathematics teachers influenced by altruistic factors strive to live for others driven by their prosocial behaviour; therefore, the majority of challenges in mathematics teaching and learning could easily be dealt with and the performance of learners would be enhanced.

2.2.2.4 Past events or experiences

"Past events or experiences" are all the things experienced by the participants in this study in the past especially during their schooling years that might have had a bearing on their choice of mathematics education as a career. Some events or experiences might lead people to regard or disregard making some career choices in life. Some say "experience is the best teacher". The mathematics teachers influenced by "past events or experiences" may have been influenced by factors such as the way their former mathematics teachers taught them the subject, the state of mathematics, their competence in mathematics and shortage of mathematics teachers. Therefore, it is thought that "past events or experiences" influenced mathematics teachers would like to emulate their former teachers by being good teachers.

2.2.2.5 Influence of others

The influence for choosing some career or a certain path in life could either be direct or indirect. The mathematics teachers that are influenced by some significant other (people such as mentors, role models and celebrities) tend to thrive well in their endeavours to equal or surpass the feat or legacy they observed from their very important persons (VIP). The mathematics teachers that are influenced by VIPs tend to set realistic goals as they have observed what and how their VIPs are perceived among society. Therefore, such mathematics teachers tend to do well to be equated to their so-called role models. It is very imperative to have such teachers in mathematics because it is believed that such teachers would deliver the goods (produce good results) at all times.

2.2.3 Relevance of the two theories to this study

The ERG has been utilised as a construct to understand what internal perspectives compel individuals to be influenced in a certain way (Caulton, 2012). Therefore, internal perspectives could influence individuals in a particular way in

response to the stimuli around them. An individual's needs (such as physiological, safety, belonging, esteem or self-actualisation) are the critical elements that trigger some motivation towards their attainment. Individuals are influenced differently to fulfil their day-to-day obligations and satisfy their needs, irrespective of whether they are similar demographically (race, ethnicity, gender, area).

According to Weiner (2010), individuals possess variety of drives that necessitate them to seek numerous ways to achieve their aspirations in life. It is presumed that individuals could be influenced by the specific type of needs that they would like to satisfy. It is believed that teachers could be driven by the thirst of ERG needs to choose mathematics education as a career. For instance, existence needs could drive teachers to choose mathematics education as a career to satisfy their economic needs as well as the conditions of service and social status which are external (extrinsic) to an individual. The relatedness needs could drive teachers to choose mathematics education as a career to satisfy both their external forces (extrinsic) and the inner personality structures (intrinsic). The growth needs could drive teachers to choose mathematics education as a career to satisfy both their inner personality structures (intrinsic) and prosocial behaviour (altruistic). One could argue that existence needs could be linked mostly with extrinsic factors; relatedness needs mostly with intrinsic and extrinsic factors and growth needs could be linked with intrinsic and altruistic factors.

The FIT-CF was relevant because it addressed all the secondary research questions in the data collection instruments. The themes presented in this study are slightly different from the themes in the FIT-CF just in name only, but they portray the same content (see Table 2.1).

Table 2.1: Current study themes alignment to FIT-Choice elements

Current study themes	FIT-Choice elements
Intrinsic factors	Intrinsic values
Extrinsic factors	Task return and personality utility value
Altruistic factors	Social utility value
Past events or experiences	Prior teaching and learning experiences

The influence of others	Socialization influences

Table 2.1 shows how the different themes of this study and those of the FIT-CF are aligned. The link between the research questions and the different elements of both ERG and FIT-CF is demonstrated in Table 2.2.

Table 2.2: The link between the research questions and the elements of both ERG and FIT-Choice theories

Research Questions	ERG needs	FIT-Choice elements
"What are the *intrinsic factors* that influenced teachers to become mathematics teachers?"	Relatedness; Growth	Self-perceptions (teaching abilities); Values (intrinsic value).
"What are the *extrinsic factors* that influenced teachers to become mathematics teachers?"	Existence; Relatedness	Task perceptions (social status; salary); Values (personal utility value (job security; time for family))
"What are the *altruistic factors* that influenced teachers to become mathematics teachers?"	Growth	Values – "social utility value" (shape future of children/adolescents; enhance social equity; make a social contribution; work with children/adolescents).
"What *past events* or *experiences* influenced teachers to become mathematics teachers?"		Socialization influences (prior teaching and learning experiences; social influences).
Who influenced teachers to become mathematics teachers?		Socialization influences (social influences).

Table 2.2 shows that intrinsic factors are relevant to related and growth needs of the ERG, self-perceptions (teaching abilities) and values (intrinsic value) of the FIT-CF. Extrinsic factors are relevant to existence and relatedness needs of the ERG, task perceptions (social status; salary) and values ("personal utility value" [job security; "time for the family"]) of the FIT-CF. Altruistic factors are relevant to growth needs of ERG, and values ("social utility value" [shaping future of children/adolescents; enhancing social equity; making a social contribution; working with children/adolescents]) of the FIT-CF. "Past events or experiences" are relevant to socialisation influences ("prior teaching and learning experiences"; social influences) of the FIT-CF. The "influence of others" is relevant to socialization influences (social influences) of the FIT-CF. The international perspectives on the teaching profession is presented and discussed in detail in the next section.

2.3 THE INTERNATIONAL PERSPECTIVES ON THE TEACHING PROFESSION

According to Bakar et al. (2014), teaching is considered a noble profession that enlightens the global community. It is presumed that the teaching profession is of utmost importance to emancipate the nations of the world economically (such as alleviating poverty, improving health and livelihood, escalating prosperity and solving challenges being brought by climate change). Therefore, according to Salifu (2013), the global community's aspirations cannot be attained without the rigorous involvement of teachers. Before exploring literature on the factors influencing teachers to choose mathematics education as a career, it is preferable that this exploration is preceded by a review of the literature on the international perspectives on the teaching profession in general. Therefore, in this section, some international perspectives on the teaching profession that are believed to have influenced teachers to choose teaching as a career are presented and discussed.

2.3.1 Teaching as a popular career choice

Low, Lim, ChIng, and Goh (2011) assert that the teaching profession in Singapore is a relatively high-status profession. This is attested to by Adecco (2012) that children in Singapore prefer teaching to other so called "lucrative" professions followed by becoming a doctor, pilot or flight attendant. Pollari, Salo and Koski (2018) stated that the prospective subject teachers in Finland were usually selected from among the most talented and motivated students.

It could be presumed that the popularity of the teaching profession could have potentially influenced people to choose teaching as a career. This could be a true testament of such a presumption in countries such as Singapore and Finland where a teaching profession is regarded as a popular career choice. Teachers have been driven by their existence and relatedness needs to be influenced by the popularity of the teaching profession. The popularity of the teaching profession and its high status in some countries seem to have influenced the teachers *extrinsically* towards satisfying their existence and relatedness needs, thereby enhancing their *task perceptions (*social status) *and values'* personal utility value (job security). It is presumed that if the popularity of the teaching profession could be fostered across the world, the teaching profession could attract extrinsically

motivated mathematics teachers as social status is one of the characteristics of extrinsic factors.

2.3.2 In-service training/professional development in teaching

A huge amount of non-monetary elements such as professional development were found to have influenced teachers to pursue the teaching profession (Ingersoll & May, 2012). The teachers in countries such as Sweden are continually engaged in professional development or in-service training with a specific focal point on intensifying their subject knowledge and didactics (Organisation for Economic Co-operation and Development [OECD], 2011). The same could be stated about Singapore that in-service teachers spend 100 hours every year training to obtain adequate knowledge, skills and values in order to riposte to students' importunity in a better way, manage the new defiances and to acclimatise to new teaching situations (National Institute of Education [NIE], 2009). In SA, teachers were required to do the Advanced Certificate in Teaching (ACT) to augment their respective subjects' or phases' knowledge, skills and values and also to can teach new subjects or phases (DHET, 2011). In other countries such as Zimbabwe (Manwa, Mukeredzi & Manwa, 2016), mentorship was utilised to augment the teachers' knowledge, skills and values for professional maturation and expansion (Maphalala, 2013).

The continuous development of people at the workplace is of utmost importance. The teachers stay abreast with new and modern technological skills to solve everyday challenges related to their work. This could potentially influence people to choose a career where there is constant professional development.

Based on the picture painted in the above paragraph, the relatedness and growth needs would dictate how the teacher would satisfy those needs. Every teacher needs to be exposed to in-service training, professional development and peer-group mentoring occasionally to attain proficiency in their duties. Therefore, every teacher might have been driven towards the achievement of their relatedness and growth needs by the in-service training, professional development and peer-group mentoring like in countries such as Sweden, Singapore and Zimbabwe. It could be argued that the in-service training, professional development and mentoring (peer-group) seemed to have been *intrinsic* determinants for teachers to become

mathematics teachers to fulfil their self-perceptions (teaching abilities) and values (intrinsic value). It is presumed that continuous professional development and mentorship would make the intrinsically motivated mathematics teachers more self-determined, skilful and develop the love of teaching mathematics more.

2.3.3 Working conditions in the teaching profession

The extrinsic dimension of motivation, according to Armstrong (2015), among others consists of conditions such as working hours, versatility of time on task and job security. Huge remuneration, job security and sturdy work stations are hugely the prepotent extrinsic enticements (Sayed & McDonald, 2017). According to Gunther (2019), remuneration is by far the most important factor that influenced teachers' choice of teaching as a career. The remuneration of teachers could have an effect in the recruitment of suitable and adequate teachers across areas of need (Grissom, Viano, & Selin, 2015). Beaudin (1995), although a couple of decades ago, indicated that the huge remuneration in other professions swivel negatively the recruitment of the most sought-after teaching streams such as mathematics and science.

The teachers in Singapore are well remunerated financially (Low et al., 2011). For instance, teachers' salaries in Singapore are comparable to those of other professions requiring a similar level of training and qualifications such as aerospace engineers and accountants (Ministry of Education Singapore [MOE], 2014). The teachers also get allowances such as annual bonus, performance bonus, contribution toward retirement funds (CRF), medical benefits and annual leave entitlement (MOE, 2014), provided to all civil service employees. Furthermore, the teachers are also remunerated for their devotion and long service if they served for at least 30 years, and different portion of pay-outs are laid for long service of different durations (minimum four years) (MOE, 2014). In a country such as Sweden in regions or subjects where teacher shortages are more significant (such as in mathematics), teachers tend to get higher salaries (Organisation for Economic Co-operation and Development [OECD], 2011). Amidst other influences, the huge salaries have predominantly influenced teachers to choose teaching as a career in some cultures of the world such as Malaysia (Azman, 2013); Africa (Cross & Ndofirepi, 2013); Hong Kong (Gu & Lai, 2012); and Turkey (Yuce, Sahin, Kocer & Kana, 2013).

According to Kecici (2019), all the participants in the study were mainly influenced by job security to pursue teaching. The same was also revealed by Sayed and McDonald (2017), namely that working conditions were a factor to influence teachers to pursue a teaching profession. According to Bakar et al. (2014), Malaysian government provides the teaching force with conducive working conditions such as job security. Teaching is a secured job in Thailand since teachers are provisioned with incentives such as medical and housing allowances, and education allowances for their kids (Syamananda, 2017). The same could be true in SA, where, according to Benell and Akyeampong (2007), teaching provisions job security to teachers since about 13 years to date amid the escalating rate of unemployment among the youth.

In a country such as Estonia, 35 working hours per week, about 7 hours per weekday, are regulated for teachers (OECD, 2016). The teaching load in South African schools are similar to Estonia, as teachers have 35 working hours per week, translating to seven hours per weekday. This also has the potential to influence people's choice of teaching as a career to have ample time to concentrate on their private affairs.

The working conditions could be categorised as including workloads/teaching loads, incentives and other benefits. The competitive salaries and lucrative benefits in the teaching profession have the potential to influence people's choice of teaching as a career. The favourable working conditions are the drivers towards the teachers' realisation of their existence and relatedness needs. Therefore, that might have been the reason for Gomba (2015) to state that it was key for the Zimbabwean government to please qualified and experienced teachers through the increase of their remunerations. Therefore, some teachers seem to be *extrinsically* influenced to become mathematics teachers by the financial benefits of different sorts for their task perceptions (salary) and values ("personal utility value" [job security; time for family]). The favourable working conditions could presumably attract more extrinsically motivated mathematics teachers to resolve the shortage of mathematics teachers.

2.3.4 Sponsorship Schemes for initial teacher training (ITT) and development

According to Bakar et al. (2014), initial teacher training (ITT) in Malaysia is covered by the government either through scholarships or education loans but when one is granted a scholarship they have to work for the Ministry of Education for a period of seven years. Countries such as Finland and Canada provide funds for ITTs coupled with monthly living allowances to prospective teachers (Darling-Hammond, 2017). This could have some relevance to a country such as Singapore where according to Chew (2016), the Singapore government provides funding for teachers' continuing professional development (CPD) during their teaching span extended to studying masters and doctoral levels. The prospective teachers get funded for agreeing to teach at some particular districts of some states in USA for three years (Boggan, Jayroe & Alexander, 2016). In SA, the government established the sponsorship scheme called Funza Lushaka Bursary (FLB) Scheme to recruit people willing to pursue teaching as a career, especially to scarce skills subjects such as mathematics.

Funding might have potentially influenced people to choose teaching as a career to utilise readily available resources. Whenever you are granted such a sponsorship, the teaching job would be a guarantee after completion. In this context it could be presumed that government sponsorships potentially influenced people to choose mathematics education as a career.

If the teachers were sponsored for CPD and pursuing masters or doctoral level studies to attain some of their ERG needs, they would presumably be *extrinsically* influenced to be mathematics teachers for task perceptions (social status) and values ("personal utility value" ([job security]). It is presumed that funding should be readily available across the different levels of mathematics education to attract extrinsically motivated mathematics teachers who would like to enhance their subject content knowledge and skills.

2.3.5 Autonomy in the teaching profession

According to Bunn and Wake (2015), curricular autonomy is one of a huge quantity of non-monetary factors that were found to have influenced teachers to join teaching as a career. The Finnish teachers have a great deal of autonomy in their jobs in relation to lesson planning, kinds of teaching techniques they utilise

and student assessment (Pollari et al., 2018). In a country such as the USA according to Torres and Weiner (2018), the teachers have the autonomy to make decisions in relation to their operation and are supported by the ministry to ensure that this operation yields effective outcomes, and that the teachers have autonomy in terms of how to teach (such as to design specific learning activities to accomplish an objective).

Based on scenario presented in the previous paragraph, people could potentially be influenced to become teachers to be autonomous. The basis of every teacher's influence is embedded in their ERG needs and the attainment of such needs. Therefore, teachers might be driven by their relatedness and growth needs to want some freedom to design their own specific learning activities to accomplish the learning objectives. The teachers could be *intrinsically* influenced to choose mathematics education as a career by being autonomous in their self-perceptions (teaching abilities) and values (intrinsic value). Autonomy at work is necessary for intrinsically motivated mathematics teachers to build their self-determination in executing their teaching activities.

2.3.6 Appraisal in the teaching profession

According to Darling-Hammond (2013), a perfect teacher appraisal system in teaching would be a solitary comprehensive system with numerous roles as a channel of appraisal for promotion, monetary reward, collaborative learning and professional development for an individual appraisee. This could be similar to the trend in countries such as the Czech Republic, Bulgaria, and Singapore where "formal appraisal led to changes in teachers' salaries for a majority of teachers" (Burns & Darling-Hammond, 2014: 40). In SA, there is a modernised version of appraisal, Integrated Quality Management System (IQMS), to determine teachers' monetary rewards.

Based on the picture painted in the previous paragraph, it is believed that the teachers could be driven by their existence and relatedness needs and be influenced by appraisals in the teaching profession. Therefore, the teachers could be *extrinsically* influenced to choose mathematics education as a career by getting some increment in their salaries to satisfy their task perceptions (salary) and values (personal utility value). The incentives are presumed to be the significant

determinants for extrinsically motivated mathematics teachers to perform some tasks and put extra effort in their work.

2.3.7 Clear career path in teaching

According to Darling-Hammond (2017), Singapore has established numerous teaching career paths for leadership roles for teachers to pursue during their teaching span, that is to develop teachers in senior leadership roles to assist in the training and induction of novice teachers thereby enhancing the integration process of theory and practice. In SA, the career path starts from post level 1 (entry level as a teacher) and extends to upper post levels according to the grading of the school (size of the school is in terms of learner population). People prefer dynamism (constant change or progress) in life. They always want to be elevated to higher positions. The career path in the teaching profession could potentially have an influence in people's choice of teaching as a career.

The teachers' existence and relatedness needs would dictate how people feel about promotions and higher positions. Therefore, teachers are driven by promotions and high positions to be *extrinsically* influenced to become mathematics teachers to satisfy their task perceptions (social status; salary) and values (personal utility value [job security]).

2.3.8 School holidays as a motivating factor

The long holidays are also among the leading factors swaying teachers to join teaching in other cultures such as Malaysia (Azman, 2013); Africa (Cross & Ndofirepi, 2013); Hong Kong (Gu & Lai, 2012); and Turkey (Yuce et al., 2013).

In SA, for instance, there are four school holidays (recess) each academic year. This is not a practice perculier to SA because it is a general global trend to afford schools periods of recess that are structured according to the dynamics of each country, e.g. season and climatic conditions. Therefore, the ample holidays could potentially influence people to choose teaching as a career.

Therefore, it is safe to state that teachers could *extrinsically* be influenced to choose mathematics education as a career to satisfy their task perceptions and values or relatedness needs (personal utility value [time for the family]). The extrinsically motivated mathematics teachers would presumably be overjoyed

about the generous holidays in the teaching profession to rest a little as mathematics is a demanding job.

2.4 POSSIBLE FACTORS THAT INFLUENCE TEACHERS TO CHOOSE TEACHING AS A CAREER

According to Agbaria (2013), racial, vocational and ethnic factors, influence the choice of teaching as a profession like many other fields. The factors for choosing the teaching profession are similar for students from different areas.

As mentioned in the limitations of the study, the majority of the literature presented and discussed was based on the possible factors that influenced teachers' choice of the teaching profession in general. This study aimed to investigate both the motivational factors and other pertinent factors that influenced teachers' choice of mathematics education as a career. However, the drives which were predisposed to the choice of teaching as a career and which made teachers choose mathematics education as a career would be more or less the same. Therefore the literature of the factors that influenced teachers' choice of teaching as a career could be comparable to the factors that influenced mathematics teachers to choose mathematics education as a career.

Low et al. (2011) indicated that prospective teachers in Singapore were mostly driven to become teachers by *intrinsic* and *altruistic factors* and the least by *extrinsic factors.* According to Low et al. (2017), prospective teachers in Singapore were mostly triggered to become teachers by their prior teaching experiences. For some others, their previous school teachers influenced them in relation to the subject specialisation, how they would teach the subject, and their identities. Intrinsic value and social utility value stimulated the prospective teachers' decisions to become teachers added by the harmonising of their attributes towards the nature of the teaching profession (Low et al., 2017).

It was revealed in Low et al.'s (2011) study that teachers were influenced the most by *intrinsic factors* followed by *altruistic factors* and the least by *extrinsic factors*. However, in Low et al.'s (2017) study, it was revealed that teachers were influenced the most by *prior teaching experiences* and by their former teachers driven by intrinsic value and "social utility value". The variance of the two studies' findings could have come about by the differences in the period or era in which the

participants were surveyed (there was a difference of five years between the two studies), their demography, the different types of ERG needs and other pertinent influences. This current study argued that the teachers in Singapore seemed to have been positively influenced to become teachers in 2017 as they were in 2011.

According to Yu and Bieger (2013), observed teaching expertise, devotion for teaching, the social value of teaching, and past event of teaching and learning were key causal factors in the decision of becoming a teacher in USA. The personal values, social influence, and remuneration were considered less important to the decision (Yu & Bieger, 2013). It is presumed that teachers in the USA are positively motivated because their fundamental influences are embedded in their ERG needs. Further, the teaching profession in the USA has been chosen due to *intrinsic*, *altruistic*, "past events or experiences" and less chosen on *extrinsic factors* which are positive signs of the livelihood of the profession.

According to Mudavanhu (2015), different kinds of situations such as obtaining low A-level points and indecisiveness compelled the people to choose teaching, and their drives were sometimes out of choice. According to Mudavanhu (2015), another reason for choosing to teach was the pressures to please the so-called important people (spouses, brothers and sisters, parents, family members and important teacher in their lives). The researcher continued by stating that students were influenced by "*extrinsic factors* ranging from route to employment, job security to life-long learning" (Mudavanhu, 2015: 164). Some students were influenced to join teaching by *altruistic factors* and *intrinsic factors* (passion for teaching, the love of teaching, and seeing teaching as a calling); and some were influenced to join the teaching profession because of their *prior knowledge of teaching*, training and work experience (Mudavanhu, 2015).

The teachers in Zimbabwe seem to have been influenced to become mathematics teachers by *intrinsic factors*, *extrinsic factors*, *altruistic factors*, "prior knowledge of teaching", "the influence of others" and as a "fall back career" for their *socialisation influences*, *intrinsic value*, *personal utility value*, *relatedness* and *growth* needs. It is presumed that the teachers in Zimbabwe were positively influenced to become teachers, although the study of Mudavanhu (2015) did not categorically indicate the merit of the influences.

According to Du Preez (2018), the factors in the study that had the huge influence on students of mathematics choosing teaching as a career were *intrinsic factors*. Furthermore, they said that the chance to improve the lives of children, the community and the country were adored by the teachers. The prospective mathematics teachers revealed that their choice of teaching was genuine and they thought that they possessed the knowledge and capabilities to perform well as mathematics teachers amid the lamentations that mathematics teaching was challenging (Du Preez, 2018). In addition, the prospective mathematics teachers recognised their previous mathematics teachers' impact on them, coupled with their past experiences during their schooling that had influenced them to become mathematics teachers (Du Preez, 2018). The mathematics student teachers acknowledged "the mostly positive impact of their mathematics teachers, as well as their own experiences at school, in their decision to become mathematics teachers" (Du Preez, 2018: 7). The teachers in Du Preez's (2018) study were influenced the most by *intrinsic factors* followed by *altruistic factors*. Therefore, it is presumed that teachers in Du Preez's (2018) study were positively influenced to become mathematics teachers to satisfy their ERG needs.

According to Ngoepe (2014), the prospective mathematics teachers at a tertiary level were intrinsically influenced to choose mathematics education as a career due to influences such as an affection for mathematics, an adoration of mathematics and of teaching mathematics, understanding mathematics and liking mathematics, enjoyment of teaching mathematics, apprehension of mathematics since their school days, the essence of mathematics, willingness to obtain a qualification and the significance of mathematics. The prospective mathematics teachers chose mathematics education as a career voluntarily which was rare in the recruitment of mathematics teachers on previous occasions (Ngoepe, 2014). The teachers in Ngoepe (2014) were influenced by *intrinsic factors*; therefore, it is presumed that they were positively influenced to become mathematics teachers to fulfil their ERG needs.

According to Akkoc and Yesildere-Imre (2017), the teachers were influenced to become mathematics teachers by intrinsic factors (self-determination), the influence of others (the way mathematics teachers used to teach them) and "fall back career" (insufficient qualification scores for a first career choice)

According to Mudzielwana (2015), the prospective teachers were subjected to both good and bad influences determining their choice of mathematics and a teaching career. Factors such as the *past events or experiences* (knowledge which student teachers already possessed when they came into teaching) might have played an exhilarating role in their lives (Mudzielwana, 2015).

It could be safe to state that the possible factors that influenced the teachers to choose mathematics education as a career ranged from *intrinsic factors*, *altruistic factors*, "past events or experiences" to "the influence of others" as was presented by the literature studied. Therefore it is safe to state that mathematics teachers could have been positively influenced to become mathematics teachers in SA (i.e. mainly influenced by *intrinsic factors*, *altruistic factors*, "past events or experiences" to "the influence of others" in that sequence*)*. The question of "the influence of others" might not necessarily be by direct means, it might be by indirect means. *Extrinsic factors* seemed to have contributed the least to the teachers' influence in becoming mathematics teachers, although they were not indicated in both the researches reviewed. In SA, teaching have some *extrinsic* benefits ranging from teaching being a secured job, some benefits such as a 13th cheque, medical aid benefits and many holidays. The teachers seemed to have been influenced to choose mathematics education as a career by *intrinsic factors*, *altruistic factors*, *extrinsic factors*, "past events or experiences" and "the influence of others" for their *socialisation influences*, *task demand*, *task return*, *self-perception*, *intrinsic value*, *personal utility value*, *existence*, *relatedness* and *growth* needs.

According to Markovits and Kartal (2013), the majority of the prospective teachers in Israel and Turkey were influenced to choose teaching as a career mostly by *altruistic factors* and the least by a "fall back career". According to Balyer and Ozcan (2014), the categories of prospective teachers' influences to choose teaching as a career were *altruistic-intrinsic*, *extrinsic* and being influenced by *others.* Balyer and Ozcan (2014) stated that many student teachers seemed to have some composite reasons for choosing the teaching profession as a career namely; "*altruistic–intrinsic reasons"* (a combination of *altruistic* and *intrinsic reasons* but dominated by *altruistic reasons*), *extrinsic reasons*, *self-realisation* (fulfilment of one's own potential) *reasons*, *material reasons*, and influence by

some people. According to Massari (2014), the prospective teachers were influenced to choose teaching as a career the most by *altruistic reasons* (teaching profession, adoration of children and communal duty for raising the young) followed by *intrinsic* and lastly *extrinsic reasons.*

Yuce et al. (2013) asserted that prospective female teachers were influenced by *intrinsic*, *altruistic*, and *influence-based* [not based on personal profit and money] factors and their counterparts were mostly influenced by *mercenary-based* [based on personal profit and money] *extrinsic* motivation. According to Amengual-Pizarro and Garcia-Laborda (2017), their findings revealed that in general prospective teachers were influenced the most by *intrinsic motivations,* followed by *altruistic motivations* and *instrumental reasons* (which they described as "the use of reason as an instrument for determining the best or most efficient means to achieve a given end") by both male and female participants to go into teaching. According to Charalambos (2017), the love for children and the influence of former teachers on their participants were the most key factors for choosing teaching as a career. In essence, it could be presumed that the teachers were influenced the most by *intrinsic factors* and by their *former teacher*.

Ebru, (2012) indicated that one-quarter of participants in the study were influenced by a "fall back career" as their university entrance exam scores were not high enough for their intended career choices.

According to Baran, Maskan and Baran (2015), the significant number of teachers revealed that they chose teaching voluntarily, followed by choosing it inadvertently, then by perceiving it as a secured job and by believing that it was their family's importunities with a few choosing it for good remuneration. In essence, it is presumed that the teachers were influenced to become mathematics teachers the most by *intrinsic factors* followed by a "fall back career", *extrinsic factors* (job security), influence by *their family* and the least by *extrinsic factors* (salaries).

According to Kecici (2019), all their participants mainly voiced employment stability, while engaging with children and youths was also attractive and motivating for them in becoming teachers. In essence, it is presumed that the students in Kecici's study were influenced the most by *extrinsic factors* followed by *altruistic factors*. According to Sayed and McDonald (2017), their participants were predominantly influenced by *extrinsic factors* (such as good salaries, job security

and the need “to function in a stable work environment”), followed by *intrinsic factors* (such as a passion for teaching) and the least by *altruistic factors* (such as “supporting and working with young children as well as doing good for society and the community”).

The picture that emerged from the literature review was that the possible factors that influenced students to become teachers were varied and complex, which could be attributed to ERG needs which are the drives of every teacher’s motivations. As it was said before, the possible factors that influenced teachers’ choice of teaching as a career could be comparable to those of choosing mathematics education as a career. It is safe to state that teachers seem to have been influenced by *intrinsic factors*, *extrinsic factors*, *altruistic factors*, “*past events or experiences” (*such as “prior teaching experiences”*)*, a “fall back career”, “the influence of others” and other pertinent factors to choose mathematics education as a career to satisfy their different ERG needs. The chronology of how the participants were influenced by which factors may be depended largely on the ERG needs, the demography, the period or era and other situations in which those participants found themselves. It is presumed that a similar sample from a different demographic area and from a different period or era might be influenced differently depending on their specific ERG needs. In this literature review, some different findings and conclusions were revealed from various studies that would direct the findings of this study.

2.5 THE STATE OF MATHEMATICS TEACHING IN SA

In the previous sections literature provided some insights into how peoples’ choices to pursue teaching as a career were influenced by numerous factors. At this stage it could be argued that the challenges facing mathematics teaching (and learning) in SA could have a silver lining when viewed through the lense of the theories framing this study. First there is a need to explore literature on the state of mathematics teaching (and learning) in SA. According to McCarthy and Oliphant (2013), in SA, unemployment rate of about 50% of the young people is perpetuated by incompetency in mathematics regardless of mathematics being the bedrock on admission to institutions of higher learning and the whole world’s knowledge oriented economy. Therefore, the recruitment of the positively motivated mathematics teachers should be perceived in a serious light. The

characteristics of the mathematics teachers such as those that are altruistically motivated would be the right tonic to resolve some of the challenges being faced in South African mathematics teaching. Altruistically motivated mathematics teachers may, among others, be characterised by attributes such as prosocial involvement which is a construct of concepts such as helping behaviour and prosocial behaviour. Bierhoff (2002) states that prosocial behavior is a particular kind of altruism that perpetuates selfless help for others influenced by internal influences such as concern, empathy, or by altruistic values.

According to Skemp (2008), the teaching of mathematics bestows potent course of action of creating intellectual regimen, inspiring rational infering and intellectual diligence to all globally. People with mathematical skills are able to solve the problems in their daily lives. The rate of unemployment in SA is on the increase every year, especially among young people. Therefore, the positive state of mathematics teaching in SA could provide some solutions to the different challenges encountered in the country.

The bedrock on different kinds of professions in the global community could well be established by the adequate and suitable mathematics teaching (Tella, 2008). It is still relevant even today; therefore, mathematics teaching should be a priority in different societies of the world. Very few of our young people in SA are becoming entrepreneurs, artisans, engineers, doctors and other mathematical careers. It is believed that the majority of these young people are not well equipped in mathematical skills. The country seems to be relying on foreign nationals for various important scarce skills. Learners should be imparted with the skills required to thrive in their potential future professions and endeavours.

The fundamental teaching of mathematics is essential in order to provide every citizen with the weaponry to tackle daily life challenges (Ojose, 2011). As stated by Steen (2001) almost two decades ago, the constructive teaching of mathematics would bestow science with a solid cornerstone potent for philosophies and warrant humankind a robust economy on top of commissioning citizens with the extent to sway their lives constructively.

Eight years ago, the South African government allocated a large portion of its budget to the education system but it was stll not yielding the much anticipated and admirable results (Modisaotsile, 2012). Education was one of the priorities of

the South African government (Presidency, 2017), but yet it is still not producing the required outcomes, especially the performance of learners in mathematics. Some of the rural schools are still affected by a lack of LTSM, leadership, commitment, parental involvement and community involvement, just to mention a few. The question is whether this state of affairs could have the potential to influence teachers to choose mathematics education as a career. It could be argued that due to their character as well as due to the scenario painted above, the altruistic or altruistic-intrinsic motivated mathematics teachers would be influenced to choose mathematics education as a career to improve the state of mathematics teaching in SA.

It was confirmed in the study conducted by Mogari (2014) that due to the examination that was approaching the teachers that attended the programme on the ethnomathematics approach reverted to their old fashioned way of teaching mathematics to prepare the learners well. The mathematics teachers only utilised the ethnomathematics approach perfectly when requested and then only for that matter and not in their everyday teaching (Mogari 2014), although it was thought that mathematics teachers would have passionately embraced the ethnomathematics perspective in their teaching, especially because that is what is endorsed and promoted by the curriculum. The weak academic achievement of learners in the Trends in International Mathematics and Science Study (TIMMS) (Mogari, 2014) and the local Annual National Assessments [ANA] (Mntunjani, Adendorff & Siyepu, 2018) seem to indicate that the South African teaching curriculum is less rigorous and demanding than that of some other countries in preparing the teachers' judgement.

Mogari's (2014: 21) study had demonstrated that mathematics teaching in SA was indeed different from other countries in the sense that more focus is on obtaining good grades in the examinations, as a result teaching is dominated by transmission of knowledge and learning is characterised by memorisation. Essentially, "the teaching of mathematics in South African schools was not portrayed as a practical activity, a resource or a social construct; instead, it was generally taught as an abstract body of knowledge where learners had to prove and memorise theorems, and solve problems by simplifying and finding the value of the unknown" (Mogari, 2014: 21).

Dhlamini and Mogari (2013) found that the group-work strategy for Grade 10 could adequately enhance learning for some particular mathematical content areas. Another factor that played a major part in the teaching of mathematics was to effectively find the strategies to enhance mathematics learning to enable learners to utilise the knowledge, skills and values acquired to tackle the endeavours of their everyday life (Mogari, 2014). However, it would appear that the teaching of mathematics had no bearing on learners' lives during or after their schooling, and this could possibly account, at least partly, for the rate of unemployment among youth in SA. Therefore, learners should be taught to be mathematical thinkers and problem solvers. Considering the view that there could be a silver lining in this state of affair, therefore, based on the underpinnings of altruism, one could argue that the state of mathematics teaching could impact on teachers' choice of mathematics education as a career. Prosocial traits that characterised altruism such as sympathy and being concerned with other people and acts of wanting to help, could influence teachers' choices to pursue mathematics education as a career.

According to Spaull (2011), the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) who administered tests for Grade 6 learners in 15 African countries, South African learners performed badly compared to learners from underprivileged countries such as Botswana and Zimbabwe. The rural learners were worst affected as they came in 12th out of 15 countries. Potgieter (2010) stated that only 17,4% of Grade 6 learners in the Western Cape province of SA were competent in mathematics in further benchmark tests in 2007 and 2009. The South African learners performed very bad than almost the learners from other countries, both developed and developing countries, in the comparative tests (Howie et al., 2007). This trend was also observed at the secondary school level in mathematics and science (Taylor, Fleisch & Shindler, 2007). Mji and Makgato (2006) revealed in their study that mathematics and science in SA were inadequately taught to learners in the class. The trend was prevalent among black South African learners as they could not read and understand the language of learning and teaching (LoLT) of mathematics.

In Figure 2.3, the ANA results showed that Grade 9 performed very poorly compared with Grades 3 and 6. It also indicated that the other two grades showed

some improvement over the years, while the performance of grade nine was declining.

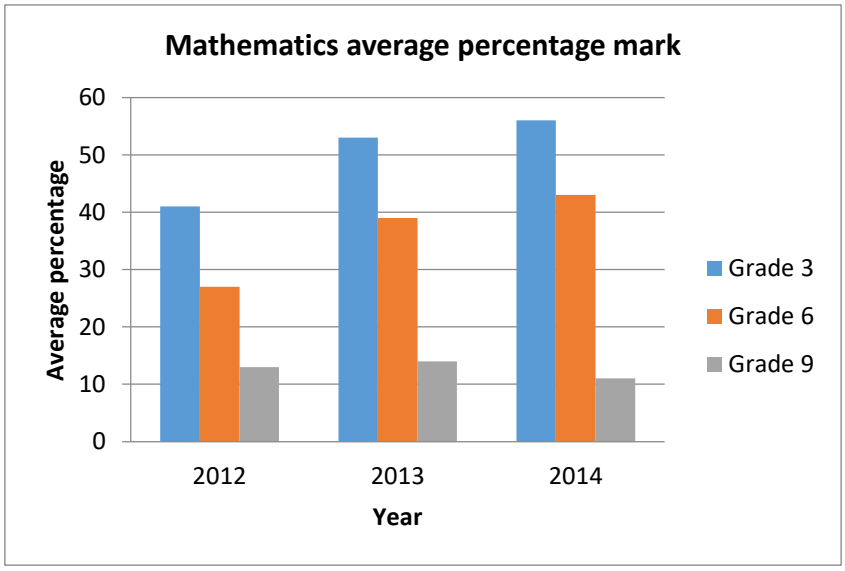

Figure 2.3: Report on the Annual National Assessment of 2014 (DBE, 2014)).

Grade 9 is the threshold to the FET classes, whereby the learners should select subjects according to their future career choices. Given this scenario, it is presumed that such learners would find it hard to choose mathematics as a major subject in FET.

Contrary to ANA results shown in Figure 2.3, the National Senior Certificate (NSC) mathematics results were showing some improvements from 2013 to 2017, according to the NSC Schools Subjects Report (see Figure 2.4) (DBE, 2017).

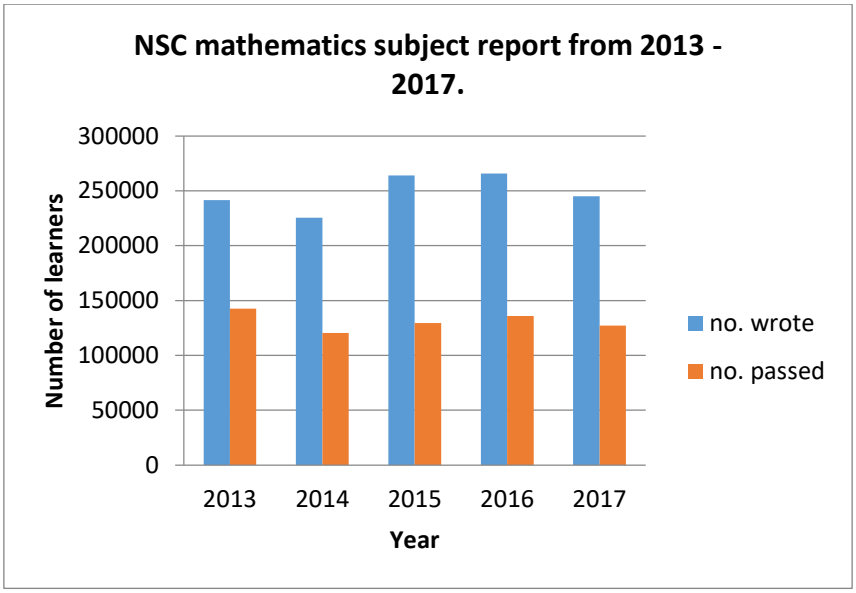

Figure 2.4: NSC mathematics results from 2013 to 2017 (Source: DBE, 2017)

In Figure 2.4, the number of learners that wrote mathematics in the NSC showed some sign of improvement. It showed that more learners were choosing mathematics in the FET. The results showed some insignificant small fluctuation. The learners' mathematics subject pass was improving; the question would be whether the results could be qualified or not. Given the seemingly bleak picture/scenario presented above, and the character of altruistically motivated teachers who are mainly driven by empathy, sympathy and generally prosocial outlook, they are likely to be influenced by drive to assist the situation characterised by unsatisfactory average performance of learners in mathematics in SA.

The learners' performances did not paint a good picture qualitatively either, one could ask what the reasons could be. According to Tachie and Chireshe (2013), the learners' performance in mathematics was attributed to external factors namely; poorly qualified mathematics teachers and lack of LTSMs (such as textbooks for mathematics). It also emerged from Tachie and Chireshe's (2013) study that students attributed their poor performance of mathematics to teachers' misconduct such as absenteeism, verbal abuse of learners and not inspiring them. Some teachers allegedly came to work under the influence of alcohol, mindless of their daily duties, while others were accused of discouraging learners in spite of learners providing the correct solutions during the class discussions.

In Figure 2.5, the responses to the statement “learners fail mathematics because the classroom environment is not always stimulating”, showed that the participants agreed that learners failed mathematics because the classroom environment was not always stimulating.

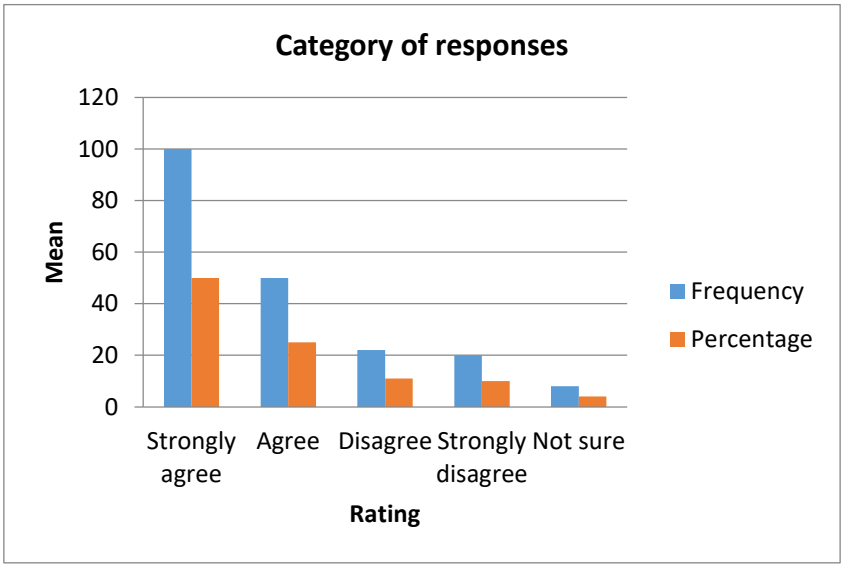

Figure 2.5: Response to the question: "Learners fail mathematics because the classroom environment is not always stimulating" (Source: Tshabalala & Ncube, 2012)

Figure 2.5. shows the responses of the participants to the survey of why learners fail mathematics by Tshabalala and Ncube (2012). The majority of the responses shows “strongly agree” that classroom environment is not always stimulating during mathematics teaching and learning.

It is presumed that maybe the relevant LTSMs of mathematics were not available to the learners in the classroom. Given the not so conducive classroom environment and the attributes of altruistically motivated mathematics teachers, this could be another situation that could have a propensity to attract people with altruistic orientation to pursue mathematics education as a career to improve the classroom environment for the sake of the learners’ performance.

In Figure 2.6, responses to the statement: “teachers are not competent to teach mathematics”, showed that the participants were also in agreement that teachers were not competent to teach mathematics. It is presumed that because of the shortage of mathematics in South African rural schools, every teacher would be given a mathematics subject to teach even when not properly qualified.

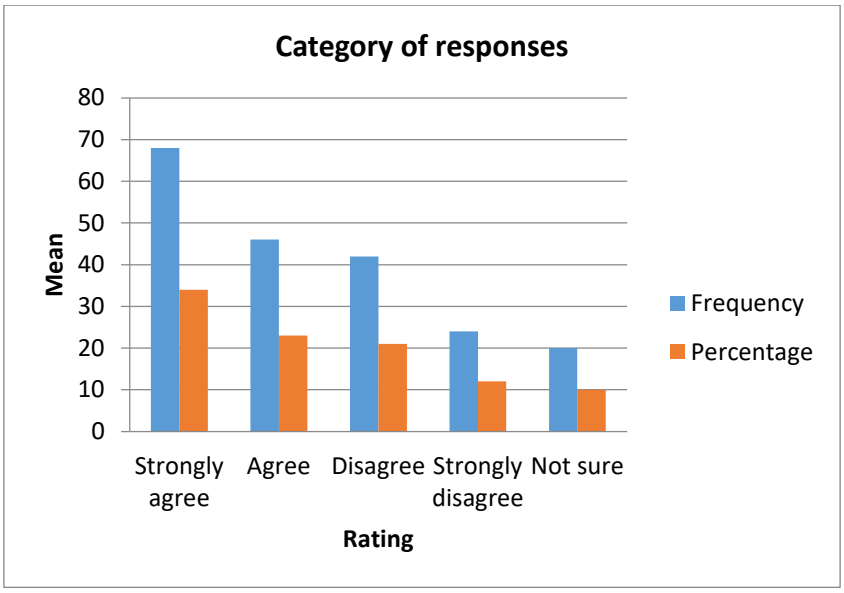

Figure 2.6: Responses to the statement: "Teachers are not competent to teach mathematics" (Source: Tshabalala & Ncube, 2012)

Figure 2.6 shows the responses to the statement that “teachers are not competent to teach mathematics” by Tshabalala and Ncube (2012). The majority of the responses shows “strongly agree” that “teachers are not competent to teach mathematics”.

Almost two decades ago, De Wet (2004) had found that some South African secondary school teachers were compelled to teach subjects they were not qualified to teach with little enthusiasm for the content knowledge of the subject. Spaull (2013), almost 10 years later to De Wet’s (2004) study, stated that many South African Grade 6 mathematics teachers’ content knowledge of Grade 6 mathematics was inadequate, the majority of them were unable to respond to activities meant for their learners, according to an analysis of the SACMEQ test.

This study concurred that teachers’ content knowledge needed to be developed and capacitated in different content knowledge and skills. It is presumed that the learners should also acquire the necessary literacy and numeracy skills at an early age to enhance their grasp of the content knowledge and skills at a later stage in their schooling. The teachers struggled under the conditions they were working in such as the progression of learners stipulated in the National Policy Pertaining to Programme and Promotion Requirements (NPPPPR), the teacher-pupil ratio, the workload, a lack of LTSMs and overcrowding just to mention a few.

According to Pretorius (2008), more than a decade ago, there was a teacher shortage in SA in particular, especially in rural areas, in subjects such as mathematics, physical science and technology. The phenomenon led SA to hire teachers from foreign countries, among others from Zimbabwe. According to the DHET's (2013) report, some of the subjects that were mainly offered by foreign teachers were English, geography, life sciences and mathematics. De Villiers (2007) stated that there were about 10 000 foreign teachers in SA by 2004, 4 000 were approximated to be mathematics and science teachers.

This study argued that those who obtained good mathematics grades in their NSC exams, opted for different mathematical career choices than teaching. The government introduced the FLB Scheme to recruit more teachers (see Figure 2.7).

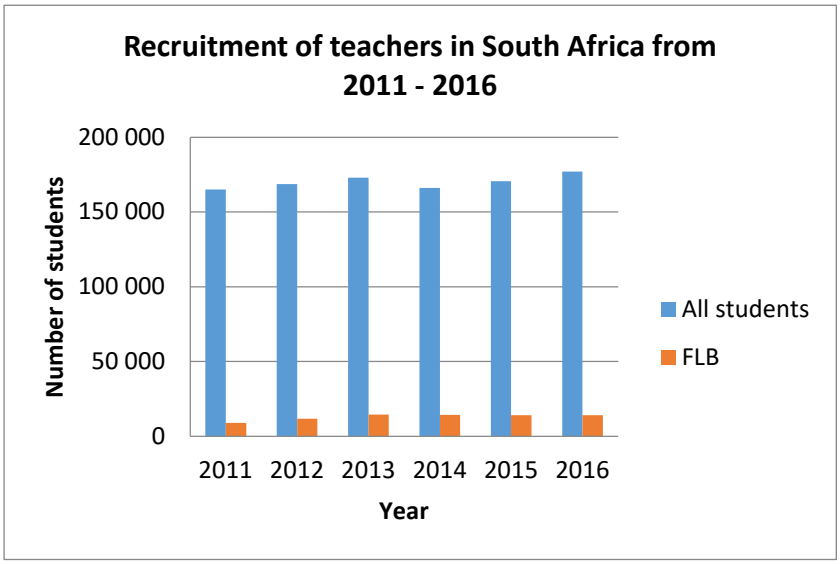

Figure 2.7: Recruitment of teachers in South Africa from 2011 - 2016 (Source: DHET, 2018)

Figure 2.7 shows the recruitment of teachers in SA from 2011 – 2016 in which the students holding the FLB increased since 2011. The bursary scheme was being utilised for teachers training. The percentage increased from 2011 to 2014 and declined insignificantly in 2015 and 2016.

Based on the scenario given by Pretorius (2008), DHET (2013) and De Villiers (2007) and the character of the altruistically motivated mathematics teachers, it would be safe to assume that teachers have been *altruistically* influenced to become mathematics teachers by their own choices not by being influenced by extrinsic factors such as funding to address the teacher shortage.

The explicit requirements and guidelines for teacher qualifications and learning programmes are provided for in the policy document to redress the South African mathematics teachers' inadequate content and conceptual knowledge (De Clercq, 2013). It is presumed that the South African government had to train the teaching workforce qualitatively to make the teaching and learning process envied in the public sector. The middle and high-class families seem to take their children to expensive independent schools to avoid alleged poor mathematics teaching and learning at the public schools. The state must make sure that all the mathematics teachers are properly qualified to offer the mathematics subject. Given the bleak scenario of poor mathematics content and conceptual knowledge and the attributes of altruistically motivated mathematics teachers, it could be safe to state that teachers seem to have been *altruistically* influenced to become mathematics teachers by the government's role in the provision of opportunities for development to the underdeveloped mathematics teachers for them to uplift the standard and quality of mathematics teaching at public schools.

2.6 CONCLUSION

This chapter on literature review discussed the international perspectives on the teaching profession, the state of mathematics teaching in SA and the possible factors that influence teachers' choice of teaching as a career. The focus of this study was on the question "Why do teachers choose mathematics education as a career?" We looked at the teaching profession of countries around the worlds to learn how the perception of the teaching profession influenced mathematics teachers to choose mathematics education as a career. The reasons seemed to range from *intrinsic*, *extrinsic*, *altruistic*, prior teaching experiences, "the influence of others" to a "fall back career" and other pertinent factors depending on the country. Teachers are driven and triggered by their needs to be influenced in a particular way (for instance, altruistically, intrinsically and others) to make their own career choices. Altruistically or intrinsically influenced mathematics teachers would be critically sought and recruited to improve the people's lives among the nations of local and global communities.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

The aim of this research called for an empirical understanding of a research methodology that could be utilised to find, among others, factors that influenced teachers to become mathematics teachers. Therefore, to answer the primary research question of this study, “Why do teachers choose mathematics education as a career?” and also to address the purpose of this study, specific research paradigm, research method and research design have been utilised. According to Creswell (2008), any study to be undertaken requires the utilisation of numerous research procedures and research practices (e.g. qualitative, quantitative or mixed methods). The quality of the study findings hugely depends on the methodological procedures followed in that specific study whether it be qualitative, quantitative or mixed methodologies, while its validity hugely depends on how data has been gathered (e.g. by survey questionnaires, interviews or observations) (Babbie & Mouton, 2001).

In this chapter, the research paradigm, research method and research design are presented and discussed. In this study, MMR was utilised. Both the quantitative data and the qualitative data were collected sequentially to answer the main question. The data collection methods and instruments are presented and discussed briefly for both the quantitative and qualitative methods. The population, sample, data analysis, methodological norms, the role and reflexivity of the researcher and ethical considerations are also presented and discussed.

3.2 RESEARCH PARADIGM

According to Morgan (2007: 50), “research paradigms are shared belief systems that influence the kinds of knowledge researchers seek and how they interpret the evidence they collect”. Creswell and Plano Clark (2011) maintain that a research paradigm is perceived as a research phenomenon comprised a worldview and researchers’ ontological, epistemological and methodological assumptions. Essentially, these assumptions translate to the nature of reality, how knowledge is constructed, and the process of research respectively. A pragmatic paradigm was adopted in this study.

A pragmatic paradigm is a deconstructive paradigm that promotes the use of MMR, “evading the controversial issues of truth and reality” (Feilzer, 2010: 8). According to Kivunja and Kuyini (2017), a pragmatic paradigm emanates from the discourse between researchers revealing that utilising a single paradigmatic inclination of a study would be inadequate to collect rich data needed to determine the solutions to challenges. According to Shannon-Baker (2016), a focal point of the pragmatic paradigm is to augment transferability of the solution brought upon by the strengths of integrating both the quantitative data and qualitative data in a single study. In a pragmatic paradigm the researcher utilises “what works” to acquire responses to a research question in a study (Creswell & Plano Clark, 2011).

This study utilised a pragmatic paradigm to determine practical answers for the question “Why do teachers choose mathematics education as a career?” and determine the useful meanings.

3.2.1 Ontology

Okeke and van Wyk (2015) define the term ontology as the speciality of bestowing issues of physical being and the determination of whether the physical being is partial or impartial. It explores “the nature of reality and what is real”, as well as the assumptions that researchers make when they conduct their studies (Creswell & Plano Clark, 2018: 37).

According to Creswell (2013), in a pragmatic paradigm, ontology is grounded on both exceptional and collective realities. In this study, the nature of reality was based on the perspectives of the sub-sample’s interviews to explain the survey results. The singular realities were explored through a survey (quantitative aspect of the study), and the multiple realities emerged from the interviews (the qualitative aspect of the study).

3.2.2 Epistemology

The term epistemology is the discipline of consciousness, what true consciousness would be, the reliability of assertions about consciousness and relates to how a researcher comes to know it for a specific discipline and what that consciousness constitutes (Okeke & van Wyk, 2015). Bryman (2008) defines

epistemology as an issue in which the inquiry of what is (or should be) is considered to be an admissible philosophy in a speciality.

According to Creswell (2013), in a pragmatic paradigm, epistemology is grounded on feasibility, whereby the researchers gather data by “what works” to respond to the research question. The survey questionnaires and interviews protocol were utilised sequentially to address the research question.

3.2.3 Methodology

According to Oso and Onen (2011), methodology is the speciality of directing research and a comprehensive course of action utilised to respond to the research question. Okeke and van Wyk (2015) define methodology as the best plan of action that could be utilised by researchers for gaining consciousness.

According to Creswell (2013), methodology is utilised to conduct the gathering of both the quantitative and qualitative data and subsequently integrate the data in a pragmatic paradigm. Both quantitative data and qualitative data were collected in this study. The two sets of data were collected sequentially, the first phase was utilised to collect and analyse the quantitative data, the second phase was to collect and analyse the qualitative data. The qualitative data was then utilised to arrive at an in-depth explanation of the quantitative data.

This study valued both the subjective (by means of interviews) and objective (by means of survey questionnaires) approaches to determine the responses of the primary research question.

3.3 RESEARCH METHOD

According to Myers (2009: 28), “a research method is a strategy and inquiry which moves from understanding assumptions to research design and data collection.” A research method (e.g. qualitative, quantitative or mixed methods) is a prototype of carrying out a study following the ambience of a particular paradigm (Sarantakes, 2005). This study utilised the MMR approach.

The MMR means the integration of quantitative and qualitative designs that eventually yield a comprehensive grasp of a research problem instead of utilising quantitative or qualitative approaches in isolation (Denzin & Lincoln, 2013). In the MMR, the researcher integrates both quantitative and qualitative data to bestow

the consolidated understanding of a research problem (Creswell & Plano Clark, 2007). The discernment, typically, of the MMR is to convey that numerical data is collected and analysed in a quantitative approach and narrative data in a qualitative approach (Hayes, Bonner, & Douglas, 2013). In the integration of quantitative and qualitative data gathering, the vigour of both the quantitative and qualitative approaches is utilised to reduce their shortcomings yielding the comprehensive grasp of the subject being explored (Scammon et al., 2013). According to Creswell and Creswell (2018), the practical level of utilising MMR is because it provides an advanced and compounded approach to a study that attracts the researchers on the spearhead of the new research procedures. At the operational level, MMR is a convenient plan of action to obtain comprehensive grasp of research problems by complementing quantitative data with a qualitative follow-up data collection and analysis (Creswell & Creswell, 2018).

This study utilised both the quantitative and the qualitative research methods to minimise the limitations of both the approaches if either of them were utilised in isolation. The results of quantitative research were then explained by the qualitative questions in the interview protocol. MMR was chosen to enable a more comprehensive and complete understanding of the primary research question in this study. The MMR was utilised to assist in explaining in more detail the factors that influenced the participants to become mathematics teachers. The qualitative findings were utilised to corroborate and explain the findings of the quantitative data. The MMR in this study increased the usefulness and credibility of the results found.

3.4 RESEARCH DESIGN

An explanatory sequential design was utilised that involved the gathering and analysis of quantitative data followed by a gathering and analysis of qualitative data with the focus of utilising qualitative results to assist in describing and elucidating the findings of a quantitative phase (Creswell, 2014). The quantitative data was collected in the first phase of this study from 57 FET mathematics teachers at the secondary schools of the selected cluster in the Vhembe District to investigate the question, “Why do teachers choose mathematics education as a career?”. In the second phase of this study, the qualitative was collected as a follow-up to help explain which group of factors, *intrinsic*, *extrinsic*, *altruistic*, “past

events or experiences" and "the influence of others", influenced the participants to become mathematics teachers. In this exploratory follow-up, the tentative plan was to explore which of these factors influenced the participants to become mathematics teachers by conducting interviews with nine FET mathematics teachers at the secondary schools of the selected cluster in the Vhembe District.

Yin (2009) defines research design as mainly initiating a structured articulation which undertakes the correlation among the research's primary research questions and verifiable data gathered within the study conducted. The intent of this study was to expand on the initial quantitative findings of the first phase of data collection through a second qualitative research phase to provide a more in-depth understanding of the quantitative data. The timing was sequential; the quantitative data was collected and analysed first, followed by the qualitative data collection and analysis. The combination of the two data sets occurred during the data collection and analysis stages. The quantitative and qualitative data were connected between the two phases because the selection of participants and the compilation of the interview questions were finalised after the information from the quantitative data was reviewed. Then the findings from the two phases were integrated during the interpretation stage. In that light, an explanatory sequential design was seen to be appropriate to help interpret the findings, and it was utilised.

Explanatory sequential design is a design often utilised in MMR to seek data from people from an indestructible quantitative framework or in areas comparatively new to qualitative research (Creswell, 2014). According to Creswell, "explanatory sequential design consists of a two-phase project in which the researcher collects quantitative data and analyses the findings in the first phase". Creswell continues by stating that the researcher then, informed by the findings of the first phase, plan and construct the second qualitative phase to complement the first phase. In this research design, the quantitative findings typically strongly suggest the types of participants that should be purposefully selected in the qualitative phase and types of questions that should be directed to the participants to clarify and explain the findings of the first phase (Creswell, 2014: 224). According to Creswell (2014), the distinctive course of action in the explanatory sequential design could necessitate gathering quantitative data and analysing it in the initial phase and further pursuing

qualitative data in the subsequent phase to assist in annotating the quantitative responses. The justification of utilising the explanatory sequential design, according to Creswell (2014), is basically to have the qualitative data assisting in annotating the primary quantitative results comprehensively.

The explanatory sequential design was utilised to explain the quantitative data collected and analysed in more detail according to the factors that influenced the participants to become mathematics teachers by adding the insights obtained from the collection and analysis of the qualitative data. Both the quantitative and qualitative methods were equally prioritised in this study. The qualitative data was collected by means of interviews to explain the quantitative findings previously collected via a survey. Nine participants were interviewed to explain the findings of the survey previously conducted with 57 respondents. The explanatory sequential design started with the collection of quantitative data and its analysis, and then qualitative data was collected and analysed to explain the findings of the quantitative data initially collected (see Figure 3.1).

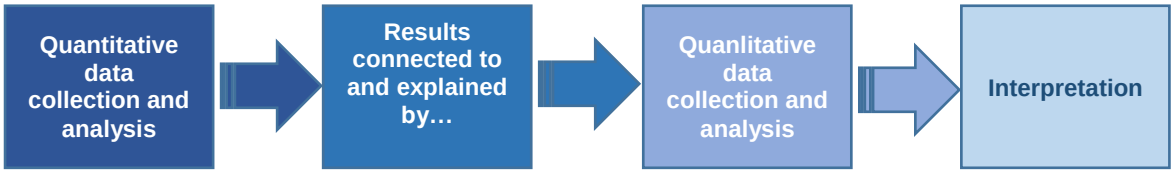

Figure 3.1: The Explanatory Sequential Design (Adapted from Creswell & Plano Clark, 2011)

Figure 3.1 shows that Phase 1 would be the quantitative data collection and analysis. The quantitative findings would be connected to the qualitative data collection and analysis to explain the quantitative findings in-depth. The findings would be interpreted according to the three different cohorts in the narratives.

3.5 DATA COLLECTION

The data collection was accomplished by employing two distinct phases. The first phase was used to collect and analyse the quantitative data through the use of a survey, with qualitative sampling done in in the second phase through interviews. The qualitative data collection built directly on the quantitative findings and complemented it. During the follow-up qualitative data collection, the respondents

were grouped into different cohorts and conducted qualitative data collection with individuals representing each of the cohorts. The data collection methods were accomplished through surveys in the quantitative phase and interviews in the qualitative phase.

3.5.1 Survey

According to Scheuren (2004), a survey is a technique of gathering data from a sample of individuals. A survey is a research technique whereby quantitative data is structurally gathered from a huge sample obtained from a population (De Leeuw, Hox & Dillman, 2008). A survey in a study is considered to be an excellent technique of gathering data from a sample of individuals focusing on apprehension of their intentions, proficiency, emotions, beliefs, convictions and self-reported conduct (Neuman, 2006). The results from data gathered by the utilisation of survey technique could be brought into play to propose possible causes for a certain connection and to provide prototypes of those connections (Saunders, Lewis & Thornhill, 2012).

A survey was utilised to empirically explore the factors that influenced teachers to become mathematics teachers. The data collection instrument in the survey was a questionnaire.

Parahoo (2008) defines a questionnaire as a data gathering tool in a study comprising questions with directions on how to record the answers. The questionnaire was mostly designed to be completed by the respondents themselves. The respondents complete the answers and return the questionnaire. In most cases, the questionnaire gives rise to commensurate data (Parahoo, 2008). The utilisation of questionnaires in the study could be justified based on the fact that they are tools through which participants could supply basic personal or demographic information about themselves (Creswell, 2008). The questionnaires were therefore utilised for collecting data mostly about the level at which the teachers rated factors that influenced them to become mathematics teachers.

The survey questionnaire was piloted to refine it. A pilot study necessitates conferring the data gathering tool to a small sample of individuals bearing similar attributes with the target sample (Watson, Mckenna, Cowman & Keady, 2008). The purpose of the pilot study was to refine the data collection instrument and the

survey questionnaire. The research questionnaire was constituted of six themes (see Annexure H).

3.5.2 Interviews

According to Holstein and Gubrium (2003: 3), “interviewing in qualitative study means a unique form of conversation that provides the researcher with empirical data about the social world”. According to Creswell (2008), interviews are considered one of the most suitable techniques of data gathering as they give the researcher the chance to either hold face-to-face or telephone conversations with individuals who could best provide data on the *what* and *how* of the research problem. This study was conducted by means of individual telephone interviews structured in narratives. Interviewing had to be utilised because it was a distinctive research technique used as a means of gathering information that had a direct bearing on the research objectives, explaining the results found in quantitative phase in more detail. The telephone interviews were recorded. The research interview protocol was made up of five research questions (see Annexure I).

3.6 SAMPLING

This study was conducted at the secondary schools of the selected cluster in the Vhembe District of the Limpopo Province. The population was a group or subset of the Vhembe District FET mathematics teachers. The district is made up of six clusters. The FET mathematics teachers of the cluster in this study were the subset and the representative portion of the population from which the researcher intended to generalise the findings. The cluster was in the researcher’s proximity. According to Creswell (2008), a population is the class of individuals bearing similar attributes which the researcher would recognise and explore. The sampling procedure for the two phases was conducted, utilising convenient sampling for the quantitative phase and stratified random sampling for the qualitative phase.

Sampling was a convenient sampling for the first phase, the quantitative phase. According to Creswell (2008), a convenient sample is a non-probability sampling method in which the respondents or subjects are selected based on their convenient accessibility and proximity to the researcher. The sample was selected from a population of FET mathematics teachers at the selected cluster in the Vhembe District of Limpopo Province. The respondents were sampled by

communicating with their schools' principals to find what band (GET or FET) they were teaching and their total number. It was found that the cluster had 62 FET mathematics teachers altogether. Of the 62 FET mathematics teachers, five were foreign nationals, and 57 were South Africans. The five foreign nationals were excluded from the sample because this study was only based on South African FET mathematics teachers. The 57 FET mathematics teachers were sampled to conduct the survey. The sample was a subdivision and a representative segment of the population from which the researcher intended to generalise the results (William & Stephen, 2005).

The sampling for the second phase, the qualitative phase, was a stratified random sampling. According to Onwuegbuzie and Collins (2007: 285), stratified random sampling means "a sampling procedure in which the sampling frame is divided into subsections comprising groups that are relatively homogenous in respect of one or more characteristic with a random sample selected from each stratum". All 57 survey respondents were categorised into three different cohorts, Cohort 1: FET mathematics teachers that assumed teaching on or before 1994; Cohort 2: FET mathematics teachers that assumed teaching after 1994 to 2007; Cohort 3: FET mathematics teachers that assumed teaching after 2007. The numbers representing each respondent were put into three separate bowls according to their cohorts for simple random sampling. Three prospective interviewees were randomly selected according to the three cohorts. A total of nine was selected from the three different cohorts. The nine were then given some pseudonyms that they agreed upon.

Essentially, in Phase 1 there were 57 FET mathematics teachers from the population who responded to the survey questionnaires about the research question, "Why do teachers choose mathematics education as a career?"

During Phase 2 there were nine FET mathematics teachers who were interviewed to answer the research question, "Why do teachers choose mathematics education as a career?"

3.7 DATA COLLECTION PROCEDURE

According to Leedy and Ormrod (2013), the data in a research study means information obtained during the investigation or study by means of data gathering

tools. A data gathering tool is a mechanism that could be utilised to gather data such as questionnaires, tests, structured interview schedules and checklists (Teddlie & Tashakkori, 2009).

In this study, two instruments were utilised to gather the data, namely:

- Completion of the survey questionnaires: The participants completed the survey questionnaires in Phase 1 to answer the primary research question: "Why do teachers choose mathematics education as a career?" (see Annexure H)
- Interview protocol: The stratified randomly sampled participants were interviewed in Phase 2 to answer the primary research question, "Why do teachers choose mathematics education as a career?" (see Annexure I)

The survey questionnaires for answering the research question were administered to 57 FET mathematics teachers in Phase 1. The survey was conducted cross-sectional. All the 57 survey questionnaires were distributed to the respondents, site by site, and were collected immediately after the respondents completed them. The completed survey questionnaires were then analysed. The findings informed the qualitative data collection instrument, the interview protocol.

The in-depth interviews were conducted with nine FET mathematics teachers of the three different cohorts in Phase 2 (Cohort 1: Three FET mathematics teachers that assumed teaching on or before 1994; Cohort 2: Three FET mathematics teachers that assumed teaching after 1994 to 2007; Cohort 3: Three FET mathematics teachers that assumed teaching after 2007). The interviewees were interviewed telephonically. The conversations were recorded for data analysis purposes.

3.7.1 Data analysis

The researcher utilised the IBM SPSS Statistics version 25 to analyse the data from the survey. The quantitative data was represented mainly in the form of figures and tables.

For the data from interviews, the researcher utilised the recordings of the interviews and transcribed them word for word. Narrative analysis was utilised to analyse the data. According to Maree (2007), narrative analysis means a diverse

plan of action for interpreting the narratives generated in research. The researcher identified common themes and statements related to the research question in participants' descriptions of their reasons. The focus was on common themes in the reasons supplied despite the diversity in the individuals studied.

The common themes that appeared in the reasons stated for becoming mathematics teachers in this study were the same as the ones in the theoretical framework; *intrinsic, extrinsic, altruistic*, "past events or experiences" and "the influence of others". The reasons gave some directions and directives about the new recruits and also about the learners' academic achievement in mathematics as a subject.

The responses were then categorised into *intrinsic*, *extrinsic*, *altruistic*, "past events or experiences" and "the influence of others" to become mathematics teachers. In the case of qualitative responses, the emerging themes, were also considered and added to the categories considered.

3.8 VALIDITY AND RELIABILITY

Validity and reliability were considered in this study. Validity is achieved through integrity, profundity, affluence, and the realm of the data gathered by a degree of triangulation (William & Stephen, 2005) while the impartiality of the researcher, prudent sampling and the participant approach also contribute to achieving validity. The researcher and participants agreed on the description or composition of events. The researcher was also the data collection instrument for ensuring the data reliability. As this study utilised the MMR, in this case, the validity and reliability of both the quantitative and qualitative phases were considered by the researcher. According to Maree (2016), validity is the degree to which a measuring mechanism measures what it is required to measure. Reliability is the degree to which a measuring mechanism is repeatable and consistent (Maree, 2016).

In the quantitative phase, the questionnaire was piloted to ensure validity and reliability. The pilot testing was done to confirm the content validity of the scores on the instrument, to provide a first determination of the internal consistency of the items and to enhance the questions, format and instructions where appropriate. Primarily this study comprised two separate questionnaires, namely demographic and research survey questionnaires. The Cronbach's Alpha value was calculated

on the research survey questionnaire to check its reliability. The Cronbach's Alpha values of the questionnaire were above 0.7; hence the questionnaire was reliable. The two questionnaires were combined to form the final research questionnaire to address its validity (see Annexure H). According to Creswell (2014), the experimental researchers should recognise some prospective threats to the internal validity of their experiments and plan them so that those threats would probably not come to light or be minimised.

According to Gibbs (2007), qualitative validity means the researcher examines the authenticity of the results by engaging a particular course of action and reliability designates that the researcher's approach is compatible across different researchers and in a variety of studies. The researcher did member checking upon the completion of the interview transcriptions. The participants were sent the transcripts of their respective interviews to check whether the information they had provided had been coded correctly and accurately. Corrections were made where required. The potential bias of the researcher is clarified in the discussion of the researcher's role and reflexivity in Section 3.9.

All the options for following up on the quantitative results were considered and weighed. The research questions for the qualitative phase interviews were based on the items that had p-values of less than 5% ($p<0.05$) and the other items with the p-value of more than 5% (without significant differences) were considered only when their p-values were less than 50% ($p<0.5$). The researcher's role and reflexivity were also taken into consideration by explicitly identifying the possible biases, values and personal background (such as gender, history, culture, socio-economic status) (see Section 3.9). The researcher also involved several investigators and peer researchers to assist with the interpretation of the data.

3.9 THE ROLE AND REFLEXIVITY OF THE RESEARCHER

The researcher in this study was a black South African male. He was raised by a single parent who was a shop assistant. He lived in a rural village at the cluster where this study was conducted. There were no tarred roads, electricity and water supply. The youth used to look after the cattle and goats, no entertainment at all. The researcher attended school at two of the secondary schools in this study. The schools had poor infrastructures.

The researcher's ambition was to become a medical doctor, a veterinary surgeon or a dentist. The researcher was unable to study either of those careers because of the shortage of mathematics teachers and the state of mathematics teaching by then. He did not obtain the required levels of achievement to pursue his dreams. By chance, he became a teacher, a mathematics teacher for the GET, teaching mostly in the senior phase (SP). He never had a motivation to pursue teaching, let alone mathematics teaching. He assumed a teaching career in 1995, teaching in overcrowded classrooms where at times movement was restricted to the chalk board only.

The researcher interacted with the majority of this study's respondents on several fronts, in sporting and cultural activities, union activities and mathematics curriculum matters.

The researcher had explicitly conducted both the quantitative and qualitative phases of this study and interpreted the findings. The researcher was emotionally detached from the interpretation of the responses. He only followed the predetermined themes from the literature and theoretical framework.

3.10 ETHICAL CONSIDERATIONS

According to Punch (2014), a study necessitates the gathering of data from people about people. The research participants need to be protected and trust must be established with them. The integrity of research had to be safeguarded and promoted, the researcher had to guard against misconduct and impropriety that could reflect on the institutions involved and cope with new challenges during the research (Israel & Hay, 2006).

The researcher first had to obtain permission for the research from the Research Ethics Committee of the University of Pretoria. After the application was reviewed and permission was granted, the researcher had to obtain permission from the structures in the Limpopo DBE and then from the principals of the secondary schools of the selected cluster in the Vhembe District for the research to be conducted at the relevant schools. After these permissions had been obtained, invitation letters were sent to the teachers selected as participants to contribute voluntarily to the research in the survey or the telephonic interviews. This arrangement is built on the perspective that researchers initially require access to

the research site and subsequently to the potential individual participants (William & Stephen, 2005).

Neuman (2014) states that informed consent is an accord by participants indicating that they are eager to engage in the project, and they understand the course of action of the study to be conducted. Informed consent entails the rights that the participants have "to know what the research is all about, how it might affect them, the risks and benefits of their participation, and the fact that they have the right to decline to participate or to discontinue their participation at any time during the process if they chose to do so" (Bless, Higson-Smith, & Sithole, 2013: 32). According to McMillan and Schumacher (2014), "informed consent is achievable by providing subjects with an explanation of the research, an opportunity to terminate their participation at any time with no penalty, and full disclosure of any risks associated with the study" (McMillan & Schumacher, 2014: 130).

McMillan and Schumacher (2014: 134) state that "confidentiality is that no one has access to individual data or the names of the participants except the researcher and that the subjects know before they participate who will see the data". According to Bless et al. (2013), confidentiality necessitates that the data the participants give, particularly delicate personal data, must be safeguarded and should not be made accessible to anyone except the researchers. Neuman (2014) stated that confidentiality could encompass data with participants' names attached; however, the researcher should hold the participants' names in confidence or keep them secret from popular divulgence. According to Mphahlele (2009), the researchers are accountable to safeguard the participants' confidentiality regarding individuals in the study.

The completed research questionnaires and the interview recordings were kept in a safe place. They could only be accessed under strict conditions and they would be held at the University of Pretoria Ethics Committee.

Anonymity is that people remain anonymous or nameless in communal documents and the produced data is edited to ensure that all details that would allow the identity of particular individuals from being known are removed (Neuman, 2014). According to Bless et al. (2013), anonymity encompasses that the participants' data must never be directly and evidently linked with their names or any other

identifiers. No names or personal information of the respondents were reflected in the responses, the respondents were either identified through their research numbers or research pseudonyms.

Consent letters explaining the topic and aims of this study were sent to all the respondents and the participants for review, and they were invited to ask any clarity seeking questions they might have before signing the consent forms and confirming if they were willing to participate in this study. The respondents and the participants were assured that participation in this study was completely voluntary and they were entitled to withdraw at any stage without incurring any penalties.

All the respondents were given consent forms approved by the University of Pretoria that clearly stated the goals and purpose of this study. The participants were ensured that the information that they gave would remain confidential. The survey questionnaires in the quantitative phase only utilised numbers for respondents' identification and code names (pseudonyms) were utilised for interviews in the qualitative phase.

3.11 CONCLUSION

This study aimed to investigate both the motivational factors and other pertinent factors that influenced teachers' choice of mathematics education as a career at the secondary schools of the selected cluster in the Vhembe District of the Limpopo Province. This chapter explained the methods and the processes through which data in this study was collected and analysed. In that light, the MMR utilised the explanatory sequential design, which in turn utilised the survey in the quantitative phase and the interviews in the qualitative phase. The target population were FET mathematics teachers at the selected cluster in the Vhembe District. The population constituted 62 participants from which 57 respondents were conveniently selected for the survey and later stratified and randomly selected for the interviews. Questionnaires and an interview protocol were utilised as techniques for data gathering and, above all, there were methodological norms, the role and reflexivity of the researcher and ethical considerations that had been considered.

CHAPTER 4: FINDINGS

4.1 INTRODUCTION

In this chapter, the findings of the pilot study, the quantitative research survey in Phase 1 and the qualitative interviews in Phase 2 are presented. The two phases, quantitative phase (Phase 1) and qualitative phase (Phase 2) were utilised to answering the primary research question, “Why do teachers choose mathematics education as a career?” The quantitative data is presented mostly in graphs and tables, and the qualitative data is presented in narratives.

The research questions were grouped into recurring themes to facilitate analysis of the information and to answer the research questions of this study. The findings made during the research and the associated recommendations are detailed below.

4.2 PILOT STUDY

The survey questionnaire was piloted. The main purpose of piloting the instrument was to determine the relevance and validity of the content and so validate the instrument, and to make changes where appropriate to optimise the questions, format and instructions. The pilot study necessitates conferring the data collection tool to a small sample of individuals bearing similar attributes with the target sample (Watson et al., 2008). The questionnaire was distributed to 26 participants, where 12 were males, and 14 were females. The Cronbach’s alpha (α) values of the themes *intrinsic factors*, *extrinsic factors* and *altruistic factors* were calculated (see Table 5.1). The Cronbach’s alpha values of the other two themes, “past events or experiences” and “persons or groups that influenced the participants to become mathematics teachers” were not calculated because the items in “past events or experiences” did not measure the same factor or variable and the theme “persons or groups that influenced the participants to become mathematics teachers” was about the ranking of items (see Appendix H). According to Tavakol and Dennick (2011), the Cronbach’s alpha is a measure used to assess the reliability to provide a measure of the internal consistency of a test or scale and was developed by Cronbach in 1951. It is expressed as a number between 0 and 1. The general rule is that a Cronbach’s alpha of 0.7 and above is acceptable and below 0.7 is unacceptable (Tavakol & Dennick, 2011).

Table 4.1: Research's motivational factors

Factors	Alpha (α) values
Intrinsic	0.939
Extrinsic	0.729
Altruistic	0.874

Table 4.1 shows the alpha values of the motivational factors. According to the table, all the Cronbach's alpha values for the three factors were above 0.7; therefore, it can be concluded that the questionnaire was reliable. From the pilot study, 46.2% of participants were male, and 53.8% were female. Therefore, testing for differences in the way male participants and female participants responded seemed feasible. Based on the analysis of the pilot, the modifications were effected on the survey questions (also see Annexure H).

Primarily there were two questionnaires, the demographic questionnaire and the survey questionnaire. The two questionnaires comprised different items. Therefore, the two questionnaires were combined to make one final survey questionnaire (see Annexure H). The modifications to the survey questionnaire are presented below. In the demographic questionnaire, the following items were deleted:

- **Marital status**
- **Home language**

Marital status and Home language seemed not to be of significance in this study. They were both not going to be utilised in either the discussions or the interpretation of data. The following items in the demographic questionnaire were corrected:

- **Age** was modified to be in the form of a question, i.e. "**What is your age in years**?"
- **Citizenship** was changed to **Nationality**
- **Resumption as teacher** was modified to **Assumption of duty as a teacher**

- Under the item “Resumption as teacher” the part **After 2007 funded by Funza Lushaka** was modified to **After 2007** (Some people studied for teaching in the period after 2007 funded by other sources beside Funza Lushaka) (see also the Figure 2.6).

The final questionnaire was made up of six themes, summarised in Table 4.2.

Table 4.2: Survey questionnaire Themes

Themes	Items covered
A (Demographic information)	A1 - A6
B (Intrinsic factors)	B1 - B9
C (Extrinsic factors)	C10 - C18
D (Altruistic factors)	D19 - D25
E (Past events or experiences)	E26 - E30
F (The influence of others)	F1 - F10

According to Table 4.2, Theme A (*Demographic information*) had six items running from A1 through to A6 (A1 - A6), Theme B (*Intrinsic factors*) had nine items running from B1 through to B9 (B1 - B9), Theme C (*Extrinsic factors*) had nine items running from C10 through to C18 (C10 - C18), Theme D (*Altruistic factors*) had seven items running from D19 through to D25 (D19 - D25), Theme E (*Past events or experiences*) had five items running from E26 through to E30 (E26 - E30) and Theme F (*Persons or groups that influenced the participants to become mathematics teachers*) had ranking items running from F1 through to F9/10 (F1 - F9/10).

4.3 PHASE 1: RESEARCH SURVEY

The research survey questionnaire was distributed to the sample of 57 FET mathematics teachers, to answer the main research question, “Why do teachers choose mathematics education as a career?” The respondents were supposed to respond to the research questions in the survey. Items A1 through to A6 were demographic items; the respondents were required to circle the appropriate

number in the box provided alongside the question (see Appendix H). Items in Theme (B) through to (E) were responded to by circling the relevant Likert scale ranging from *strongly disagree* (1), to *strongly agree* (5) in the survey questionnaire (see Annexure H).

Theme (B) and Theme (C) had nine items apiece to be responded to: (B1 – B9) and (C10 – C18) respectively, Theme (D) had seven items (D19 – D25) and Theme (E) five items (E26 – E30). Theme (F) was about ranking the persons or groups from (1) to (10), where (1) represented the person or group who influenced the respondents the most and (10) represented the person or group who influenced the respondents the least.

The findings of the survey were presented statistically through different graphs.

4.3.1 Overall findings across gender

The themes that were in the survey were the *intrinsic factors*, the *extrinsic factors*, the *altruistic factors*, “past events or experiences” and “influence of others”. The 57 participants (FET mathematics teachers) responded to the different themes in the survey questionnaire. The mean values of the Themes A to Theme D were calculated (see Figure 4.1) except Theme E (deals with ranking of items). If the mean value were below 3, the respondents tended to “disagree” or “strongly disagree” with the items, and if they were 3, the respondents were “unsure”. Alternatively, if the mean value was above 3, the respondents tended to “agree” or “strongly agree” with the items.

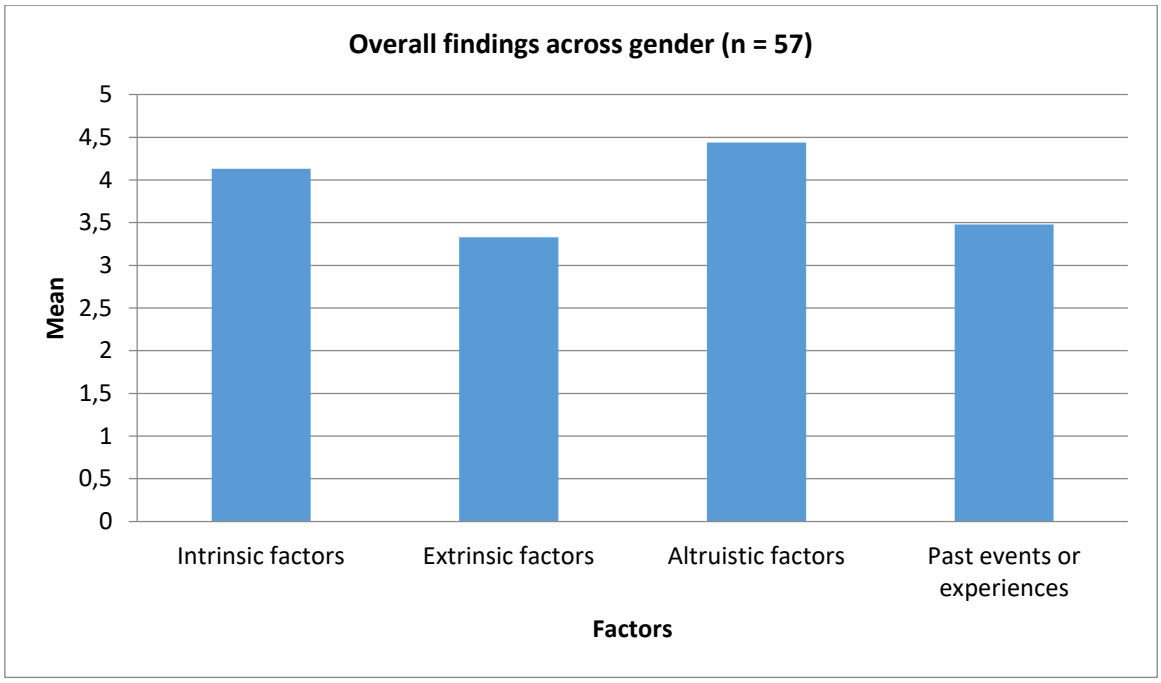

Figure 4.1: Overall findings across gender

According to Figure 4.1, in the overall findings across gender, the mean values of *intrinsic factors* were equal to 4.13 and of *altruistic factors* were equal to 4.44. The participants tended to "agree" that *intrinsic factors* and *altruistic factors* influenced them to choose mathematics education as a career. Intrinsic motivation is defined as the excitement that emanates from an individual's performance of duties at work (Lin, 2007). Altruism is defined as "a motivational state with the ultimate goal of increasing another's wellbeing" (Batson, 2008: 3). The mean values of the *extrinsic factors* were equal to 3.33 and of "past events or experiences" were equal to 3.48. Since these means are closer to 3, the participants tended to be "unsure" that *extrinsic factors* and "past events or experiences" influenced them to choose mathematics education as a career. Extrinsic factors are factors that focus on what an individual receives as incentives for performing some activities exceptionally at work (Lin, 2007). "Past events or experiences" are all the things experienced by the participants in this study in the past especially during their schooling years that might have had a bearing on their choice of mathematics education as a career.

4.3.2 Findings by the different cohorts

The 57 participants were categorised into different groups according to the period when they assumed their teaching careers. Three groups were established and

were referred to as cohorts. The concept cohort has different explanations in different contexts. In this study, a cohort refers to a group of FET mathematics teachers at the selected cluster in the Vhembe District of Limpopo Province. The three different cohorts were:

- Cohort 1 – FET mathematics teachers that assumed teaching on or before 1994.
- Cohort 2 – FET mathematics teachers that assumed teaching after 1994 to 2007.
- Cohort 3 – FET mathematics teachers that assumed teaching after 2007.

According to Figure 4.2, in Cohort 1 the mean values of *intrinsic factors* were equal to 4.16, of *altruistic factors* were equal to 4.23 and of "past events or experiences" were equal to 3.69. Therefore, the Cohort 1 participants tended to "agree" that they were influenced to choose mathematics education as a career by *intrinsic factors*, *altruistic factors* and "past events or experiences".

The mean values of *extrinsic factors* were equal to 3.41 in Cohort 1; therefore, the participants tended to be "unsure" if they were influenced by *extrinsic factors* to choose mathematics education as a career.

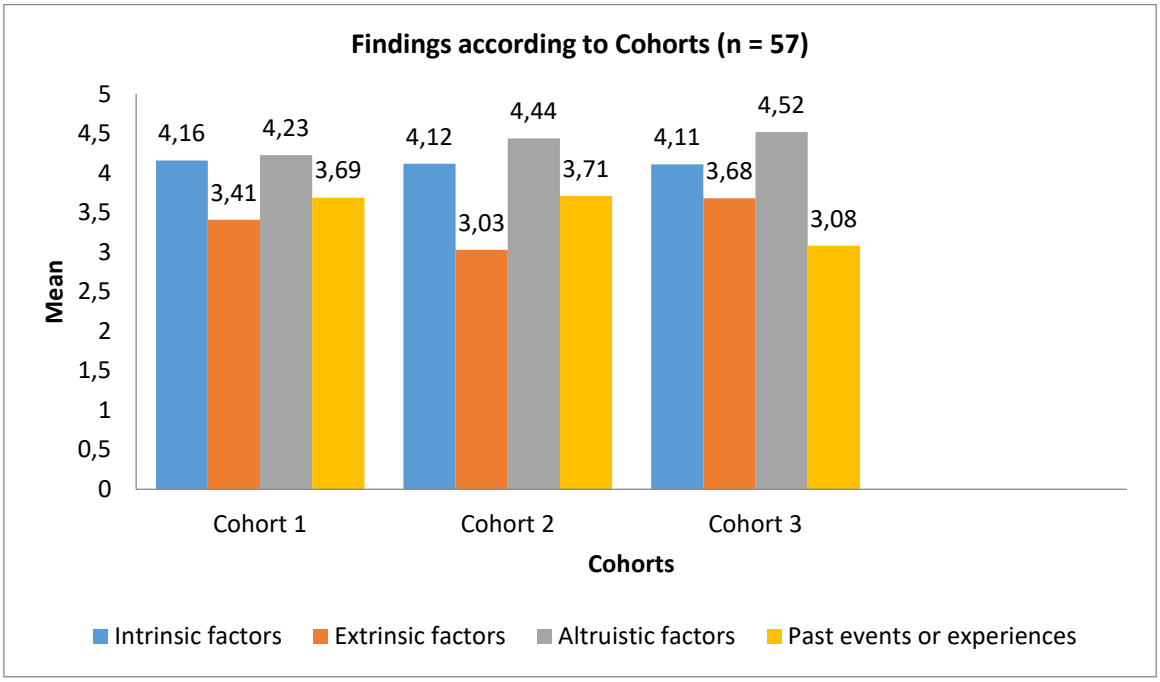

Figure 4.2: Findings according to different Cohorts

In Cohort 2 the mean values of *intrinsic factors* were equal to 4.12, of *altruistic factors* were equal to 4.44 and of “past events or experiences” were equal to 3.71. Therefore, the participants tended to “agree” that they were influenced to choose mathematics education as a career by *intrinsic factors*, *altruistic factors* and “past events or experiences”. The mean values of *extrinsic factors* in Cohort 2 were equal to 3.03; therefore, the participants tended to be “unsure” if they were influenced to choose mathematics education as a career by *extrinsic factors*.

In Cohort 3, the mean values of *intrinsic factors* were equal to 4.11, of *extrinsic factors* were equal to 3.68 and of *altruistic factors* were equal to 4.52. Therefore, the Cohort 3 participants tended to “agree” that they were influenced to choose mathematics education as a career by *intrinsic factors*, *extrinsic factors* and *altruistic factors*. The mean values of “past events or experiences” were equal to 3.08 in Cohort 3; therefore, the participants tended to be “unsure” that they were influenced to choose mathematics education as a career by “past events or experiences”.

The statistical tests were run to establish the significant differences in all the four factors: *intrinsic factors*, *extrinsic factors*, *altruistic factors* and “past events or experiences”. The significant differences were found in both overall *extrinsic factors* and overall “past events or experiences”. The statistics showed that overall *extrinsic factors* had a significant difference (Kruskal-Wallis = 7,805, p = 0.020) and the significant difference was between Cohort 2 and Cohort 3 (Mann-Whitney = 148,000, p = 0.006). Cohort 3 tended significantly more towards “agree” than Cohort 2, which was towards “unsure”. In overall, the significant difference of “past events or experiences” was (Kruskal-Wallis = 7,353, p = 0.025) and it was between Cohort 1 and Cohort 3 (Mann-Whitney = 48,000, p = 0.049), and between Cohort 2 and Cohort 3 (Mann-Whitney = 160,500, p = 0.012). Cohort 1 tended significantly more towards “agree” than Cohort 3, which was towards “unsure”, and Cohort 2 tended significantly more towards “agree” than Cohort 3, which was towards “unsure”.

4.3.3 Items with significant differences

The mean values were calculated according to the different items of the different themes. Based on the calculations, some items in *extrinsic factors* and some items

in “past events or experiences” had significant differences. In *extrinsic factors* the significant differences were in the items “Teaching has many holidays” (Kruskal-Wallis = 7,270, p = 0.026) and “Teaching is a secured job” (Kruskal-Wallis = 10,859, p = 0.004) (see Figure 4.3).

According to Figure 4.3, in the item “Teaching has many holidays” the significant differences were between Cohort 1 and Cohort 3 (Mann-Whitney = 44,000, p = 0.020), and between Cohort 2 and Cohort 3 (Mann-Whitney = 165,500, p = 0.018). Cohort 3 tended significantly more towards “strongly agree” than Cohort 1, and Cohort 3 tended significantly more towards “strongly agree” than Cohort 2. The mean values of Cohort 2 were equal to 3.75 and of Cohort 3 were equal to 4.75; therefore the two cohorts tended to “agree” that “Teaching has many holidays” influenced them to choose mathematics education as a career and Cohort 3 tended to “strongly agree”.

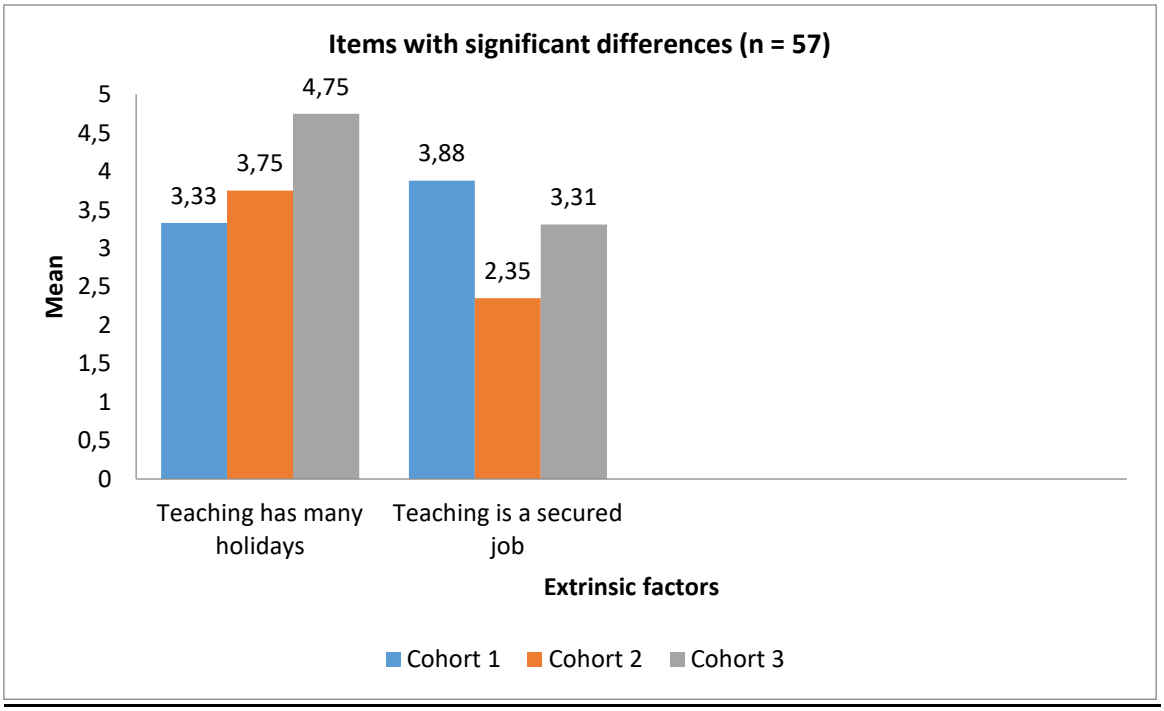

Figure 4.3: Extrinsic factors items with significant differences

The mean values of Cohort 1 were equal to 3.33; therefore, the participants tended to be “unsure” that “Teaching has many holidays” influenced them to choose mathematics education as a career.

In the item “Teaching is a secured job”, the significant differences were between Cohort 1 and Cohort 2 (Mann-Whitney = 49,500, p = 0.005), and between Cohort 2 and Cohort 3 (Mann-Whitney = 175,000, p = 0.020). Cohort 1 tended significantly more towards “agree” than Cohort 2, and Cohort 3 tended significantly more towards “unsure” than Cohort 2, which was towards “disagree”. The mean values of Cohort 1 were equal to 3.88; therefore, the participants tended to “agree” that “Teaching is a secured job” influenced them to choose mathematics education as a career. The mean values of Cohort 2 were equal to 2.35; therefore, the participants tended to “disagree” that “Teaching is a secured job” influenced them to choose mathematics education as a career. The mean values of Cohort 3 were equal to 3.31; therefore, the participants tended to be “unsure” that “Teaching is a secured job” influenced them to choose mathematics education as a career.

In “past events or experiences” significant differences were in the items “Shortage of Mathematics teachers” (Kruskal-Wallis = 7,639, p = 0.022) and “State of Mathematics education” (Kruskal-Wallis = 5,995, p = 0.049) (see Figure 4.4).

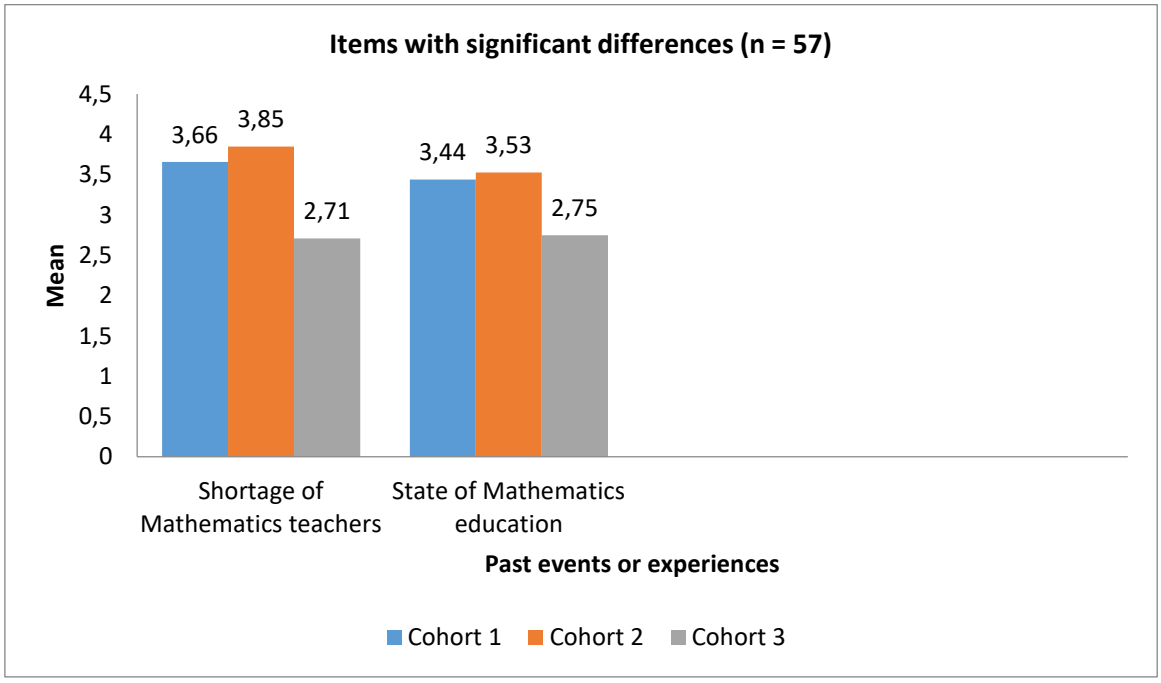

Figure 4.4: Past events or experiences items with significant differences

According to Figure 4.4, in the item “Shortage of Mathematics teachers” the significant differences were between Cohort 2 and Cohort 3 (Mann-Whitney =

160,000, p = 0.009). Cohort 2 tended significantly more towards “agree” than Cohort 3, which was towards “unsure”. The mean values of Cohort 1 were equal to 3.66 and of Cohort 2 were to equal 3.85; therefore, the participants in both tended to “agree” that they were influenced to choose mathematics education as a career by “Shortage of Mathematics teachers”. The mean values of Cohort 3 were equal to 2.71; therefore, Cohort 3 tended to be “unsure” that they were influenced to choose mathematics education as a career by “Shortage of Mathematics teachers”.

In the item “State of Mathematics education”, the significant differences were between Cohort 2 and Cohort 3 (Mann-Whitney = 178,500, p = 0.025). Cohort 2 tended significantly more towards “agree” than Cohort 3, which was towards “unsure”. The mean values of Cohort 2 were equal to 3.53; therefore, the participants tended to “agree” that they were influenced to choose mathematics education as a career by “State of Mathematics education”. The mean values of Cohort 1 were equal to 3.44 and of Cohort 3 were equal to 2.75; therefore, the participants in Cohort 1 and Cohort 3 tended to be “unsure” that they were influenced to choose mathematics education as a career by “State of Mathematics education”.

4.3.4 Findings by gender

The factors that were in the research survey were *intrinsic factors*, *extrinsic factors*, *altruistic factors* and “past events or experiences”. The respondents were 57, of the 57 respondents 30 were male participants (n = 30) and 27 were female participants (n = 27). The mean values of the different themes by gender were calculated (see Figure 5.5). If the mean values were below 3, the respondents tended to “disagree” or “strongly disagree” with the statements, and if they were 3 the respondents were “unsure”. Alternatively, if the mean was above 3, the respondents tended to “agree” or “strongly agree” with the statements. According to Figure 4.5, in *intrinsic factors* the mean values of female participants were equal to 4.29 and of male participants were equal to 3.98; therefore, they tended to “agree” that they were influenced to choose mathematics education as a career by *intrinsic factors*.

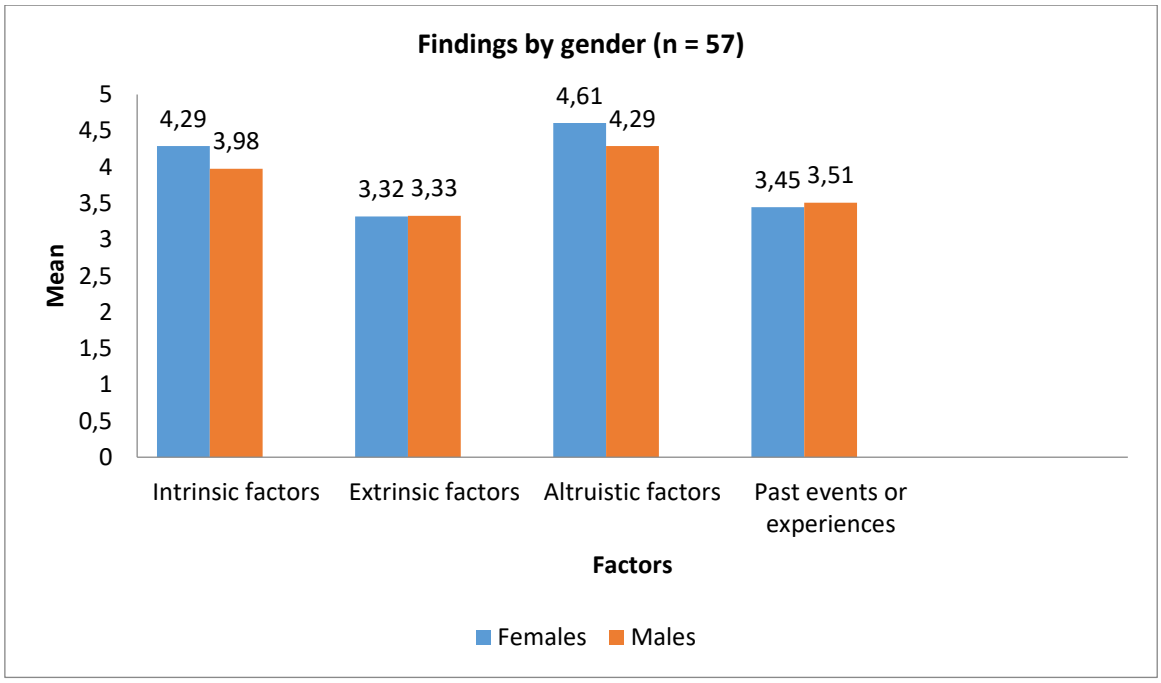

Figure 4.5: Findings by gender

It appears that the female participants were influenced more than the male participants; the significant difference of their respective means was (Mann-Whitney = 318,0 p = 0.235). Therefore there was no significant difference between their means.

In *extrinsic factors* the mean values of female participants were equal to 3.32 and of male participants were equal to 3.33; therefore, they tended to be “unsure” that they were influenced to choose mathematics education as a career by *extrinsic factors*. The means for both female and male participants had no significant difference.

In *altruistic factors* the mean values of the female participants were equal to 4.61 and of the male participants were equal to 4.29; therefore, they tended to “agree” that they were influenced to choose mathematics education as a career by *altruistic factors*. It appeared that the female participants “strongly agree” to be influenced by *altruistic factors* more than the male participants. The significant difference between their respective means was (Mann-Whitney = 336,5. p = 0.260); according to the p-value there was no significant difference however one item had a significant difference (Teaching allows me to raise the ambitions of underprivileged youths) (Mann-Whitney = 297,0, p = 0.049).

In “past events or experiences”, the mean values of the male participants were equal to 3.51; therefore, they tended to “agree” that they were influenced to choose mathematics education as a career by “past events or experiences”. The mean values of the female participants were equal to 3.45; therefore, they tended to be “unsure” that they were influenced to choose mathematics education as a career by “past events or experiences”. The male participants seemed to be influenced by “past events or experiences” more than the female participants; however, there was no significant difference between their means.

4.3.5 Findings for the influence of others

The question “Who influenced you to become a mathematics teacher?” was ranked as follows: 1 through to 9/10: A 1 meant the person or group who influenced you the most and 9/10 the person or group that influenced you the least (see Annexure H). In this study, the ranking of “Who influenced participants to become a mathematics teacher?” across gender tended to show that the respondents were influenced mostly by their parents followed by other family members and the least by others. According to the data, the females were more influenced by parents and secondly by other family members than the males.

In summary the findings revealed that the participants were influenced mostly by *altruistic factors* followed by *intrinsic factors,* and the least by *extrinsic factors* and “*past events or experiences”*. The findings also revealed that Cohort 3 was influenced the most by *altruistic factors* than the other two Cohorts. The female participants seemed to be influenced by *altruistic factors* and *intrinsic factors* more than the males. Pertaining to “the influence of others” the respondents were influenced mostly by their parents followed by other family members and the least by others. According to the data, female respondents were more influenced by parents and secondly by other family members than the male respondents.

4.4 PHASE 3: INTERVIEWS

The interview protocol was developed based on the results of the survey (see Appendix I). The nine interviewees from the three different cohorts (Cohort 1 [n = 3]), Cohort 2 [n = 3] and Cohort 3 [n = 3]) were stratified randomly sampled to respond to the questions in the interview protocol. The open-ended questions for the interview were informed by the items from *extrinsic factors* and “past events or

experiences" that showed a significant difference at a 5% level of significance ($p<0.05$). In the case of the *intrinsic factors* and *altruistic factors*, no item showed significant difference; therefore the items included in the interview protocol were those that had significant difference at less than a 50% level of significance ($p<0.5$). The interviewees were stratified randomly sampled to corroborate the results of the survey. The participants were constituted by three cohorts of teachers as follows:

- Cohort 1 (n = 3) FET mathematics teachers that assumed teaching on or before 1994,
- Cohort 2 (n = 3) FET mathematics teachers that assumed teaching after 1994 to 2007, and
- Cohort 3 (n = 3) FET mathematics teachers that assumed teaching after 2007. To answer the main research question, "Why do teachers choose mathematics education as a career?" The participants were supposed to answer the open-ended questions in the interview protocol (see Annexure I).

The findings were transcribed word for word, and some of their responses that seemed to be relevant to the research questions in the interview protocol were presented hereunder as narratives:

Question 1.

"How have the following *intrinsic factors* influenced you to become a mathematics teacher?"

(a). "Skills"
(b). "Qualities"

People that are influenced intrinsically perform their tasks at the best of their abilities. The majority of the participants across the cohorts seemed to have been *intrinsically* influenced by some "mathematical skills" and "teaching qualities"; therefore, they could impart the skills and qualities to their learners. Some of their responses are presented as follows:

> *… based on skills, I was influenced through teaching learners addition and subtraction through the use of sticks as well as through using the counting frame in the form of an abacus. … as far as qualities of teachers are concerned, through teachers who*

used to be model of dignity under all circumstances by coming to school wearing very beautiful suits and ties, …. Teacher A

I was good at maths. While I was looking at teaching it was good for me because I was good, I was a good communicator. Teaching needs someone of that calibre. Teacher B

I was good at maths, especially in measurement. So by being a teacher, I could help the learners to measure accurately. And in relation to qualities, I was always neat, punctual, discipline, respectful and diligent. Teaching was associated with these (sic) qualities. Teacher C

I was good at the construction of shapes using the tools in the mathematical instrument. Teacher D

I loved maths especially multiplication by being a teacher I would like to teach my learners different methods of multiplication …. Then with qualities, being a teacher that (sic) motivated me … to be punctual, discipline, respect … Teaching maths … is associated with this (sic) qualities, the qualities of being punctual, the qualities of being disciplined … being respected (sic) and also … teaching kids to come early in the morning to school to study. Teacher E

I may say that I'm a logical person, and I tend to be good with numbers than … theory, so you know I'm more towards the numbers than theory I can be relunctant to memorise long statements but I can be very efficient with numbers so I think one of the things or the qualities my passion for numbers, that I've … got love for numbers than theory. Teacher G

I am very patient and I'm good in (sic) communication it is not been (sic) hard to communicate with learners as maths is hard but I can communicate and conduct everything with them. Teacher H

I was good … at maths …. In as far as the qualities were (sic) are concerned. … I was a very patient person, teaching needed patience especially teaching maths. Teacher I

Question 2.

"How have the following *extrinsic factors* influenced you to become a mathematics teacher?"

(a). "Many holidays"

(b). "Secured job"

External stimulants could also be influential factors in choosing a career. The majority of the participants across the cohorts seemed to have been *extrinsically* influenced by external stimulants such as "many holidays" and "mathematics education as a secured job". Some of their responses are presented below:

> *In as far as many holidays are concerned, … they give us time to relax and visit our relatives who stays (sic) far away from us …. But in as far as secured jobs are concerned teaching mathematics is a scarce skills, but scarce skills as teaching mathematics is, there are no retrenchment for maths teachers, which is an advantage.* Teacher A
>
> *…in teaching you are able to rest a bit and re-energise. Teaching is very secured, no retrenchments nothing at all, so it is nice to be a teacher in particular maths teacher.* Teacher B
>
> *Many holidays allowed both the learners and the teachers to get some rest. People were able to visit their relatives elsewhere. mathematics teachers were scarce those days so the ones available were well respected and their jobs were secured.* Teacher C
>
> *One spends lots of time at home …. It is an influence … on its own. … teaching is a secured job. … nobody loses their job.* Teacher D
>
> *… when you are a teacher you have lots of holidays thus why I loved mathematics teacher (sic) … I could travel around to see the world and also to rest. It also help (sic) us to spend quality times with our families, thus why to be a teacher is a good job. … being a teacher helped me to have a secured job where there are no retrenchment (sic).* Teacher E

I thought I have (sic) got more time to relax so I became interested to be a teacher …. … when you are teaching mathematics you become more secured because there are (sic) lack of those skills in our country South Africa so as a mathematics teacher your job is more secured because even if I can resign today then tomorrow they are hiring me. Teacher F

… give me much time to focus on other area or … family issue or the business so thus why I like the teacher (sic) because they have the many holidays. Teacher H

… it is now good to get some rest every now and then. I think being a maths teacher is secured. You do not get fired or redeployed at random. Teacher I

Question 3.

"How has the following *altruistic factor* influenced you to become a mathematics teacher?"

(a). "Raising the ambitions of underprivileged youths"

It is becoming difficult and rare to find people influenced to take up some jobs because of *altruistic factors*. People only look to serve their own interests. The majority of the participants across the cohorts in this study were *altruistically* influenced to become mathematics teachers. They chose mathematics education to "raise the ambitions of underprivileged youths". Some of the participants' responses are presented below:

… to studying mathematics in universities and technikons which at the end of the day those who pass mathematics can be in the position of being employed in very good field such as field in chemical as well as mechanical field or chemical as well as mechanical industries. Teacher A

… majority of us at village schools were not willing to do maths. It was regarded as a difficult subject. So by being a teacher, I could encourage the youth to take maths and maths-related fields. Teacher C

the rural schools are performing this nowadays. So I encourage the youths to work hard irrespective for (sic) … where they are coming (sic) for (sic) so that they can succeed. Teacher D

By loving mathematics and teaching the basics of maths made the youth in our village to love maths and to have another mind set about mathematics. Teacher E

… to teach this subject in order to empower those poor learners in our rural areas, so I encourage them that … mathematics is the key to success if you have studied mathematics, even the government recognise (sic) you as a better person. Teacher F

… I wanted to be a better maths teacher to enable our underprivileged youth to achieve what they want to achieve in life. Teacher I

Question 4.

"What *past events* or *experiences* of the following time frames influenced you to become a mathematics teacher? How?"

(a). "On or before 1994"
(b). "After 1994 to 2007"
(c). "After 2007"

Some events or experiences might lead people to regard or disregard making some career choices in life. Some say "experience is the best teacher". All the participants across the cohorts in this study were influenced by different "past events or experiences" based on the particular time frame. The responses varied from "the perception people had about the subject mathematics", "the shortage of mathematics teachers" and "how their then mathematics teachers taught them the subject" (Cohort 1), "the state of mathematics teaching" (Cohort 2), and "lack of direction and dedication", "teaching experiences" and "family background" (Cohort 3) are presented below:

I was influenced by one of my maths teacher (sic) who was very good in offering or teaching mathematics. This teacher used to spare the rod and spoil the child if we failed maths. Teacher A

The state of maths teaching was not good. I wanted to teach my learners well so that they could qualify anywhere and everywhere. Teacher B

… there was some shortage of maths teachers. So I wanted to reduce the shortage of maths teacher (sic). Teacher C

…lack of direction and dedication. If you wanted to pursue some career you needed to work hard to achieve that career. Teacher D

… before 1994 we have (sic) that being (sic) of saying maths is a difficult subject. By being a maths teacher, I changed the way … we think (sic) about maths and encourage (sic) other teachers and also learners to love mathematics by … teaching them the basics of mathematics. Teacher E

… prior 1994 … mathematics was … mostly regarded as a difficult subject in our country … I decided that never the less even if they said this subject is challenging I'm going to teach mathematics. During our time they regarded mathematics as a difficult subject most of the scholars replaced mathematics with history. Teacher F

… while I was a student at the university, … I studied BSc in chemistry, so I was a chemistry tutor at the university so I had to relate with the students … and teach them chemistry and again in 2015 I worked … at the science centre at the University of Pretoria so … I worked there as a science communicator, so we would have learners come into the science centre and we would do science shows and do science workshops and explain the exhibit … with that interaction that I had with the learners … I tend (sic) to be more drawn into teaching … it was only in 2015 when I discovered that I can (sic) be … a good teacher. Teacher G

… to become a mathematics teacher it's like I come from … the disadvantage (sic) family … and it's like … mathematics in South Africa since the time you mentioned … it was a scarce subject everyone … who needed to be taught maths is (sic) easy to get the job. Teacher H

We had a shortage of maths teachers. … the state of maths teaching was not good. I think that was one of the reasons for the majority of us not qualifying for our respective career choices. Teacher I

Question 5.

"Who influenced you to become a mathematics teacher? How?"

People are influenced by some persons or groups directly or indirectly for choosing some way of life and even career choices. In contrast to the quantitative findings, the qualitative participants seemed to have been influenced by other persons beside their parents in different ways. The responses are presented below:

I was influenced by my mathematics teacher in primary school through his teaching of mathematics using a BODMAS rule. Teacher A

… my aunt. She's the one who encouraged me to become a teacher, she requested (sic) me to try teaching. Teacher B

… no particular person, I just wanted to be a teacher because of the way the teachers were treated in society. They used to command respect back then. Teacher C

… it was not a matter of who but what. I chose teaching because of the free entry if you had obtained the government's bursaries, the department deploys you anywhere.. Teacher D

… no particular person I can say I just wanted to be a teacher because of the way teachers dressed then, wearing the two-piece stockings and handbags … they were respecting (sic) by everyone thus why I loved to be a mathematics teacher". Teacher E

… it was that science centre manager, the former science centre manager of the of Sci-Enza at the University of Pretoria … her name is Rudi Horak. … she would give feedback … it could be one of your careers to be a teacher … she took me to develop me more into this teaching thing. Teacher G

> *… no one influenced me to become a mathematical teacher … the situation is about (sic) the family issue like I come from … the disadvantage (sic) family so when I arrive at the university they told me about how should I conduct to be a teacher and is simple you get the bursary and everything.* Teacher H

> *No particular person at all. My results only qualified me nursing, policing and teaching. It was not easy to be enrolled at the nursing college so that's how I was enrolled for teaching.* Teacher I

During the interviews, it was also established from some of the participants that choosing mathematics education as a career was not their first choice. The mathematics education became a "fall back career". It incidentally happened that they decided to become mathematics teachers. Those participants had the following to say about becoming mathematics teachers:

> *I didn't want to become a maths teacher. I wanted to be a nurse. (Follow-up) when I had exhausted my opinion (sic) of becoming a nurse, I decided to look elsewhere and teaching became the next option.* Teacher B

> *… I had no intention of becoming a maths teacher.* (*Follow-up) it was a matter of … not being accepted … at some tertiary institution … for my intended field of studies, so then I decided to become a teacher.* Teacher D

> *… when I arrive at the university they told me about how should I conduct (sic) to be a teacher and is simple you get the bursary and everything.* Teacher H

> *So I did not qualify for … my intended career choice. (Follow-up) it was … a last resort. It was very difficult to have a breakthrough into nursing or policing.* Teacher I

In summary the findings revealed that participants were overwhelmingly influenced to choose mathematics education as a career by *altruistic factors* (such as "Teaching allows me to raise the ambitions of the underprivileged youths"), *intrinsic factors* (such as "I have skills to be a good teacher" and "I have qualities of a good teacher"), "past events or

experiences" (such as "State of mathematics education" and "The shortage of mathematics teachers"), *extrinsic factors* (such as "Teaching has many holidays" and "Teaching is a secured job") and "influence of others" (i.e. directly or indirectly). Some participants revealed that becoming mathematics teachers was not their initial choice but "fall back career".

4.5 CONCLUSION

The purpose of this study was to investigate both the motivational factors and other pertinent factors that influenced teachers' choice of mathematics education as a career at the secondary schools of the selected cluster in the Vhembe District of the Limpopo Province. This chapter presented the findings of the pilot study and the two phases, Phase 1: Research survey and Phase 2: Interviews. The findings of the quantitative phase were presented in graphs, and those of the qualitative phase were presented in interviewees' narratives.

CHAPTER 5: DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

In this chapter, the discussions, the nexus between the theoretical framework and the research findings, conclusions and recommendations are presented in answering the question, “Why do teachers choose mathematics education as a career?”

5.2 DISCUSSIONS

To contextualise the narratives, this study unfolded in two phases, Phase 1 (research survey) and Phase 2 (interviews). Qualitative interviews were utilised to explain the quantitative data in detail. From the findings, numerous factors that influenced teachers’ choice of mathematics education as a career were revealed. The discussion of the findings was guided by the following influential factors’ categories: *intrinsic factors*, *extrinsic factors*, *altruistic factors*, “past events or experiences”, “fall back career” and “the influence of others”. In addition, the discussion of the findings shared insights into the three cohorts, namely Cohort 1, Cohort 2 and Cohort 3.

5.2.1 Factors that influenced teachers to choose mathematics education as a career

The categories of influential factors were presented in merit order, i.e. from the most influential to the least influential.

5.2.1.1 Altruistic factors

According to the literature (Chapter 2, subsubsection 2.2.2.3), *altruistic motivation* is characterised by, among other things, attributes such as prosocial orientation, which in turn includes an eagerness to help other people and be empathetic to others. When one considers the state of mathematics teaching in SA and rural areas it is perhaps not surprising that *altruistic factors* were the most influential factors in the choice of mathematics education as a career. Bierhoff (2002) states that prosocial behavior is a particular kind of altruism that perpetuates selfless help for others influenced by internal influences such as concern, empathy, or by altruistic values. Therefore, helping underprivileged youths by mathematics teachers, without seeking any reward, praise or favour in return, may have been

the main driver to influence the teachers. It makes mathematics teachers feel fulfilled. Therefore, such triumph resonates with the growth (self-actualisation) needs of the ERG theory. It can be argued that *altruistically* motivated teachers are always concerned with the needs of the others, about their wellbeing, and finding a solution to their challenges.

The high premium that mathematics teachers place on *altruistic factors* as a determinant for career choice resonates with the observation by Friedman (2016: 16) who perceived altruism as the "dominant motive that leads people to choose the teaching profession". The inclination of the majority of teachers to be influenced by *altruistic factors*, therefore, suggests their desire to assist others. This is particularly so, given that the most frequently voiced option among the elements of *altruistic factors* across the three cohorts was "Teaching allows me to raise the ambitions of the underprivileged youths". Although there could be other issues which led to the aforementioned option being the most popular determinant in the category of *altruistic factors*, it is argued that teachers are empathetic to the situation confronting youth in rural areas where the study was undertaken. For instance, one of the common issues they are confronted with, appears to be their perceptions that mathematics is a difficult subject. This challenge is compounded by socio-economic issues such as poverty and child-headed families, which are quite prevalent in rural areas. All these might have appealed to *altruistically* driven teachers to choose mathematics education as a career, with the motive to uplift the standard of young people.

In addition, although Onatir (2008) argued that *altruistic influence* on teaching as a career choice was not gender-dependent, the findings of this study revealed that female teachers were influenced more by *altruistic factors* than their male counterparts. Again, the idea of "Teaching allows me to raise the ambitions of the underprivileged youths" received more female voice than male voice. This, therefore, seems to suggest that female teachers are more prosocial and possibly more empathetic and are more likely to help learners than their male counterparts.

Another noteworthy observation regarding *altruistic influence* was that Cohort 3, namely mathematics teachers who assumed teaching after 2007, was also influenced more by "Teaching allows me to raise the ambitions of the underprivileged youths" than the other two cohorts. It is assumed that the trend

could be emanating from the fact that the majority of the Cohort 3 mathematics teachers are younger than those in Cohort 1 and Cohort 2. This could further imply that the wellbeing of youths appealed more to Cohort 3 by virtue of age group than the other cohorts.

Some of the issues that seem to be challenging to rural youths are their poor academic achievement in mathematics. This is also confirmed by Tachie and Chireshe's (2013) study in which the learners attributed the poor performance to external factors, because of issues such as poorly qualified mathematics teachers and teachers' absenteeism. Therefore, mathematics teachers having been motivated by relatedness (social and esteem needs), growth needs (self-actualisation) and prosocial behaviour would offer their services beyond the four walls of the classroom without expecting personal rewards. In the interview responses, it was shown that underprivileged youths would be encouraged to enrol in mathematics and related mathematical careers to help break the chains of unemployment among the young people because becoming an engineer, pilot, doctor and significant others make the person marketable. It was also revealed in the interviews that the love of mathematics among the underprivileged youth could be inculcated by the *altruistically* motivated mathematics or being prosocialists.

5.2.1.2 Intrinsic factors

Intrinsically motivated mathematics teachers may be characterised by attributes such as self-driven or self-regulating, highly focused throughout the teaching with clearly defined goals, self-critical, realistically self-reflecting on their own actions and possibly devoting their personal time to their professional development. Given the aforementioned characteristics, it is presumed that the *intrinsically* motivated mathematics teachers would always be enthusiastic about mathematics teaching. They are likely to love mathematics teaching, but they also accept criticism because they know that would lead them to self-actualisation. These characteristics resonate with the intricacies of the ERG theory which advocates that when one's existence needs (physiological and safety needs) are met, they will then be driven by relatedness needs (social and esteem needs) and growth needs (self-actualisation). It is argued that after the teaching process, they are likely to reflect on whether they have achieved their objectives or not. Therefore, such types of teachers are the first to accept when they have not reached the

desired standards. Due to their *intrinsic* orientation, such teachers are generally perceived to be self-regulating. They do not need an immediate supervisor breathing down their necks for them to do their work. Therefore, such mathematics teachers seem to be self-determined to perform the given task well without any external force pushing them or any other reward of some sort. *Intrinsically* motivated mathematics teachers would always be confident in their skills, and they are effective in the classroom. Moreover, they may feel a deep connection to their peers, possibly providing or receiving continuous mentoring or participating in collaborative activities.

Intrinsic factors were the second most influential category of factors in the study (mean = 4.13) that influenced teachers' choice of mathematics education as a career. *Intrinsic motivation* means the self-determination to discharge a certain activity or take part in a certain activity (Boulhrir, 2017). This resonates well with the assertion by Lin (2007) that intrinsic motivation is the excitement that emanates from people's performance of their duties at work. It could be asserted that the pleasure and satisfaction derived from teaching mathematics could have played a significant role in influencing teachers who participated in this study to choose mathematics education as a career. The significant scenario could be that teachers opted for mathematics education to have pleasure and satisfaction in cascading the mathematical skills to the learners. The prominence in responses to the statements such as "I have the skills to be a good teacher" and "I have the qualities of a good teacher" is indicative of teachers' self-determination to perform the teaching activities probably with pleasure and satisfaction. In other words, teachers perceived themselves as having what it takes to pursue mathematics education as a career. In the interview responses mathematics teachers indicated that they are good at mathematics; therefore, it would be a pleasure to them to impart the skills to the learners, and it would also give them some satisfaction.

In addition, it was revealed that female mathematics teachers were more influenced by the two aforementioned factors than their male counterparts. Given the myth and stereotype that generally females cannot teach mathematics, this observation is quite significant as it dispels such myth and stereotypes. On the other hand, it was revealed that more male teachers were influenced by the factor *"*I like working with children*"* than their female counterparts. This observation is

perhaps not surprising and might have been occasioned by the recent trend where men are becoming involved in the upbringing of their children at their respective homesteads. This, therefore, could have had a ripple effect on their social life, including having a bearing on career choice that requires working with children such as teaching.

Another interesting observation was that both males and females were influenced the least by “I always wanted to be a teacher”. It could be argued that for some mathematics teachers, teaching was not their first career choice, rather a “fall back career”. What could be a cause for concern is that this could result in teachers giving up the teaching profession to pursue other attractive opportunities when they arise. It is shown in their interview responses that some were never interested in mathematics education, but they eventually pursued it because of some circumstances in their lives such as not obtaining the required grades for their intended career choices.

The fact is that *intrinsic factors* influenced Cohort 1 (FET mathematics teachers that assumed teaching on or before 1994) the most, more than the other two cohorts, although no statistically significant differences were found across the cohorts. Notwithstanding a lack of significant difference, it seems that Cohort 1 was influenced by intrinsic factors such as “I have the skills to be a good teacher” and “I have the qualities of a good teacher”.

The *intrinsic factors* seem to have strong relationship with the *altruistic factors*. It is not surprising that *altruistic factors* and *intrinsic factors* are the most dominant of the four motivational factors. This was confirmed by Balyer and Ozcan (2014) when they asserted that many student teachers seemed to have some different reasons for choosing the teaching profession as a career and might be *altruistic-intrinsic* reasons. Therefore, it is thought that such mathematics teachers were influenced by the combination of *altruistic-intrinsic* reasons and have been positively influenced because these factors seem to form the fundamental pillar of attracting teachers to mathematics education. It is hoped that the combination of *altruistic-intrinsic* reasons as the fundamental pillar may make the mathematics teachers stay longer in mathematics education than those that are influenced by external determinants who eventually leave for other professions. The mathematics teachers that are *intrinsically* motivated seem to be constantly

involved in activities such as in-service training, peer-group mentoring and professional development to stay abreast at all times and be able to respond to students' demand in a better way and update their knowledge as life-long learners. The *intrinsically* motivated mathematics teachers seem to share personal aspirations with peers and express their opinions in an open and creative environment to enhance their mathematical teaching skills. Therefore, such mathematics teachers are likely to identify and share good pedagogic practices throughout the school system.

Mathematics achievement among the learners in SA, especially in rural areas, has been a long-standing concern which could be solved by *intrinsically* motivated mathematics teachers' self-determination in classrooms. Indeed Akhtar et al. (2017) assert that admirable outcomes are attained by an individual's genuine intrinsic motivation such as executing their duties, perception of peculiar virtuosity and the sense of delight at work. Therefore, whenever the "intrinsic mathematics teachers" are on task, their learners tend to benefit a lot, such as acquiring mathematical content knowledge, mathematical skills and problem-solving skills for their daily lives. According to Delgado (2017: 154), *intrinsic motivation* in education is "a support tool to facilitate knowledge transfer between individuals, encourage the development of [study] groups outside the formal structures, allow rapid troubleshooting, transfer best practices and develop professionals to share experiences". Therefore, it is argued that "intrinsic mathematics teachers" could be the right tonic the rural learners need to perform at their utmost best since their performance of mathematics is low.

5.2.1.3 "Past events or experiences"

The "past events or experiences" was the third influential category of factors (mean = 3.48) that influenced teachers' choice of mathematics education as a career. Based on the data gathered, "past events or experiences" such as "My competence in mathematics", "Competence of my mathematics teacher(s)" and "Shortage of mathematics teachers" influenced teachers' choice of mathematics education as a career. Therefore, mathematics teachers were influenced by, among others, their competence in mathematics, the competence in mathematics of the teachers that taught them and the shortage of teachers in mathematics. The trend is consistent with Du Preez's (2018) assertion that the impact at school of

the teachers that taught them mathematics, bad experiences and wanting to improve the way mathematics was taught at school, the mathematics teachers' passion for teaching mathematics and the confidence that the teachers gained from former mathematics teachers helped to inspire them to choose mathematics education in SA. In addition, it was also indicated by Low et al. (2017) that teachers were overwhelmingly influenced by their teaching experiences gained in the past, which inspired them to join the teaching profession. Mudavanhu (2015) asserted that some teachers chose the teaching profession because of the knowledge of teaching, training and work experience gained in the past.

In addition, Cohort 2 seemed to have been influenced to a greater extent than the other two, although statistically there is no significant difference. This could be the case because Cohort 2 teachers got into the teaching profession when SA attained democracy in 1994. The mathematics teachers could have attended their initial teacher education at better teacher training institutions around the country. Therefore, it is presumed that they wanted to improve the teaching and learning of mathematics in rural areas as it was characterised by poor teaching by under-qualified mathematics teachers.

The mathematics teachers influenced by "past events or experiences" that were bad may have chosen mathematics education with an intention to correct those "past events or experiences" by performing at their utmost best. Based on their bad past experiences, some mathematics teachers in this category are likely to understand the similar circumstances learners experience and mitigate them. In the interview responses, it was revealed that the mathematics teachers wanted to address the challenges at schools (such as the poor state of mathematics teaching and shortage of mathematics teachers); therefore they wanted to utilise their own prior teaching experiences and other past experiences to address those challenges.

5.2.1.4 Extrinsic factors

Extrinsic motivation is regarded as reward-driven behaviour. The reward can be tangible or abstract. The *extrinsically* motivated mathematics teacher seems to be driven by the implications of the ERG theory that existence needs (physiological and safety needs) are of utmost importance to be realised first before the other

needs within the theory. Therefore, *extrinsically* motivated mathematics teachers are those that are influenced by external rewards such as money, fame, grades, and praise to satisfy the first level (existence needs) advocated in the ERG theory. *Extrinsic* motivators would improve the short-term performance but have a negative effect on longer term performance when an incentives are no longer on the table. Additionally, when the promise of a reward is broken, there would be an even greater decrease in performance. Gneezy et al. (2011) declared that the motivation to perform the task without the additional reward that was previously offered could be permanently reduced as the performance was reward driven. Although the work of Gneezy et al. (2011) is almost ten years old, it still provides some fundamental perspective pertaining to reward-driven behaviour. Therefore, it is presumed that whenever the incentives are available mathematics teachers would always perform to the best of their abilities to uplift the standard of mathematics in rural areas.

The *extrinsic factors* were the fourth influential category of factors (mean = 3.33) that influenced teachers' choice of mathematics education as a career. According to Balyer and Ozcan (2014), *extrinsic factors* can be defined as having some reference to economic circumstances as well as the conditions of service and social status. Therefore, based on the data gathered, *extrinsic factors* such as "Teaching allows more time for family", "Teaching has many holidays" and "Teaching has many fringe benefits" were dominant across the cohorts. This trend is consistent with what Du Preez (2018) has found, namely that the teaching profession gives teachers ample free time (teachers working for 7 hours a day in SA) and more time for family, and job opportunities for mathematics education were possible in various different locations of SA, especially in rural areas due to the scarcity of mathematics subject and teachers. This trend is similar to other countries such as Singapore where teacher status is reasonably high inclusive of mathematics education (Lim, 2014). It is thought that a few mathematics teachers were influenced to choose mathematics education due to the ample time they have after work and the many holidays offered. The *extrinsically* motivated teachers are also influenced by the job security associated with the mathematics education due to the scarcity of teachers in this field.

It was revealed in the findings that male teachers have been influenced a little more than female teachers, although there is no statistically significant difference. In addition, Cohort 3 (FET mathematics teachers that assumed teaching after 2007) has been mostly influenced by *extrinsic factors* (such as “Teaching allows more time for family”, “Teaching has many holidays” and “Teaching has many fringe benefits”) than the other two cohorts. It is also believed that a few mathematics teachers are influenced by *job security* and *salaries,* although the factors were not among the most dominant ones. The trend was echoed by Lim (2014) that a good reward system and a more balanced work-life (demands of personal life, professional life and family life) structure were afforded to the teachers in Singapore. It is believed that the daily working hours in SA allow mathematics teachers to have a balanced work-life as teaching mathematics is a demanding job. A couple of interview responses attested to that saying that they get plenty of time to concentrate on other matters affecting their lives after the daily working hours. It was also revealed in the interview responses that mathematics teachers were influenced by the many holidays in mathematics teaching to have some rest as mathematics teaching is very demanding. In addition, it was indicated that being a mathematics teacher, you do not easily lose your job, as mathematics is a scarce skill subject in SA.

Nowadays young people are recruited to the teaching profession by being offered bursaries by the government such as the Funza Lushaka (meaning *teach the nation*) Bursary Scheme to pursue teaching especially in scarce skills subjects such as mathematics. It is believed and attested to by one of the interview participants that immediately after completion, the FLB holder is deployed anywhere where there is a dire need for such a teacher without undergoing interviews in Limpopo Province for quite several years. This is similar to what is found in some states in the USA where prospective teachers also get funded for agreeing to teach at some particular districts for a period of three years (Boggan et al., 2016). It is thought a similar trend is utilised in SA for those who receive FLBs, they need to work for the DBE for a duration equivalent to the funding period. According to Mudavanhu (2015: 164), students’ motivation for becoming teachers that could be described as *extrinsic* were ranging from “route to employment, job security to life-long learning”. It seems to be the trend in SA since the

establishment of the government funding that finding the job is certain after completion. It was revealed in the interviews that being raised in a disadvantaged home background makes one vulnerable at tertiary institutions in relation to pursuing their intended career choices; therefore they ended up being recruited unwillingly to mathematics education through a variety of funding such as the FLB Scheme.

The “extrinsic mathematics teachers” perform at their utmost best when there is some reward for them. They rely on the rewards to give their best, for instance, they perform to get awards at the end of the academic year, and when they do not get such recognition, the subsequent performance would be mediocre. This is similar to a country such as Sweden where teachers were individually paid based on the labour market in regions or subjects where teacher shortages were greater such as in mathematics (OECD, 2011). It is believed that positive reinforcements could help to motivate mathematics teachers to be more productive and retain them longer in the system

5.2.1.5 “Fall back career”

A *“fall back* career” is a career that people choose as their last resort. The mathematics teachers that are influenced by “fall back career” are believed to have tried to pursue some careers, but due to one reason or another they did not qualify so then they “fell” back to mathematics education. Therefore, such mathematics teachers might be contemplating leaving the profession again for some other interesting careers. This resonates with the ERG theory that existence needs (physiological and safety needs) would always be a priority before any other need. Therefore, mathematics teachers influenced by “fall back career” would need to satisfy their existence needs; meanwhile, they could start searching for greener pastures (good looking careers at face value).

The fifth and the final influential category of factors was thus “fall back career” that influenced teachers’ choice of mathematics education as a career. During the interviews, a few teachers indicated that they became teachers by chance. Teachers might have chosen mathematics education as a career because their intended fields were out of reach or for some other reasons. This trend is consistent with Mudavanhu (2015), who indicated that different kinds of situations

such as obtaining low A-level points and indecisiveness compelled the people to choose teaching and it was sometimes a “fall back career”. It is believed that mathematics teachers influenced by “fall back career” might have fallen short of the required grades for their initial career choices; then mathematics education was the nearest available one. Some of the interview responses had alluded to that they wanted to pursue some other significant careers, but due to the circumstances, they had to pursue mathematics education instead. The reasons for pursuing mathematics as a “fall back career” were a result of getting low grades that stifled them from pursuing their preferred career choices (Ebru, 2012; Mudavanhu, 2015). It is believed that it could be the case with some of the mathematics teachers that are currently in service. It was revealed in the interview responses that some of the teachers did not obtain good grades in mathematics, therefore, they did not meet the requirements of all their intended career choices but mathematics education.

The mathematics teachers influenced by “fall back career” are believed to be unstable as their passion and love for mathematics education is not there. Some of these mathematics teachers might still be in limbo (not knowing) whether to stay or leave. It is believed that they do not dedicate themselves to the profession. They are just there to satisfy their existence needs (physiological and safety needs) at the expense of the poor learners. Their intention is to see through the terms and conditions of their funders to work for the government for the duration equivalent to the funding period. It is believed that the services of such people are not needed in SA.

5.2.2 “The influence of others”

The influence for choosing some career or a certain path in life could either be direct or indirect. The mathematics teachers that are influenced by some significant other (people such as mentors, role models and celebrities) tend to thrive well in their endeavours to equal or surpass the feat or legacy they observed from their very important persons (VIP). This is in line with the ERG theory that existence needs (physiological and safety needs) come first, then relatedness needs (esteem and social needs) and lastly the growth needs (self-actualisation) although Kaita and David (n.d) and Mykhailovska and Malpa (2016) contrast that notion.

The mathematics teachers that are influenced by VIPs tend to set realistic goals as they have observed what and how their VIPs are perceived among society. Therefore, such mathematics teachers tend to do well to be equated to their so-called role models. It is very imperative to have such teachers in mathematics because it is believed that such teachers would deliver the goods (produce good results) at all times. The interview responses have revealed that some mathematics teachers were not directly influenced by a particular person to pursue mathematics education but indirectly which can be called a *"*hidden curriculum*"* (such as how the VIPs dresses, conduct themselves and others) meaning that everybody is secretly taught something by VIPs in their every engagement.

5.3 THE NEXUS BETWEEN THE THEORETICAL FRAMEWORK AND THE RESEARCH FINDINGS

This study utilised the ERG theory by Alderfer (1969) and the FIT-CF by Richardson and Watt (2006) as the guiding theoretical framework.

5.3.1 The ERG theory

The ERG theory has shown that individuals driven by specific ERG needs would then be influenced in a particular way towards satisfying their desired needs. It is understood that the participants were influenced as reported in this study in pursuit of their own specific needs. Therefore, it is now not surprising that the participants were influenced the most by *altruistic factors*. Using the ERG theory, we were able to classify all the motivational factors (intrinsic, extrinsic and altruistic) to satisfy the teachers' needs for *existence*, *relatedness*, or *growth*.

Secondly, in the discussion of this study, ERG assisted in showing that the state of other people could trigger the emphatic behaviour of the potential helper. This study was conducted in rural areas where the socio-economic challenges are prevalent. Therefore, the teachers wanted to improve the lives of underprivileged in SA and in rural areas in particular.

5.3.2 The FIT-Choice framework

Firstly, the FIT-CF assisted in the development of the secondary research questions with the themes such as *intrinsic*, *extrinsic*, *altruistic factors, "*past events or experiences*" and "*the influence of others*"*. Secondly, the FIT-CF

assisted in the development of the data collection instruments survey questionnaire in Phase 1 and the interview protocol in Phase 2. All the themes in the data collection instruments were demonstrated in the FIT-CF. Thirdly, the Literature Review had shown that all the teachers' influences were embedded in the FIT-CF, even choosing the teaching profession by chance or as a last resort. In addition, the FIT-CF assisted with the characteristics of different motives that influenced teachers' choice of mathematics education as a career. Lastly, the FIT-CF demonstrated in the conclusions that teachers indeed were influenced by those factors (*intrinsic factors, extrinsic factors, altruistic factors,* "past events or experiences", "fall back career" and "the influence of others") to choose mathematics education as a career.

5.4 RESPONSES TO THE RESEARCH QUESTIONS

This study is about examining the motivational factors and other pertinent factors that influenced teachers' choice of mathematics education as a career. To answer the primary research questions, "Why do teachers choose mathematics education as a career?", five secondary research questions pertinent to the primary research question were posed in the beginning of this study. Both quantitative and qualitative data were collected sequentially in two phases based on the secondary research questions of this study. The qualitative data was then utilised to explain in detail the quantitative data. In this section the responses to the secondary research questions are then summarised based on the findings and discussions to reveal the core factors that influenced teachers' choice of mathematics education as a career.

QUESTION 1: "What are the intrinsic factors that influenced teachers to become mathematics teachers?"

The *intrinsic factors* were the second influential category of factors (mean = 4.13) that influenced teachers' choice of mathematics education as a career. Nine items were included in the pursuit of answers to this secondary question. According to the data gathered the most influential *intrinsic factors* were the following: "I have the skills to be a good teacher" and "I have the qualities of a good teacher". All the factors did not have significant differences in respect of responses, however, "I have the skills to be a good teacher" and "I have the qualities of a good teacher"

have a p-value of $p<0.5$. During the interviews, some teachers declared their love for mathematics and that they were good at the subject. They also indicated that they would like to pass the mathematical skills to their learners.

QUESTION 2: "What are the extrinsic factors that influenced teachers to become mathematics teachers?"

The *extrinsic factors* were revealed as the fourth influential category of factor (mean = 3.33) that influenced teachers' choice of mathematics education as a career. Nine items were included in the pursuit of answers to this secondary question. Based on the data gathered, *extrinsic factors* such as "Teaching allows more time for family", "Teaching has many holidays" and "Teaching has many fringe benefits" were dominant across the cohorts. However, the factors "Teaching has many holidays", and "Teaching is a secured job" have some significant differences ($p<0.05$) across the cohorts. Although these *extrinsic factors* have little to do with mathematics education, however, they are important pointers that also influenced teachers' choice of mathematics education as a career. During the interviews, some teachers indicated that being the mathematics teacher your job was secured, no redeployment and you quit "today" you get hired "tomorrow".

QUESTION 3: "What are the altruistic factors that influenced teachers to become mathematics teachers?"

The *altruistic factors* were the most influential category of factors (mean = 4.44) that influenced teachers' choice of mathematics education as a career. Seven items were included in the pursuit of answers to this secondary question. The most significant determining factor under *altruistic factors* was "Teaching allows me to raise the ambitions of the underprivileged youths" ($p<0.05$). During the interviews, the teachers indicated that they would like to encourage their learners to love mathematics, enrol in mathematics and related mathematical fields. In addition, factors such as "Teaching allows me to shape the child and adolescents' future", "By being a teacher, I can help the young to live a meaningful life" and "By being a teacher, I can bring an impact on children and adolescents' future" were also prominent in influencing teachers to choose mathematics education as a career.

QUESTION 4: "What past events or experiences influenced teachers to become mathematics teachers?"

“Past events or experiences” was the third influential category of factors (mean = 3.48) that influenced teachers’ choice of mathematics education as a career. Five items were included in the pursuit of answers to this secondary question. Based on the data gathered, “past events or experiences” such as “My competence in mathematics”, “Competence of my mathematics teacher(s)” and “Shortage of mathematics teachers” influenced teachers’ choice of mathematics education as a career. The factors did not have significant differences, however “State of mathematics education” and “Shortage of mathematics teachers” had p-value of $p<0.5$. The teachers’ responses ranged from the poor state of mathematics education, the shortage of mathematics teachers and their poor background that led them to choose mathematics education as a career.

QUESTION 5: “Who influenced teachers to become mathematics teachers?”

There was a lack of consistency between what was revealed in the survey and what emerged from the interviews in relation to issues pertaining to this question. Ten items were included in the pursuit of answers to this secondary question. The survey phase revealed that teachers were influenced the most by their parents. However, it was revealed during the interviews that teachers were not influenced by their parents or significant persons. Teachers were influenced by things that their influencers were doing or how they were conducting themselves, such as the way former mathematics teachers taught them, how teachers dressed, their family background and teaching status.

5.5 CONCLUSIONS

With the above cautions in mind, some tentative conclusions can be drawn from this study. The justification of utilising the explanatory sequential design, according to Creswell (2014), is basically to have the qualitative data assisting in annotating the primary quantitative results comprehensively. The conclusions of this study will, therefore, be in a narrative explaining the quantitative data in more detail.

There were a couple of themes that this study was pursuing. The themes were motivational factors (*intrinsic factors, extrinsic factors, altruistic factors), “*past events or experiences” and “the influence of others” to become mathematics teachers. The themes of this study were similar to the findings of Balyer and Ozcan (2014), their studies revealed that the reasons for choosing to teach could

be categorised into *altruistic*, *intrinsic*, *extrinsic* and *being influenced by others*. During the analysis of the qualitative findings, another theme emerged, a “fall back career”; the theme was also part of the FIT-CF. In the findings of this study, the following conclusions can be made:

The first conclusion was about the motivational factors (*intrinsic, extrinsic, altruistic factors)* and “past events or experiences”; the participants were influenced the most by *altruistic factors* (such as “Teaching allows me to raise the ambitions of the underprivileged youths”), followed by *intrinsic factors* (such as “I have skills to be a good teacher” and “I have qualities of a good teacher”), “past events or experiences” (such as “State of mathematics education*”* and “The shortage of mathematics teachers”) and the least by *extrinsic factors* (such as “Teaching has many holidays” and “Teaching is a secured job”). These findings are similar to the study by Bakar et al. (2014) who also found that student teachers in Malaysia rated *altruistic factors* as more significant for them to choose to teach than *intrinsic* and *extrinsic factors*. These findings are directly in contrast to Low et al. (2011) and Yuce et al. (2013) respectively. In Low et al. (2011), the female participants seemed to have been more influenced by *intrinsic factors* and *altruistic factors* than their male counterparts, although the differences were not statistically significant. On the other hand, male teachers seemed to have been strongly influenced by *extrinsic factors* and “past events or experiences”, more than their female counterpart. In Yuce et al.’s (2013) findings, the prospective female teachers were influenced by *intrinsic*, *altruistic*, and *influence-based* [not based on personal profit and money]. They further indicated that males, on the other hand, mostly became teachers due to mercenary based *extrinsic motivation*”. This might be due to the aspect that was indicated in the ERG theoretical framework utilised in this study (the ERG theory accounted for differences in need preferences between cultures as the order of needs could be different for different people and described human behaviour). Therefore, the very same cultural groups could have different needs if they were found in different settings (see Section 5.3).

The participants in this study seemed to have been satisfied with their choices of becoming mathematics teachers. By joining the teaching profession, the participants mostly wanted to contribute to society by “Raising the ambitions of the underprivileged youths”. These findings were similar to Du Preez (2018)

contending that making a social contribution was rated as one of the most important reasons for choosing mathematics education as a career, and students profusely stated that they want to improve the lives of children, the community and the country were adored by the teachers. It is assumed that if mathematics teachers could be influenced the most by *altruistic factors* followed by *intrinsic factors*, the mathematics labour force would be extremely motivated to give their best in teaching mathematics, thereby producing quality mathematics results.

On average, the *extrinsic factors* were the least influential factors for participants to become mathematics teachers. However, the responses showed that there are certain *extrinsic factors* that played a major role in influencing the participants to choose mathematics education, for instance, the issue of “rural allowances” for mathematics teachers (Bennell, 2004) and “job security” when you have pursued a mathematics education. They indicated that the generous holidays gave them ample time to rest and spend quality time with their loved ones. Moreover, by being mathematics teachers, the participants’ jobs would always be “secured” as there is a shortage of mathematics teachers in rural areas.

Pertaining to “past events or experiences”, the participants seemed to have been influenced by, for instance, “My competence in mathematics” as well as by a variety of past events and experiences. The majority of participants were competent in mathematics; therefore, their mathematical content knowledge and skills will be of utmost importance. The male participants were more strongly influenced by “past events or experiences” than their female counterparts. The participants that were taught mathematics well irrespective of their demographic location and who were inspired to become mathematics teachers would likely become good mathematics teachers themselves.

The teachers influenced by “past events or experiences” would likely stay longer in the teaching profession because they had some good prior teaching experiences. SA could benefit a lot from that since it was struggling to recruit suitable people into the teaching profession. The country should consider establishing one-year learnership programmes for prospective teachers to expose them to classroom situations before they could decide to pursue teaching. Similar programmes have been established in successful countries such as Singapore; the prospective

teachers were given the opportunity to test themselves against real classroom politics. The programmes were successful.

Teachers that were mostly *altruistically* and *intrinsically* motivated seemed to remain in teaching for a longer period irrespective of being promoted and remunerated better or not. Teachers that were mainly *extrinsically* motivated more easily left the profession for some businesses or other sectors of the economy when the opportunities arose. Since the participants in this study were dominantly influenced by *altruistic factors* followed by *intrinsic factors*, the government of SA, especially the Limpopo DBE, should improve the conditions of labour, the class sizes or teacher-learner ratio, the schools' safety and the provision of LTSMs compliant to the fourth industrial revolution. The teachers in SA complained about salaries; the salaries were not competitive compared to other professions. On the other hand, the teachers' salaries in a country such as Singapore were competitive in relation to other professions. Therefore, the teaching profession in Singapore is equally a sought-after career because of the salaries.

The second conclusion was pertaining to who influenced the participants to become mathematics teachers. The participants in the interviews were mostly indirectly influenced by some persons or groups. The participants had been influenced by such persons or groups through some "hidden curriculum", for instance, when they saw how some professionals or "role models" conducted themselves or dressed up, they could get impressed by that. The onlooker might envy the position and the profession of that particular professional or "role model" and become influenced, since some of the participants were influenced by the conduct of their former teachers. All the teachers and specifically mathematics teachers should be exemplary and be models of dignity at all times, be it at home, work and everywhere.

The third conclusion, about 44% of the teachers interviewed became teachers incidentally. The teaching profession was not their first choice, it was their last resort. The findings were similar to (Baran et al., 2015; Markovits & Kartal, 2013) who revealed that a low percentage of teachers chose to teach as a last resort or by chance. Some people would also opt for teaching because their intended career choices were out of their reach; they did not qualify. These findings were similar to those of Ebru (2012), who revealed that a small percentage of teachers

stated that they would have chosen a different career if their university entrance exam scores had been higher. Since some people might become teachers by chance or as a “fall back career”, rigorous induction programmes should be instituted to orientate them to the teaching profession.

Overall the participants were mainly influenced to become mathematics teachers by *altruistic factors* in this study. The other factors: *intrinsic factors*, *extrinsic factors* and “past events or experiences” were somehow reinforcements to their decisions to take up mathematics education as a career. Some “past events or experiences” had some bearing on the participants’ initial decisions to become mathematics teachers and also a “fall back career”. The issue of “the influence of others” to become mathematics teachers had little bearing in their decisions.

The implication of the findings is that understanding the factors that influenced teachers to choose mathematics education as a career could provide insight on how recruitment, retention and effectiveness of mathematics teachers could be optimised in SA. The findings might also become the guiding instruments of choice for design and implementation of policy changes. In addition, the findings might be utilised to customise the interventions for redress in disadvantaged rural areas of the Limpopo Province.

5.6 RECOMMENDATIONS

The rationale of this study was to investigate the question, “Why do teachers choose mathematics education as a career?” The following recommendations are made:

- The DBE should make a point that the relevant policies and programmes are in place to support the teaching force, especially the novice teachers. The retention rate of quality mathematics teachers should be maintained at all times, even in the deep rural areas of the Limpopo Province. All the sticking issues that might hamper or hinder the delivery of quality education should be addressed to sustain the quality of the teaching and learning process.
- This study was conducted at only one of the six clusters in the Vhembe District. The same or similar study should be conducted across the entire district, the Limpopo Province and to other provinces of South Africa.

- This study was limited to only FET mathematics teachers, therefore a similar study should be considered where a broader scope is covered to include all mathematics teachers across the different bands of the Basic Education sector. Such a study might yield different results to contribute to the body of knowledge about why teachers choose mathematics education as a career.
- The incentives or rural allowances versus the retention rate of mathematics teachers should also be explored.
- The learners' performance in mathematics versus the motivational factors that led teachers to become mathematics teachers should also be explored.

5.7 CONCLUSION

The rationale of this study was to investigate the question, "Why do teachers choose mathematics education as a career?" This study showed that teachers were motivated to join teaching because of a variety of factors. The data collected was categorised according to motivational factors (*intrinsic, extrinsic, altruistic)*, "past events or experiences" and "the influence of others" to become mathematics teachers and also a "fall back career". Both the ERG theory and FIT-CF were utilised to explain the participants' responses and this study's findings. The discussions of the survey and interviews, the nexus between the theoretical framework and the research findings were discussed and some conclusions were reached. Some recommendations were made for further research.

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ANNEXURES

ANNEXURE A: LETTER OF INVITATION TO PARTICIPATE IN SURVEY

Dear Respondent

I, **Kubayi Moses Langutani**, being supervised by **Dr. R.D. Sekao**, invite you to participate in a research entitled: **Choosing mathematics education as a career: narratives of three different cohorts**. I am currently enrolled in the MEd SMTE at the University of Pretoria and am in the process of writing my Dissertation.

The purpose of the research is to determine **reasons why teachers choose mathematics education as a career**. The survey questionnaire has been designed to collect information on: **Choosing mathematics education as a career**.

Your participation in this research project is completely voluntary. You may decline altogether or withdraw at any time during the data collection process. There are no known risks to participation beyond those encountered in everyday life. Your responses will remain confidential and anonymous. Data from this research will be kept under lock and key and reported only as a collective total. No one other than the researcher will know your individual answers to the survey.

The letter of application for permission to conduct research has been written to the Limpopo Department of Education, Vhembe District and Hlanganani Cluster secondary schools.

The letter of informed consent to the school principal has also been written in which he/she will have to sign for permission to be granted for the study at the

school. It has been indicated in the letter that the identity of all respondents will be protected and they will remain anonymous. The findings of the research will be used to promote teaching and learning and will be published.

If you agree to participate in this project, please answer the questions on the questionnaire as best as you can. It should take approximately 30 - 60 minutes to complete the survey.

Thank you for your assistance in this important endeavour.

Yours Sincerely

Kubayi M.L.

_____ _____

Kubayi M.L. (Student) Dr. R.D. Sekao (Supervisor)

For any questions please feel free to contact either myself or my supervisor.

Student	Supervisor
Kubayi M.L.	Dr. R.D. Sekao
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e-mail: moseskubayi@ymail.com	e-mail: david.sekao@up.ac.za

ANNEXURE B: LETTER OF INVITATION TO PARTICIPATE IN THE INTERVIEW

Dear Participant

I, **Kubayi Moses Langutani**, being supervised by **Dr. R.D. Sekao**, invite you to participate in a research entitled: **Choosing mathematics education as a career: narratives of three different cohorts**. I am currently enrolled in the MEd SMTE at the University of Pretoria and am in the process of writing my Dissertation.

The purpose of the research is to determine **reasons why teachers choose mathematics education as a career**. The interview schedule has been designed to collect information on: **Choosing mathematics education as a career**.

Your participation in this research project is completely voluntary. You may decline altogether or withdraw at any time during the data collection process. There are no known risks to participation beyond those encountered in everyday life. Your responses will remain confidential and anonymous. Data from this research will be kept under lock and key and reported only as a collective total. No one other than the researcher will know your individual answers to the interview.

The letter of permission to conduct research has been written to the Limpopo Depart tment of Education, Vhembe District and Hlanganani Cluster secondary schools.

The letter of informed consent to the school principal has also been written in which he/she will have to sign for permission to be granted for the study at the school. It has been indicated in the letter that the identity of all participants will be protected and they will remain anonymous. The findings of the research will be used to promote teaching and learning and will be published.

If you agree to participate in this project, please answer the questions on the interview schedule during the interview session as best as you can. It should take approximately 30 - 60 minutes to complete one interview session.

Thank you for your assistance in this important endeavour.

Yours Sincerely

Kubayi M.L.

_____ _____

Kubayi M.L. (Student) Dr. R.D. Sekao (Supervisor)

For any questions please feel free to contact either myself or my supervisor.

Student	Supervisor
Kubayi M.L.	Dr. R.D. Sekao
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ANNEXURE C: INFORMED CONSENT FORM FOR RESPONDENT/PARTICIPANT.

Participant information sheet

Research title	Choosing mathematics education as a career: narratives of three different cohorts
Researcher/Student	Name: Moses Langutani Kubayi Email: moseskubayi@ymail.com Contact number: 072 010 8628
Supervisor	Name: Dr. R.D. Sekao Email: david.sekao@up.ac.za Contact number: 012 420 4640

What is the purpose of this research?
To examine the reasons why teachers choose mathematics education as a career. To lay foundation to develop teacher policies and to help profile teachers for recruitment.The literature indicates different reasons, for example extrinsic, intrinsic and altruistic reasons. Korb (2010), investigated reasons for choosing teaching among 406 students in order to evaluate the widespread belief that students choose teaching as a last resort career.

Why have I been chosen?
You have been chosen because you are currently teaching mathematics in the FET. You are falling in one of the three cohorts: Cohort 1: mathematics teachers that got into teaching before 1994; Cohort 2: mathematics teachers that got into teaching between 1994 and 2007; Cohort 3: mathematics teachers that got into teaching after 2007.

What happens if I volunteer to take part in this study?
First, it is up to you to decide whether or not to take part. If you decide to take part you will be asked to complete the questionnaire or to be interviewed at your school for about 30 - 60 minutes per sitting. The survey questionnaires will be distributed to the

respondents to respond to. The questionnaires will then be collected immediately after completion. For the interviews, you will be interviewed. You will be requested to respond to the interview questions to the best of your knowledge.

What will I have to do?
For the survey, you will be required to complete the survey questionnaire for about 30 – 60 minutes. For the interviews, you will be required to avail yourself for interview of about 30 - 60 minutes. The interview will be face to face and will be audio taped or tape recorded. The interviews will be between 1st of May 2018 and 30th of September 2018.

Will I received any financial reward or travel expenses for taking part?
No.

Are there any other benefits of taking part?
You will be contributing to the laying of foundation for developing teacher policies and helping the profiling of teachers for recruitment.

Will participation invoke any physical discomfort or harm?
No.

Will participation involve any embarrassment or other psychological stress?
No. The questions will be of low sensitivity.

What will happen once I have completed all that is asked of me?
For the survey, that will be all. For the interview, you will be asked to comment on the results related to your information given during the interviews.

How will my taking part in this study be kept confidential?
The survey questionnaires will require your code name (pseudonyms) only. The interview questions will never ask you to say name. The researcher will address you as interviewee or the code name given to you after consenting to take part. The data analysis and write up will still be coded securing anonymity of participants.

How will my data be used?
The overall results will be used by the researcher to write the dissertation. The data will also be utilised by Dr. R.D. Sekao, my supervisor. The data will be used to inform future studies and used in research articles.

Who has reviewed this study?
This study has undergone full ethical scrutiny and all procedures have been risk assessed and approved by the Faculty of Education and Research Ethics Committee at the University of Pretoria.

What if I am unhappy during my participation in the study?
You are free to withdraw from the study at any time. During the study itself, the recording will be deleted and personal information discarded. You do not need to give reason for your withdrawal. After you have completed the research you can still withdraw by contacting either the researcher or supervisor. If you are concerned that regulations are being infringed, or that your interests are otherwise being ignored, neglected or denied, you should inform Dr. R.D. Sekao, who will investigate your complaint (Tel: 012 420 4640, Email: david.sekao@up.ac.za).

Which language will the study follow?
English.

How do I take part?
Contact the researcher the contact details are given below. The researcher will answer any clarity seeking questions and explain how you can get involved. Name: Moses Langutani Kubayi Cell: 072 010 8628. Email: moseskubayi@ymail.com

ANNEXURE D: INFORMED CONSENT DECLARATION

Research title	Choosing mathematics education as a career: narratives of three different cohorts
Researcher/Student	Name: Moses Langutani Kubayi Email: moseskubayi@ymail.com Contact number: 072 010 8628
Supervisor	Name: Dr. R.D. Sekao Email: david.sekao@up.ac.za Contact number: 012 420 4640

Please intial

I confirm that I have read and understood all the information provided in the informed consent form relating to the above study and I have had the opportunity to ask questions.	
I understand this study is designed tofurther scientific knowledge and that all procedures have been risk assessed and approved by the Faculty of Education and Research Ethics Committee at the University of Pretoria. Any questions I have about my participation in this project have been answered to my satisfaction.	
I fully understand my participation is voluntary andthat I am free to withdraw from this study at any time and at any stage, without giving any reason.	
I have read and fully understand this consent form.	

_____ _____ _____

Name of respondent/participant Signature Date

_____ _____

Kubayi M.L. (Student) Dr. R.D. Sekao (Supervisor)

For any questions please feel free to contact either myself or my supervisor.

Student	Supervisor
Kubayi M.L.	Dr. R.D. Sekao
Cell-phone: 072 010 8628	Tel: 012 420 4640
e-mail: moseskubayi@ymail.com	e-mail: david.sekao@up.ac.za

ANNEXURE E: LETTER OF APPLICATION TO CONDUCT RESEARCH

Contact details: 072 010 8628

Email: moseskubayi@ymail.com

P.O. Box 531

Elim Hospital

0960

2018 - 04 - 09

Head of Department: Limpopo Education

Private Bag X9489

POLOKWANE

0700

Dear Sir/Madam

APPLICATION FOR CONDUCTING RESEARCH IN LIMPOPO PROVINCE, VHEMBE DISTRICT: HLANGANANI CLUSTER SECONDARY SCHOOLS.

I, **Moses Langutani Kubayi**, being supervised by **Dr. R.D. Sekao**, hereby wish to apply for permission to conduct research in the Limpopo Department of Education, Vhembe District at Hlanganani Cluster secondary schools with FET Mathematics teachers. The fieldwork is intended to start in May 2018 and end in September 2018.

The research is entitled: **Choosing mathematics education as a career: narratives of three different cohorts**. I am currently enrolled in the MEd SMTE at the University of Pretoria and am in the process of writing my Dissertation.

The purpose of the research is to determine **reasons why teachers choose mathematics education as a career**. The enclosed questionnaire and interview schedule have been designed to collect information on: **Choosing mathematics education as a career**.

Thank you for your consideration in this project.

Yours Faithfully

Kubayi M.L. (UP Student no.: 13307292)

_____ _____

Kubayi M.L. (Student) Dr. R.D. Sekao (Supervisor)

For any questions please feel free to contact either myself or my supervisor.

Student	Supervisor
Kubayi M.L.	Dr. R.D. Sekao
Cell-phone: 072 010 8628	Tel: 012 420 4640
e-mail: moseskubayi@ymail.com	e-mail: david.sekao@up.ac.za

ANNEXURE F: LETTER OF INFORMED CONSENT FOR PRINCIPAL

Contact details: 072 010 8628

Email: moseskubayi@ymail.com

P.O. Box 531

Elim Hospital

0960

2018 - 04 - 09

The Principal

Dear Sir/Madam

APPLICATION FOR CONDUCTING RESEARCH AT THE SCHOOL.

I, **Moses Langutani Kubayi**, being supervised by **Dr. R.D. Sekao**, hereby wish to apply for permission to conduct research at the school with FET Mathematics teacher(s). The fieldwork is intended to start in May 2018 and end in September 2018.

The research is entitled: **Choosing mathematics education as a career: narratives of three different cohorts**. I am currently enrolled in the MEd SMTE at the University of Pretoria and am in the process of writing my Dissertation.

The purpose of the research is to determine **reasons why teachers choose mathematics education as a career**. The survey questionnaire and interview schedule

have been designed to collect information on: **Choosing mathematics education as a career**.

Thank you for your consideration in this project.

Yours Faithfully

Kubayi M.L. (UP Student no.: 13307292)

_____ _____

Kubayi M.L. (Student) Dr. R.D. Sekao (Supervisor)

For any questions please feel free to contact either myself or my supervisor.

Student	Supervisor
Kubayi M.L.	Dr. R.D. Sekao
Cell-phone: 072 010 8628	Tel: 012 420 4640
e-mail: moseskubayi@ymail.com	e-mail: david.sekao@up.ac.za

I _____ , grant permission that the selected school, as determined by the researcher, cooperate by participating in the above-mentioned research. I am aware that the findings of the research will be used to promote teaching and learning and will be published. I am furthermore aware that identities of all respondents or participants will be protected and they will therefore remain anonymous.

Signed: _____ Date: _____

ANNEXURE G: LETTER FOR LEAVE OF ABSENCE FROM WORK

Contact details: 072 010 8628

Email: moseskubayi@ymail.com

P.O. Box 531

Elim Hospital

0960

2018 – 04 – 09

Head of Department: Mpumalanga Education

Private Bag X11341

NELSPRUIT

1200

Dear Sir/Madam

APPLICATION FOR LEAVE OF ABSENCE: MYSELF.

I, **Moses Langutani Kubayi**, being supervised by **Dr. R.D. Sekao**, hereby wish to apply for a leave of absence from work since I will be doing my research project. The fieldwork is intended to start in May 2018 and end in September 2018.

The research is entitled: **Choosing mathematics education as a career: narratives of three different cohorts**. I am currently enrolled in the MEd SMTE at the University of Pretoria and am in the process of writing my Dissertation.

The purpose of the research is to determine **reasons why teachers choose mathematics education as a career**. The enclosed questionnaire and interview schedule have been designed to collect information on: **Choosing mathematics education as a career**.

Thank you for your consideration in this project.

Yours Faithfully

Kubayi M.L. (UP Student no.: 13307292)

_____ _____

Kubayi M.L. (Student) Dr. R.D. Sekao (Supervisor)

For any questions please feel free to contact either myself or my supervisor.

Student	Supervisor
Kubayi M.L.	Dr. R.D. Sekao
Cell-phone: 072 010 8628	Tel: 012 420 4640
e-mail: moseskubayi@ymail.com	e-mail: david.sekao@up.ac.za

ANNEXURE H: DATA COLLECTION INSTRUMENT (SURVEY QUESTIONNAIRE)

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA
Faculty of Education

SURVEY QUESTIONNAIRES.

A. Answer each question by **circling** the appropriate number in the box provided alongside the question.

For office use

Respondent's number A0 ☐

1. Gender A1 ☐

Male	1
Female	2

2. What is your age in years? _____ A2 ☐

3. Nationality A3 ☐

South African	1
Non-South African	2

4. Grades being taught A4i ☐

Grade 10	1
Grade 11	2
Grade 12	3

A4ii ☐

A4iii ☐

5. Overall 2018 End of year mathematics results' analysis in %

i. Grade 10

A5i

0 – 29	1
30 – 39	2
40 – 49	3
50 – 59	4
60 – 69	5
70 – 79	6
80 – 100	7

ii. Grade 11

A5ii

0 – 29	1
30 – 39	2
40 – 49	3
50 – 59	4
60 – 69	5
70 – 79	6
80 – 100	7

iii. Grade 12

A5iii

0 – 29	1
30 – 39	2
40 – 49	3
50 – 59	4
60 – 69	5
70 – 79	6
80 – 100	7

6. Resumption as teacher

A6

On or before 1994	1
Between 1994 and 2007	2
After 2007	3

B. What are the *intrinsic factors* that influenced you to become mathematics teacher?

Please kindly use one of the following codes:

1 = Strongly disagree

2 = Disagree

3 = Unsure

4 = Agree

5 = Strongly agree

1. Teaching suit my personality B1 ☐

1	2	3	4	5

2. I like teaching B2 ☐

1	2	3	4	5

3. I always wanted to be a teacher B3 ☐

1	2	3	4	5

4. I admire the teaching job B4 ☐

1	2	3	4	5

5. I am interested in teaching B5 ☐

1	2	3	4	5

6. I have the skills to be a good teacher B6 ☐

1	2	3	4	5

7. I have the qualities of a good teacher B7

1	2	3	4	5

8. I like working with children B8

1	2	3	4	5

9. I have the emotional and psychological strength to be a teacher B9

1	2	3	4	5

C. What are the *extrinsic factors* that influenced you to become mathematics teacher?

Please kindly use one of the following codes:

1 = Strongly disagree

2 = Disagree

3 = Unsure

4 = Agree

5 = Strongly agree

10. Teaching has many fringe benefits C10

1	2	3	4	5

11. Teachers are paid well C11

1	2	3	4	5

12. Teaching has many holidays C12

1	2	3	4	5

13. Teaching provides a clear career path C13

1	2	3	4	5

14. Teaching is a secured job C14

1	2	3	4	5

15. A teacher is well respected by the society C15

1	2	3	4	5

16. By being a teacher I can improve my social status C16

1	2	3	4	5

17. Teaching allows more time for family C17

1	2	3	4	5

18. My family encouraged me to choose a teaching position C18

1	2	3	4	5

D. What are the *altruistic factors* that influenced you to become mathematics teacher?

Please kindly use one of the following codes:

1 = Strongly disagree

2 = Disagree

3 = Unsure

4 = Agree

5 = Strongly agree

19. Teaching allows me to influence the next generation D19

1	2	3	4	5

20. Teaching allows me to provide social service to the society D20

1	2	3	4	5

21. Teaching allows me to raise the ambitions of underprivileged youths D21

1	2	3	4	5

22. By being a teacher, I can bring an impact on children and adolescents' future D22

1	2	3	4	5

23. By being a teacher, I can help the young to live a meaningful life D23

1	2	3	4	5

24. I want to stimulate children and adolescents intellectual thoughts D24

1	2	3	4	5

25. Teaching allows me to shape the child and adolescents' future D25

1	2	3	4	5

E. What *past events* or *experiences* influenced you to become mathematics teacher?

Please kindly use one of the following codes:

1 = Strongly disagree

2 = Disagree

3 = Unsure

4 = Agree

5 = Strongly agree

26. Shortage of Mathematics teachers E26

1	2	3	4	5

27. State of Mathematics education E27

1	2	3	4	5

28. Competence of my Mathematics teacher(s) E28

1	2	3	4	5

29. My competence in Mathematics E29

1	2	3	4	5

30. Lack of career guidance E30

1	2	3	4	5

F. Who influenced you to become mathematics teacher?

31. Rank these persons or group from 1 to 9 or 10, where 1 represents the person or group who influenced you most and 9 or 10 the person or group who influenced you least

1. Mathematics teacher(s) F1
2. Peer group F2
3. Parents F3

4. Other family members F4
5. School principal(s) F5
6. Career guidance teacher F6
7. Religious leader F7
8. Community leader F8
9. Other teacher(s) F9

10. Other (specify) F10

Thank you for your cooperation.

ANNEXURE I: DATA COLLECTION INSTRUMENT (INTERVIEW PROTOCOL)

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA
Faculty of Education

INTERVIEW SCHEDULE

1. How have the following *intrinsic factors* influenced you to become mathematics teacher?
   a. Skills
   b. Qualities
2. How have the following *extrinsic factors* influenced you to become mathematics teacher?
   a. Many holidays
   b. Secured job
3. How has the following *altruistic factor* influenced you to become mathematics teacher?
   a. Raising the ambitions of underprivileged youths
4. What *past events* or *experiences* of the following time frames influenced you to become mathematics teacher? How?
   a. Before 1994
   b. Between 1994 and 2007
   c. After 2007
5. Who influenced you to become mathematics teacher? How?

Thank you very much for your contribution.