LEARNERS' ATTITUDES TOWARDS MATHEMATICS IN GRADE 9, AND THEIR EFFECT ON LEARNERS' CHOICE OF SUBJECTS IN GRADE 10: A CASE STUDY CONDUCTED IN LEJWELEPUTSWA DISTRICT

MOTSOANE SELLO GERT

RESEARCH

Submitted in partial fulfilment of the requirements for the degree of

MAGISTER EDUCATIONIS

in the

SCHOOL OF TEACHER EDUCATION

at the

CENTRAL UNIVERSITY OF TECHNOLOGY

SUPERVISOR: DR B KHOBOLI

CO-SUPERVISOR: DR L SCHLEBUSCH

2017

DEDICATION

This study is dedicated to my late father, Molefi Motsoane, (a car mechanic) who sacrificed every resource to assure me of education, and to my mother, Tobatsana Motsoane, who provided me with my first experience of a formal education and thus a foundational knowledge of the schooling system. I also dedicate it to my wife Masesi Motsoane and my children, who have been very supportive throughout my studies. I thank them for understanding my use of family time to work on my studies, knowing that it will help me better understand my role as a Mathematics curriculum implementation coordinator.

DECLARATION

I declare that:

The topic **Learners` attitudes towards Mathematics in Grade 9 and their effect on learners' choice of subjects in Grade 10: A case study conducted in Lejweleputswa district** is the creation of my own work over time, that I have indicated all quotes and sources that were used in this work, and that I have also acknowledged all references used.

MOTSOANE S.G　　　　　　　　　　DATE

ACKNOWLEDGEMENTS

I, the researcher, wish to acknowledge the valuable contribution made by all participants in responding to questionnaires administered as well as the services of specialised people who ensured the production of this quality work and helped to make the study a success.

I further wish to thank my supervisor, Dr B Khoboli, and my co-supervisor, Dr L Schlebusch, for making my studies bearable by providing continuous academic support, giving encouragement and showing willingness to provide guidance when conducting the statistical analysis of the data collected. They have been very patient and consistent in giving constructive criticism in ensuring the production of this writing. They made it possible for me to enjoy the research work and better understand what the findings of my research mean in my field of work. They also helped me to regard my study as a platform that will enabled me to better understand the teaching and learning of Mathematics, so that I can give informed support to the implementation of the Mathematics curriculum in my field of work.

The Central University of Technology, Free State (Welkom Campus) made funds available to me to travel around ten schools in the Lejweleputswa district in order to administer the questionnaire process amongst participants. The university also provided financial support for tuition and all related aspects, making it possible for me to concentrate fully on my studies with little concern about the financial demands of the study. The Dean of the faculty was very patient with me as he expected good quality work in my research exercise.

I wish to thank all the colleagues and experts who helped with the editing of this manuscript and ensured the appropriate use of English to communicate the findings and recommendations without any ambiguity.

I further wish to thank all Grade 9 and 10 learners in the selected schools who participated in this research work by responding to questionnaires administered with them. Furthermore, I am grateful to the school principals and teachers who made time available and arranged classrooms for learners to participate in the research, giving a clear account of how they relate to Mathematics teaching and learning. I would also like to express gratitude to the officials of the Department of Education for registering this study and for giving their permission to visit schools and conduct the study.

A special word of thanks to my wife, Masesi Motsoane, my children, relatives and friends, who have given me their unreserved support and encouragement since I started with my studies. At times my children struggled to understand why I had to study when they were the ones attending school and I was working, and at other times they would remind me, when everyone was going to bed, that it was time for me to study. I wish to thank them for their encouragement and support.

Lastly I wish to thank God for standing by me in my silent prayer while seeking encouragement, strength and wisdom to remain focussed on my studies and what I aimed to achieve.

KEYWORDS

Mathematics teaching

Learners' performance

Mathematics knowledge

Attitude towards Mathematics

Factors Analysis

TABLE OF CONTENTS

CHAPTER 3: RESEARCH DESIGN METHODOLOGY

CHAPTER 4: DATA REPRESENTATION AND ANALYSIS

CHAPTER 5: DATA PRESENTATION FROM FACTOR ANALYSIS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

ANA: National Annual Assessment

CAPS: Curriculum and Assessment Policy Statement

DBE: Department of Basic Education

NCS: National Curriculum Statement

NSC: National Senior Certificate

OBE: Outcome Based Education

NPP: Negative Positive Positive

NPN: Negative Positive Negative

NNP: Negative Negative Positive

NNN: Negative Negative Negative

PPP: Positive Positive Positive

PPN: Positive Positive Negative

PNP: Positive Negative Positive

PNN: Positive Negative Negative

SPSS: Statistics Program for Social Sciences

ABSTRACT

The performance of learners in Mathematics from Grade 4 to 10 is not of an acceptable standard in schools. It has been noted that when learners start school they generally feel excited about learning numbers and counting, as these are directly related to their everyday lives. In later grades, however, it appears that learners gradually lose their appetite for Mathematics and their interaction with numbers as these become less 'obviously' relevant as they progress through the grades. This attitude towards Mathematics has manifested itself even in the light of changes from one curriculum to another. For example, from the use of Outcome Based Education and the National Curriculum Statement to the Curriculum and Assessment Policy Statement, the same low morale in Mathematics classrooms has persisted in South African schools.

The Annual National Assessment results over years show a very insignificant improvement, if any, in the Grade 9 Mathematics results in Lejweleputswa schools as well. The introduction of Mathematical Literacy afforded learners the option to avoid enrolling for Mathematics in Grade 10 as many do not perform well in Grade 9. It is this attitude towards Mathematics in Grade 9 that prompted a need for this study in which the factors that contribute to learners' attitudes towards Mathematics are investigated in detail. The study interrogates the extent to which learners' attitudes towards Mathematics, particularly in Grade 9, contribute to their choice of Mathematical Literacy over Mathematics in Grade 10, even when they want to pursue Science- and Technology-related fields of study after their National Senior Certificate examinations. The sample of Grade 9 and 10 Mathematics and Mathematical Literacy learners chosen within the schools in Lejweleputswa district will be expected to reflect their opinion on how they view Mathematics, by completing a questionnaire. The study will also consider the participants' ages and gender and to what extent these affect the attitude learners have towards Mathematics learning.

The literature review in this work also places teachers and their activities in a Mathematics classroom at the centre of the development of these attitudes towards Mathematics. Bear in mind that Mathematics is a subject in which concepts and knowledge at one level directly build a foundation for the next grade, and therefore any insufficient interaction with the subject at one grade has a bearing on learning

efficiently in the next. It is with this in mind that the teacher's role is interrogated in order to reveal how it affects the development of attitudes towards the learning of Mathematics.

CHAPTER 1

INTRODUCTION TO THE STUDY

1.1 INTRODUCTION

The learning of Mathematics in South Africa is of national concern; more learners opt to register for Mathematical Literacy rather than Mathematics in the hope of securing a pass mark. Some of the learners who do choose Mathematics as a subject fail to show commitment, and often lack the positive desire to get the most out of the subject. This can be easily evidenced from the National Senior Certificate (NSC) examination results with a performance average of 51% in the last four years (Department of Basic Education, 2016). The National diagnostics reports indicate that errors committed in Grade 12 examination papers are due to learners dedicating little time to practising inherent skills required to master the subject, such as problem-solving, logical reasoning, and the development of inquisitive minds (Department of Basic Education, 2016). It is this attitude of learners towards Mathematics that has been raised as an area of concern requiring research so that it can be better understood. It is hoped that the recommendations that will be made at the end of this research will eventually contribute towards improving learner enrolment in Mathematics.

Mathematics is a universal subject, so much a part of life that anyone who is a participating member of society ought to be mathematically literate in order to adjust to the technological challenges of the world. It is thus important to understand the teaching and learning of Mathematics, with particular focus on the kind of attitudes that develop in this process. It would seem that learners' attitudes towards Mathematics are ultimately determined by the learning opportunities and experiences in a Mathematics classroom. It is for this reason that in higher grades, especially in secondary school classes, the subject gets restricted to a selected group of learners. The current system in our schools does not help the situation because schools have an inadequate number of well qualified and experienced teachers to teach Mathematics. Unfortunately, some teachers lack appropriate teaching methodologies, resulting in learners losing interest and adopting a negative attitude towards the subject.

The Curriculum and Assessment Policy Statement (CAPS) describes Mathematics as a language that makes use of symbols and notations for describing numerical, geometric, and graphical relationships. It is regarded as a human activity that involves observing, representing and investigating patterns and qualitative relationships in physical and social phenomena, and between mathematical objects themselves. It helps to develop mental processes that enhance logical and critical thinking, accuracy and problem–solving, which contribute to decision-making. Mathematical problem-solving enables us to understand the world (physical, social and economic) around us, and, most importantly, teaches us to think creatively (Department of Basic Education, 2011A).

CAPS envisions Mathematical Literacy as a subject that will enable learners to become self-managing persons, productive workers and participating citizens in a developing democracy. The teaching and learning of Mathematical Literacy is thus expected to provide opportunities for learners to analyse problems and devise ways to work mathematically in solving such problems. Opportunities to engage mathematically will also assist learners to become astute consumers of basic mathematics reflected in the media (Department of Basic Education, 2011B).

It is this clear distinction between the two subjects that assists learners when making subject choices in Grade 10. Although schools are responsible for making learners aware of the distinction existing between the two subjects, there appear to be very few learners registering for Mathematics as a subject; as mentioned, those who do often fail to commit themselves to the subject. The negative attitude learners' show towards Mathematics is reflected in their performance and their results, even in the lower grades.

The Department of Basic Education (DBE) has categorised public schools into four phases from Grade R-12 (Department of Basic Education, 2013).

These categories and their respective grades are as follows:

- Foundation Phase – Grades 1-3
- Intermediate Phase – Grades 4-6
- Senior Phase- Grades 7-9, and
- Further Education and Training Phase – Grades 10-12

The exit grades are considered to be the last grades in a phase, which are Grade 3, 6, 9 and 12. Grade 3, 6 and 9 were sometimes exposed to Annual National Assessment (ANA) tests. There are external examinations, particularly for Grade 12, which are nationally administered by DBE and externally moderated by Umalusi, the Council for Quality Assurance in General and Further Education and Training. The Mathematics or numeracy performance of learners in these assessment scores indicates a need for more acute intervention to improve learner attitude in the learning of Mathematics, particularly in higher grades (Department of Basic Education, 2014).

The table below, published by the Department of Basic Education (DBE, 2014), is an illustration of performance in the ANA. It shows a steep and acute decline in numeracy or Mathematics average percentage from lower to higher grades.

Table 1.1: ANA: Free State Mathematics Average Percentage Mark (DBE, 2013A).

Grade	2012	2013	2014
1	70.2	58.9	64.5
2	59.7	59.9	63.7
3	44.7	54.9	56.2
4	36.3	35.0	37.3
5	30.9	32.5	39.3
6	28.4	40.0	48.2
9	**14.0**	**15.3**	**13.8**

It can be observed from the table that the Mathematics average percentage mark becomes lower as grades get higher. The question to be asked is: what is the relationship between the performance and attitude of learners towards Mathematics by the time they reach Grade 9? Ways of making Mathematics appealing to learners need to be investigated in order to increase the enrolment in Grade 10.

TABLE 1.2: National Mathematics percentage of learners achieving ≥50% (DBE, 2013B).

Grade	2012	2013	2014
3	**36**	**59**	**69**
6	**11**	**27**	**35**
9	**2**	**2**	**3**

The table above indicate that even the quality of results for learners in these grades reduces as the grades get higher. Far fewer learners achieve quality scores in Mathematics by the time they reach secondary school.

This negative attitude towards Mathematics is a challenge in many countries despite the effort schools put towards making Mathematics appealing to learners. South Africa is no exception; motivating more learners to opt for Mathematics in Grade 10 is a daunting challenge.

In South Africa, all learners in Grade 9 are offered Mathematics as a compulsory subject but have the option in Grade 10 to choose between Mathematics and Mathematical Literacy (DBE, 2013). Their choices could be influenced by different factors such as their perceptions as well as attitude to and their experiences in the Grade 8 and 9 Mathematics classroom. This accounts, perhaps, for why the majority opt for Mathematical Literacy rather than Mathematics. The table below compares the 2011 enrolments in Grade 9 and 2012 Grade 10 enrolments in six selected Lejweleputswa district schools for both subjects.

Table 1.3: Learner enrolment in 2011 and 2012 (Data from six schools)

School	Grade9 2011	Maths-Gr. 10 2012	Maths Literacy- 2012
A	107	18	69
B	168	50	114
C	481	42	261
D	340	75	90
E	227	52	118
F	317	120	210
Total	**1640**	**357**	**862**

The above table shows data from the six schools in Lejweleputswa district that were part of this investigation, there is a general decline in enrolment in Mathematics whilst Mathematical Literacy enrolment increases. This happen in spite of Mathematics being a fundamental requirement for engineering and science related courses. Based on the above data, which was collected by the researcher from the six different schools in

Lejweleputswa district, in 2012 only 21.8% of all the learners from Grade 9 opted for Mathematics, whilst 52.6% opted for Mathematical Literacy. As a result, in three years' time the number of learners who will be writing Mathematics examinations will be lower than 21.8% for these selected schools as learner continue to shift towards Mathematical Literacy.

Based on my experience working with schools it would appear that schools mainly consider the Mathematics results in the Grade 9 examination as the principal indicator governing the choice of subjects a learner should follow in Grade 10. The schools do not interrogate the learners' attitudes towards Mathematics or the factors contributing to the way they feel about the subject. Therefore, whatever choices they make in Grade 10 are accepted.

As someone involved in the teaching of Mathematics, I feel that the decline in the number of learners who register for Mathematics will need to be looked into closely, and as a country we need to research the different factors contributing to the decline. Therefore, this study will examine the relationship between learners' attitudes and their choices of mathematical subjects in Grade 10.

1.2 AIMS AND OBJECTIVES

The aim of the research is to investigate learners' attitudes towards Mathematics, and how these attitudes relate to their choices of mathematical subjects; in other words whether they select Mathematics or Mathematical Literacy in Grade10.

The objective of the study is to:

- Investigate learners' attitudes towards Mathematics in Grade 9 and 10.

- Determine how these attitudes relate to their choice of mathematical subjects in Grade 10.
- Provide recommendations to the Department of Basic Education on intervention strategies or activities that could be put in place to improve learners' attitudes towards Mathematics.

1.3 PROBLEM STATEMENT

From my experience of visiting and working with schools in recent years, it would appear that schools are experiencing a phenomenon where more learners enrol for Mathematical Literacy in Grade 10 than for Mathematics. Even learners taking Physical Science opt to take Mathematical Literacy and not Mathematics despite knowing that most of the science and commerce streams in University studies demand or recommend Mathematics. This is of concern in a country such as South Africa, which is experiencing a shortage of professionals in careers that require Mathematics and Science, as indicated by the Gauteng Department of Education (Gauteng Department of Education, 2016). There exists, therefore, an urgent need to increase the number of learners who opt for Mathematics in Grade10 in order to increase the number of professionals in science-related fields.

Although improved Maths and Science performance has been identified as the key to improving pupils' after-school job chances and closing the country's skills gap, 2888 schools have a shortage of maths teachers and 2 669 need more teachers of physical science, according to Basic Education Minister Angie Motshekga (Sue, 2012).

Acknowledging and understanding learners' attitude towards Mathematics could provide strategies to all stakeholders concerned on how to discourage this decline of enrolments in Mathematics and have more learners committed in excelling in the subject.

1.4 CRITICAL RESEARCH QUESTIONS

To understand the attitudes of learners towards Mathematics, the study intends to answer the following critical research questions:

a) What are Grade 9 and 10 learners' attitudes towards Mathematics?
b) How do these attitudes relate to learners' choice of mathematical subjects in Grade 10?
c) What recommendations can be made to suggest strategies or activities that can improve learners' attitudes towards Mathematics?

1.5 METHODOLOGY

1.5.1 Research design

In this study a quantitative method was used as the research tool adopted to generate data required for the participants to answer the earlier stated critical questions.

1.5.2 Data collection tools

Leedy and Ormrod (2010), assert that paper and pencil questionnaires can be administered to a large number of people, including those who live in faraway places, so that the researcher is able to cover a large number of learners as a more representative sample. Behaviours and attitudes are complex to study, so a rating scale was used in this study. Rating scales were developed by Rensis Likert in the

1930s to assess people's attitudes and are thus called Likert scales (Leedy & Ormrod, 2010). This study made use of a paper and pencil questionnaire which was administered in order to gain information from the participants. The questionnaire had closed questions that were intended to determine learners' attitudes towards Mathematics, and how these attitudes relate to their choices of mathematical subjects in Grade10.

1.5.3 Population and sample

All Lejweleputswa district schools formed the population for this study, as they all offer both Mathematics and Mathematical Literacy as subjects. From these schools, 10 were selected by the researcher to participate in this study. All learners in Grades 9 and 10 participated in the study with one class in Grade 9 and two classes (Mathematics and Mathematics Literacy) in Grade 10 in order to gain insights from those who opted for and against Mathematics in Grade 10. In total there were 600 learners from Grades 9 and 10 who answered the questionnaire.

1.5.4 Data analysis

The questionnaires were analysed statistically using the Statistics Program for Social Sciences (SPSS, Version 22.0) to determine the learners' attitudes towards Mathematics and correlate these attitudes with their choice of mathematical subjects in Grade 10.

1.6 SIGNIFICANCE OF THE STUDY

This research work is intended to unpack the attitudes of learners towards Mathematics and how these relate to the subject choices they make in Grade 10. It is expected that the findings of this research project will be used by teachers in Lejweleputswa district schools to better understand the perceptions of learners towards Mathematics teaching and learning. This understanding of learners' attitudes is intended to assist in motivating more learners to enrol for Mathematics in Grade 10, since the subject is a basic requirement for the study of science-related courses. The findings will further inform the role that can be played by stakeholders in understanding learner attitudes and so advance the love of Mathematics in schools and among learners.

1.7 ETHICAL CONSIDERATIONS

The researcher is ethically responsible for protecting the welfare of schools and learners by ensuring confidentiality of participants' identity and privacy. A consent form was made available for parents of minors who were interviewed as part of the data collection. Permission (included as Appendix 1) was also obtained from the FSDoE. Schools were advised about the legality of the study, and how it aims to improve the quality of learning Mathematics in Grade 10.

All questionnaire responses and interview records will only be used for the purpose of this research project. Its results and recommendations will be used for advancing Mathematics learning in relation to learner attitude in schools.

1.8 LIMITATIONS OF THE STUDY

The research was limited to Lejweleputswa schools offering both Mathematics and Mathematical Literacy in Grade 10. More focus was placed on urban and semi-urban (township) schools, with biasness towards underperforming and impoverished schools.

- The study was not limited only to learners doing a Grade for the first time; all learners in a Grade were included, irrespective of whether they were repeating the Grade or not.
- The results from the study are therefore not generalised but provide the basis for intervention to both learners and teachers in Lejweleputswa schools.
- Due to time and financial limitations, the study was not able to cover all schools in Lejweleputswa district.
- In order to avoid disrupting the normal running of the school, only one class was selected per Grade per subject.

1.9 EXPECTED OUTCOMES

This study aims to establish research-based findings that can inform schools about ways of improving the attitude of learners towards Mathematics. This could result in more learners taking the subject in Grade 10. It is expected that these findings will be used by schools, subject advisors and the FSDoE in order to better understand what kind of attitudes learners have, and how these relate to the choice of mathematical subjects in Grade 10. Recommendations made will guide the different stakeholders as to what in-service training and support programmes will be relevant for teacher development in order to improve teaching.

1.10 PROGRAMME OF THE STUDY

The research was planned as guided by the following chapters:

Chapter 1: Introduction and Background

The first chapter provides a general background on the participation of learners in mathematical subjects offered in Grades 9 and 10 in Lejweleputswa schools. Background information about learner enrolment will be provided as well as the statistical information from the ANA analysis about the performance average in Mathematics.

Chapter 2: Literature Review

Chapter 2 provides an idea about what other writers say about this topic as researched in other parts of the world. It further provides experiences of learners in Mathematics classrooms and their understanding of what and how Mathematics can be taught better. This section explores in-service training efforts undertaken globally to enhance the teaching and learning of Mathematics. It also covers the perceptions that the public and everyone involved in education have towards the learning of Mathematics in relation to the teaching offered by schools in the district.

Chapter 3: Methodology

This chapter deals with the methodology adopted in order to gather information for this research and includes the research design, data collection and the population from which the research sample was drawn. This section documents the process used during collection of information, and the profile of the respondents to the questionnaire.

Chapter 4: Data Presentation and Analysis

The chapter outlines how the data will be presented, to which stakeholders and for what purpose the data should be presented. The presentation provides more clarity on experiences learned from the study, reactions of participants/subjects and a more reliable research finding view. Analysis will reveal thought-provoking experiences and findings that demand reaction and action from stakeholders, in order to address the challenges faced in this study. This chapter further interprets the results as they emerge for each section.

Chapter 5: Data Presentation from Factor Analysis

The chapter deals with the use of factor analysis to establish any hidden factors on the questionnaires to be administered to learners. The Cronbach`s alpha coefficient will be considered to test how reliable different statements from the questionnaire are when grouped together for analysis purposes. The factors identified will be grouped with the respondents' views based on their gender, age and subject chosen. It will be established as to what extent age, gender and subject affect learners' relationships with Mathematics.

Chapter 6: Discussion, review and conclusion

This chapter will critically discuss the findings of the research and evaluate the questionnaire responses in order to make strategic recommendations and conclusions based on these responses. The conclusion puts forward suggestions about what should be done to better understand learner attitudes in mathematical subjects, and ways to improve the process of subject choice in Grade 10. It goes on to give the significance of the study and its use by all stake-holders in Mathematics teaching at school and in support at district level. Thematic analysis or themes and questionnaire findings are consolidated to provide a clear and specific conclusion as to what is understood as the attitude towards Mathematics and thus what support is needed to improve the situation at schools.

1.11 SUMMARY OF THE CHAPTER

This chapter provided a framework which has guided this research document to cover all relevant aspects, so that the findings are presented accurately and give reliable information. A broader perspective of how learners relate with Mathematics, particularly in Grade 9 and 10, is given with consideration of learners' experiences in Mathematics classrooms in previous grades. Statistical analysis of learner performance from Grade 1 to 8 is used mainly as a basis to establish trends and interrogate the factors that inform learner choices of Mathematics in Grade 10.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter explores the literature concerned with attitudes of learners towards Mathematics at high school level, and how these attitudes impact on their choice of Mathematics in the later stages of school. This chapter further explores social constructivism as a theory of learning, and how it relates to the learners' development of knowledge and their attitudes towards Mathematics.

2.2 DEFINING LEARNERS' ATTITUDES

Di Martino and Zan (2010) demonstrate that concept attitude originates in social psychology. Di Martino and Zan further describe the origin of attitude as related to the desire to understand the behaviour of individuals in situations that require them to make choices. Eagly and Chaiken (1993) have presented attitude as a psychological trend that is expressed by evaluating a particular entity with some degree of favour or disfavour. Attitude could be defined as a positive or negative personal feeling related to a particular activity or object that a person is participating in (Rosetta & Martino, 2007).

Studies conducted in the past focused on learners' attitudes towards Mathematics, whilst some looked at the relationship between learners' attitudes towards Mathematics and their achievement in Mathematics (Di Martino & Zan, 2010).

Therefore, the study takes the attitude towards Mathematics as a personal view of the subject which can be either positive or negative.

Hannula (2002) demonstrated attitude as not a unitary psychological construct, but as a combination of behaviour that is produced by evaluative aspects such as:

- the emotions that a learner displays when interacting with Mathematics activities;
- emotions that learners have when dealing with different mathematical concepts;
- the specific learning styles that a learner develops as a result of doing Mathematics; and
- the view that a learner has about the necessity of Mathematics in their perceived future profession (Hannula, 2002).

In their studies, Rosetta and Martino, (2007), indicate that the causes of a negative attitude are generally ascribed to a learner's characteristics and behaviours, and little is said about the teacher's responsibility in building interest in Mathematics. This attitude is considered as the starting point of a remedial action. Mata, Monteiro and Peixoto (2012), citing Nicolaidou and Philippou (2003), argue that negative attitude results from repeated failures when dealing with a Mathematics activity, and these negative attitudes may be permanent if no intervention is made early in their development. The study of attitude must again consider the role motivation plays in how learners relate to the subject. Wigfield, Eccles, Schiefele, Roeser and Davis-Kean (2006) argues that attitude emanating from the individual's feeling towards reading is informed by how much the individual concerned is motivated as this influences how much the individual involve him/herself in reading tasks. Attitudes are thus, he further argues, effective responses that accompany a behaviour initiated by a motivational state.

Singh, Granville and Dika, (2002) mention two aspects that define how motivated a learner is towards a task, the attendance of classes and school and the level of participation in and preparedness for Mathematics activities. This approach invokes a discussion about the role the learning environment plays in the development of attitude towards Mathematics. Maat and Zakaria (2010) argue that learners with a good perception of the learning environment, and a positive perception of their teachers as being supportive in class, have more positive attitudes towards Mathematics.

Ashby (2009), using Hoyles (1982), shows that previous research into attitude in Mathematics indicates that a relation may lie between an individual's perceived ability to work on a mathematical problem and their level of success, which will result in negative attitude in cases of failure to get the solution of the problem (Ashby, 2009). Jain (2014) has indicated that an individual's behaviour is directly influenced by attitude. Jain further indicates that the term 'attitude' mostly encompasses concepts such as personal preferences, intentions, opinions, feelings, values, emotions, beliefs, principles, expectations, judgments and appraisals.

Based on these definitions of attitude, an individual can range between the two points of extremely negative to extremely positive. This should include the fact that individuals could also have conflicted views about a certain aspect. Baron and Byrne (1984) define attitudes as relatively lasting clusters of feelings, beliefs, and behaviour tendencies directed towards specific persons, ideas, objects or groups.

There are a number of factors which could be utilised to explain the increasing attitudinal change of learners towards the negative as they progress higher in school grades. These factors are:

- pressure to perform: all the stakeholders expect the learners to participate and reach a specific performance (Akinsola & Olowojaiye, 2008). This expectation creates pressure on the learners.
- over-demanding tasks: the teachers' inability to create a setting that provides learners with strategies to break down the complex mathematical problems could contribute towards their negative attitude (Akinsola & Olowojaiye, 2008).
- uninteresting lessons: Guskey (1988) also notes that teachers who are believed to have competence and capacity have been observed to ensure that their teaching of Mathematics is successful through adoption of instructional strategies that make the lessons interesting. Akinsola and Olowojaiye (2008) have presented that the teaching of Mathematics in most secondary schools has been teacher-centred, follows lecturing and textbook teaching, and does not help learners to develop critical thinking and utilise their knowledge to solve problems.
- poorly planned lessons: the teacher`s personal ability to relay the complexity of Mathematics concepts influences the lesson planning, the choice of method of presentation, strategies of remediation and the general process of teaching and learning. Akinsola and Olowojaiye (2008) have then concluded that it is important for teachers to understand the impact of a learner's positive attitude towards Mathematics and hence adopt appropriate instructional strategies. Stein, Grover and Henningsen (1996) have also noted that the type of tasks

and activities presented to learners in a Mathematics classroom could greatly impact on their thinking about Mathematics.

Mohamed and Waheed (2011), indicate that attitude is considered as a multicomponent and those components are cognitive (which includes beliefs, thoughts and attributes), affective (which includes feelings and emotions) and lastly behavioural information (which includes past events and experiences) (Maio & Haddock, 2010). Jain (2014) has presented the model of attitude better graphically. This has been named the Tripartite Model. The Tripartite Model of attitude is made up of three components, namely Feelings, Beliefs and Behaviours (Jain, 2014).

2.3 THREE COMPONENTS OF ATTITUDES

The learner's attitude towards Mathematics has been noted to be influenced by different factors. These factors can be grouped into three distinctive components.

2.3.1 Cognitive component

The cognitive component includes emotion, which is represented by verbal statements of feeling (Jain, 2014). This factor looks at the students' mathematical performance, mathematical concerns, self-efficacy and self-concept, extrinsic motivation and experiences at high school (Tahar, Ismail, Zamani & Adnan, 2010; Klein, 2004). The cognitive component is seen as individuals' perception of their capacity to acquire required knowledge and thinking skills within the specific subject or content (García-Santillán, Moreno-García, Carlos-Castro, Zamudio-Abdala & GarduñoTrejo, 2012).

2.3.2 Affective component

Jain (2014) has indicated that the affective component entails a personal cognitive response to the verbal statements of belief. García-Santillán *et al*. (2012) demonstrate that the affective component includes feelings and emotions. Within the school setting, this factor is associated with the school, teacher and teaching. Different aspects of this factor include the influence of teacher teaching materials, their classroom management skills, their content knowledge and personality while preparing and teaching topics.

2.3.3 Behavioural component

The behavioural component includes aspects such as past events and experiences. This factor is influenced by the home environment and societal attitudes towards specific subjects which in this case is Mathematics (García-Santillán *et al*., 2012). Similarly, Jain (2014) describes this third component of attitude as the explicit action which an individual utilises to represent verbal statements and demonstrate the intended personal behaviour against the surrounding. Furthermore, this component includes aspects such as parental educational background and their occupation and expectations. These components also play an important role in developing the specific attitude that a student can display towards a subject. A further component is the image of Mathematics that is presented by the public in general with words and phrases such as difficult, too abstract, not for you and many more used about the subject (García-Santillán *et al*., 2012).

Hannula (2002) demonstrates attitude as not a unitary psychological construct, but as a combination of behaviour that is produced by evaluative aspects such as:

- the emotions that a learner displays when interacting with Mathematics activities;
- emotions that learners have when dealing with different mathematical concepts;
- the specific learning styles that a learner develops as a result of doing Mathematics; and
- the view that a learner has about the necessity of Mathematics in their perceived future profession (Hannula, 2002).

Research indicates that the causes of a negative attitude are generally ascribed to learner's characteristics and behaviours, and little is said about the teacher`s responsibility in building interest in Mathematics and whether to consider this attitude as the starting point of a remedial action (Rosetta & Martino, 2007). Ashby (2009), using Hoyles (1982), reveals that previous research into attitude in Mathematics indicates that a relationship may exist between an individual's perceived ability to work on a mathematical problem and their level of success. This will result in a negative attitude in cases of failure to get to the solution of the problem (Ashby, 2009).

2.4 TEACHERS VIEWS AND ATTITUDE TOWARDS MATHEMATICS

What has been shown in different studies is the necessity and impact of a good relationship between the subject teacher and the learners (Corzo & Contreras, 2011). Corzo and Contreras (2011) have further noted that the failure, passing of or enjoyment of a subject by a learner relates directly to how the teacher supports the learner. This, therefore, demonstrates clearly that a teacher who is not capable of teaching a subject effectively and who has a negative approach towards Mathematics is not able to provide the necessary support to learners in the specific subject. The type and level of teacher-learner relationships significantly impacts on the learning which then influences the individuals' subject choices (Ladd, Birch & Buhs, 1999). When teachers were asked about what they perceived the factors to be which contribute towards the decline in learners opting for subjects such as Geography, Science, Economics and Mathematics, they presented the teacher-learner relationship as the principal factor (Lyons & Quinn, 2010).

Marchisa (2011) also observes that what influences learners' attitudes towards Mathematics is their teacher's attitude towards Mathematics. More than three-quarters of the participants in Marchisa's (2011) study noted that their Mathematics teacher explains enthusiastically. More than half of the participants noted the encouragement that they receive from their teacher when encountering difficulties in Mathematics lessons. Therefore, Marchisa (2011) concluded that the teacher's attitude towards Mathematics strongly influences a learner's attitude.

A learner's attitude towards Mathematics has been noted as related to teaching and learning (Obodo, 2006). The teacher's attitude towards Mathematics has been recognised as a factor that plays a major role towards affecting a learner's attitude towards Mathematics (Relich, Way & Martin, 1994). The behaviour of Mathematics teachers towards unfamiliar mathematical concepts can scare students away from learning and exploring Mathematics. Therefore, in general, teachers' beliefs about

Mathematics, their preferences within the subject, and their view of the subject as a whole, impact on their capability in the instructional process.

Research has been conducted on learners' attitudes towards Mathematics, but the studies have concentrated on the specific variables and their influence on a learner's attitude towards Mathematics (Atanasova-Pachemska, Lazarova, Arsov, Pacemska & Trifunov, 2015). This study has then taken the research further by looking at the attitudes and their influence on the choice of Mathematics when given the opportunity to make a choice. Atanasova-Pachemska, *et al*. (2015) demonstrate that teachers are concerned with a lack of student motivation and proper devotion towards academic work. They go further to demonstrate that their study confirms that learners' attitudes towards Mathematics are related to their personal motivation and the type of social support they get.

There is a strong relationship between learners' achievement in Mathematics and their personal attitudes towards this subject (Atanasova-Pachemska*et al*., 2015). Their study shows that learners who attained high marks in Mathematics developed positive attitudes when compared to those who got low marks.

2.5 FACTORS IMPACTING ON LEARNERS ATTITUDE TOWARDS MATHEMATICS

Negativity or positivity towards Mathematics is a result of different factors. This section explores the different reasons researchers have discovered as to why learners may develop a negative attitude towards Mathematics teaching and learning. Furthermore, this section focuses on the impact of this attitude towards Mathematics, and how it influences learners of Mathematics in future classes. Mohamed and Waheed (2011) have presented Mathematics as an important core subject that forms within the school curriculum. They even recommend that Mathematics must be given more time in schools in order for different countries to achieve acceptable pass levels. When given the opportunity to make a choice the students tend to move away from Mathematics; hence this section intends to determine the different reasons why this occurs.

Marchisa (2011) notes that learners either like or hate Mathematics depending on their attitude. The personal long-term emotional character that is either positive or negative towards Mathematics could be associated with attitude. Marchisa (2011), in the study which was designed to identify the factors that could influence learners' attitude towards Mathematics, came up with five factors. These factors are:

2.5.1 Learners' beliefs about the necessity of Mathematics in their everyday life

Learners' beliefs about the necessity of Mathematics in their future career and in their everyday life was found as one of the factors influencing their attitudes towards Mathematics (Marchisa, 2011). In the sample of his study, about one-third of the respondents did not recognise the connection between classroom Mathematics and its use in their daily lives. Marchisa (2011) has further demonstrated that this is a result of textbooks and national tests that do not adopt real-life problems. The study notes that learners were not able to recognise the mathematical knowledge embedded in their everyday life problems. Marchisa (2011) notes that there is a correlation between learners' beliefs about the necessity of Mathematics in their lives and their attitude towards learning Mathematics. Therefore, learners' ability to utilise their mathematical knowledge in their everyday life seems to influence their attitude towards Mathematics.

2.5.2 Learners self-efficacy

In the study conducted by Marchisa (2011), half of the learners who were taking part considered themselves to be lacking the ability to take Mathematics whilst a similar number thought that they could be good mathematicians. Similarly, a third of the participants thought that they could not be good mathematicians, and the same number also thought that they had a talent for doing Mathematics. The study hence concludes that there is a strong correlation between learners' self-efficacy and their attitude towards Mathematics (Marchisa, 2011). Lyons and Quinn (2010) present learners' failure to picture themselves in a particular subject because of their personal ability as highly influential in the learners' choice of subjects.

2.5.3 Learners' self-judgement

Marchisa (2011) also concludes that learners' self-judgment contributes towards the attitude they have towards Mathematics. From the group that participated it was noted that more than half of them were aware that the effort that an individual puts into studying Mathematics results in good grades. The results from this study show a strong correlation between learners' self-judgment and their attitude towards Mathematics (Marchisa, 2011). Similarly, Reed and Case (2003) have also noted that learners' personal beliefs about themselves and their own abilities influence their choices. Again Rodeiro (2007) notes that personal perception of self-ability in Mathematics also plays an important role.

2.5.4 Learners self-reaction

In one of the statements posed to Marchisa, (2011:790) the participants included, 'If I solve a problem correctly, I am very happy', and, 'If I get high marks at Mathematics, I feel good'. Marchisa (2011) classifies this as self-reaction towards an achievement in Mathematics. The study found that the level of learners' self-reaction was very high and did not have any correlation with their attitude towards Mathematics.

Based on the account presented, learners' attitudes are developed over a period of time as they continuously interact with their teachers, friends, parents and all other education support structures that exist in their environment. Rodeiro (2007) has also noted that learners' choice of subjects is affected by their perception of enjoyment, or of how interesting the subject is.

2.5.5 Gender and attitude

Farooq and Shah (2008) have noted the common practice of discouraging girls from doing Mathematics in their early years; this results in girls developing a negative attitude towards the subject, which continues to secondary school level. This then accounts for a greater number of girl learners opting for subjects different from those chosen by boys. This occurs despite the fact that the achievement scores in Mathematics of both males and females were noted to be almost the same (Farooq & Shah, 2008). Farooq and Shah (2008) have also discovered that, for certain complex mathematical tasks, there was a great gap between boys and girls.

Ernest (2004) has also noted that Mathematics is largely presented as a masculine subject and there is evidence that girls tend to lack confidence compared to boys when engaging in Mathematics activities. Moreno and Mayer (1999) further demonstrated the existence of gender differences between males and females in their responses to open-ended problems. They note that males performed better than females. Similarly, Mohd, Mahmood and Ismail (2011) refer to various researchers such as Effandi and Normah (2009) and others who have noted the difference in performance between male and female learners.

Mensah, Okyere and Kuranchie (2013) indicate that gender is highly related to attitude. They further note that many girls believe that boys must perform better academically in Mathematics than them and hence this belief influences their attitudes towards Mathematics.

2.6 THE 3D MODEL OF ATTITUDE

Jain (2014) utilised the 3 components to a proposed 3D (Three-Dimension) model. This model looks at the impact of each component when combined to produce a specific personal stand. The Affect (Feeling), Behaviour (Dealing) and Cognitive (Meaning) components of attitude are essential and must be taken into consideration.

These three components can join together to construct an overall personal attitude towards a subject. Jain (2014) indicates that each of these three components can be either positive or negative (+ or -) to an individual. Table 2.2 presents the 8 possible outcomes that an individual could have based on the combination of three components of attitude. These combinations have been named Triodes (Jain, 2014). Therefore, each triode represents a different state of attitude that an individual can demonstrate.

Table 2.2: Triode table (Jain, 2014:7)

TRIODE	AFFECT	BEHAVIOR	COGNITIVE
PPP	Positive	Positive	Positive
PPN	Positive	Positive	Negative
PNP	Positive	Negative	Positive
PNN	Positive	Negative	Negative
NPP	Negative	Positive	Positive
NPN	Negative	Positive	Negative
NNP	Negative	Negative	Positive
NNN	Negative	Negative	Negative

2.6.1 PPP Triode

When the three components of attitude which are Affect, Behaviour and Cognitive, are positive they produce a PPP triode (Jain, 2014). This PPP triode occurs when an individual has positive feelings towards a subject and the available information makes his/her beliefs about the subject positive which then becomes favourable. Therefore, this triode represents an individual who is influenced by all the three components in a positive way.

2.6.2 PPN Triode

In this triode, both Affect and Behaviour components are positive but the Cognitive component is negative; this is called the PPN triode (Jain, 2014). In this triode individuals tend to like a specific subject, such as Mathematics, but on the other side experience confusion based on different sources they have. This then requires clarification to help the particular individual to make a specific choice. In this triode as presented, an individual could note the clash between feelings and beliefs, and later allow their feelings to dominate beliefs hence producing a positive response.

2.6.3 PNP Triode

The PNP triode has Behaviour as being negative while both Affect and Cognitive components are positive (Jain, 2014). An individual is seen to display both positive feelings and beliefs towards Mathematics but to turn to take an unfavourable decision. This triode demonstrates that even though the two components of Affect and Belief are influencing an individual positively towards Mathematics the response takes the opposite direction.

2.6.4 PNN Triode

Jain (2014) presents the PNN triode as a situation where only Affect is positive while both Behaviour and Cognitive components are noted to be negative. The PNN triode represents individuals who like Mathematics, but based on the information they have about it and which they consider to be reliable, make their own evaluation of the negative information known and decide to follow the unfavourable direction. In this triode there is a conflict between feelings and beliefs but notably the beliefs tend to take the upper hand from the feelings and provide direction to the individual.

2.6.5 NPP Triode

Both Behaviour and Cognitive components present a positive attitude in the NPP triode with only the Affect component being negative (Jain, 2014). In this triode combination, an individual is noted to not like Mathematics but based on the positive evaluation of various information a decision tends to be a favourable one. The NPP triode presents the conflict between the personal feelings and beliefs but at the end the beliefs tend to dominate and lead the individual towards a positive response.

2.6.6 NPN Triode

Jain (2014) has presented this combination in which there is a negative response in both Affect and Cognitive components while the component of Behaviour is noted to be positive. Jain (2014) has noted this as a rare combination to occur in reality. The NPN Triode indicates that there can be a dislike for Mathematics and its specific information but based on understanding at a particular moment, recognition of the importance of this subject can result in a positive attitude. In this particular triode an individual would take a clear stance to choose Mathematics. The personal feelings and beliefs in this triode are both negative to Mathematics but an individual decides to opt for the subject based on external stimuli.

2.6.7 NNP Triode

The positive aspect of Cognitive component when combined with the negative aspects of both Affect and Behaviour components result in the NNP triode (Jain, 2014). In this triode a person does not like Mathematics and hence displays a negative response to the subject despite having a positive evaluation of the subject. In this aspect an individual recognises the contradiction that exists between the personal feelings and beliefs, in which the feelings tend to take control over the beliefs and guide the individual towards a specific choice.

2.6.8 NNN Triode

The most common combinations of all three components has been noted as the one in which Affect, Behaviour, and Cognitive are negative (Jain, 2014). The NNN Triode represents a state in which a person does not like Mathematics and the information that reaches the individual related to this subject does not support it hence the individual tends to dislike Mathematics. In this triode it is noted that the decision of a person to do or not to do something occurs as a result of certain negative feelings, responses and beliefs.

Mohd, Mahmood and Ismail (2011) have stated that learners' attitudes towards Mathematics are very subjective and tend to vary among learners. These studies have presented the noteworthy relationship between attitude towards Mathematics and learners' academic performance in this subject. The majority of these studies have demonstrated that there is a positive correlation between learners' attitude towards Mathematics and their academic achievement.

Akinsola and Olowojaiye (2008) demonstrate that learners' attitudes towards a specific subject impacts on their success in that subject. They further note that a positive attitude results in good performance in a specific subject. Hence the learner who is constantly not doing well in a particular subject tends to regard this as a defeat.

Akinsola and Olowojaiye (2008) presented Newbill (2005) noting the debate among researchers on the existence of the presented components of attitude, based on the view that attitudes are personal constructs and hence they could not be directly observable. Hence the study adopts attitudes with the understanding that it varies with individuals and not all the positive concepts could have the same impact on two individuals.

Over a certain period of time an individual learns and develops a specific attitude derived from the 8 different triodes that have been presented above. These triodes develop a specific attitude over time as a learner encounters success or failure in Mathematics classrooms. This then results in a specific view of Mathematics which individual learners utilise when they get the opportunity to choose between subjects.

2.7 THEORETICAL FRAMEWORK

Bandura (1989:1178) has noted that in a social cognitive theory “people are neither driven by inner forces nor automatically shaped and controlled by the environment”. Similarly, their actions are driven by their motivations which influence their choices. Bandura (1997) defines self-efficacy as an individual’s belief and his personal capabilities to engage successfully in a particular activity. Bandura (1997) further indicates that social cognitive theory “is rooted in a view of human agency in which individuals are agents proactively engaged in their own development and can make things happen by their actions”. Individuals are “partial architects of their own destinies” (Bandura, 1997:8). The main aspect of this agency is viewed as an agreement that individuals have self-beliefs that facilitate the process of measuring and controlling their thoughts, feelings and actions. Bandura (1989) presents a view of human behaviour which demonstrates that individuals’ beliefs about themselves are important contributions to specific behaviour.

Rooted within Bandura’s social cognitive perspective, there is an understanding that individuals are imbued with certain capabilities that define what it is to be human. Key elements of these are the individual's abilities to symbolise, make a choice of alternative strategies, utilise a variety of experiences to learn, and ensure personal regulation and reflection. These capabilities provide human beings with the cognitive means through which they are influential in determining their own destiny.

Bandura (1997) asserts that the main aspects impacting on a human being's functioning, and which are considered the core of social cognitive theory, are self-efficacy beliefs. Self-efficacy can be defined as the individual's perceived ability to carry out certain actions in order to achieve a specific goal (Bandura, 1997). Bandura further presents the self-efficacy theory, pointing out the following:

- The degree of an individual's beliefs about their personal ability to do something is a good predictor of their motivation and behaviour towards that thing.
- Through individual's performance and mastery, exhibiting, understanding of symptoms, and social influence, individuals strengthen their self-efficacy.
- Increased self-efficacy has been observed to contribute towards improved behaviours, increased motivation, better thinking patterns, and the stronger emotional well-being of individuals.

Ünlü and Ertekin (2013) have noted that the affective domain has an impact on the learning of Mathematics. They have further identified self-efficacy as an important factor in the affective domain. Social cognitive theory describes self-efficacy as personal beliefs about the ability to perform certain activities to accomplishment (Bandura, 1977). When focusing on Mathematics self-efficacy, Burnham (2011) explains it as an individual's ability to do specific activities in Mathematics successfully. As a result, self-efficacy beliefs highly influence the level of personal achievement that an individual finally reaches (Pajares & Urdan, 2006). Similarly, individuals who have low levels of self-efficacy always believe that activities are tougher than they really are. This perceived belief that tasks are difficult promotes personal anxiety, depression and stress which then limits the views and options available when looking for a solution.

Therefore, self-efficacy in this study will be utilised to understand learners' beliefs about their attitude towards Mathematics and how this attitude relates to their choices of Mathematics when given the opportunity to make a choice.

2.8 SUMMARY

This chapter has presented the different factors that researchers have found to contribute towards Mathematics on different levels. These factors demonstrate that, for effective learning to take place, many other items must be considered as integral parts of the interaction between teachers and their learners. Furthermore, it has presented the theoretical framework that will be utilised to analyse the data. The next chapter presents the methodology of the study.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION TO THE CHAPTER

The previous chapter presented a review of the literature on learners' choice of subjects. This chapter moves on to present the chosen processes of collecting data that the researcher intended to follow for this particular research study. The chapter starts with a discussion of the statement of the research problem, research design, the different types of research methodologies, and those that have been chosen by the researcher in order to obtain data to answer the research questions. Furthermore, the population and the related sample and sampling methods are described in this chapter. Finally a detailed description of the research techniques and instruments utilised for data collection is presented in this chapter together with the strategies used to analyse data.

3.2 STATEMENT OF THE RESEARCH PROBLEM

The introduction of Mathematical Literacy in schools has caused a decline in the number of students who opt for Mathematics in secondary schools of South Africa (see Figure 1.3). This decline in learners taking Mathematics in Grade 10 over the past few years has been of great concern, as this subject is required in most science-related fields of work. Not much in South Africa is known about the cause of this decline of student numbers in Grade 10 Mathematics, and very little research has been done into learners' attitudes towards Mathematics in Grade 9, and how these attitudes impact on their choice of subjects in the following Grade, Grade 10, when they are given the opportunity to make a choice. Understanding learners' perceptions in Grade

9, and how these perceptions impact on their subject choices in Grade 10, would provide all those involved in South African education with strategies that could be utilised to deal with the decline in learners' enrolments in Grade 10 Mathematics.

3.3 RESEARCH QUESTIONS, AIM AND OBJECTIVES OF THE RESEARCH

In Chapter 1, the research questions for this study were presented as:

a) What are the Grade 9 and 10 learners' attitudes towards Mathematics?
b) How do these attitudes relate to learners' choice of mathematical subjects in Grade 10?
c) What recommendations can be made to suggest strategies or activities that can improve learners' attitudes towards Mathematics?

This chapter, therefore, presents the methodological literature, and the process that was used to collect the data for the research. This could then be used to provide answers to the set of questions mentioned.

This study aims at investigating learners' attitudes towards Mathematics and how these attitudes relate to their choices of mathematical subjects (i.e. Mathematics or Mathematical Literacy) in Grade10. The aim of the study has been fulfilled by meeting the following objectives:

- Investigate learner's attitudes towards Mathematics in Grade 9.
- Determine how these attitudes relate to their choices of mathematical subjects in Grade 10.

- Provide recommendations to the Department of Basic Education on the intervention strategies or activities that could be put in place to improve learners' attitudes towards Mathematics.

The sections that follow in this chapter present the methodological process followed to collect data that would be used to meet the presented objectives.

3.4 RESEARCH DESIGN AND METHODOLOGY

This section presents the research paradigm which has been adopted in this study; this includes ontology, epistemology and methodology. The chapter further demonstrates the qualitative nature of the research, the design of the study as well as the approach that has been chosen by the researcher to collect data for this study.

3.4.1 Research paradigm

Maree (2007) describes a paradigm as assumptions related to the fundamental aspects of the reality which gives rise to the particular world in which data has been collected. A research paradigm could also be taken as the set of beliefs and assumptions relating to features of reality which establishes a base for an individual to view the world in a particular way (Maree, 2007). Paradigm could also be defined as patterns or models utilised as acceptable strategies in the process of collecting data. Paradigm has been presented as a way of looking at or researching phenomena, a world view, a view of what counts as accepted (Cohen, Manion & Morrison, 2011). Three research paradigms which are positivist, interpretive and constructivist are presented by Blanche and Durrheim (2012).

Blanche and Durrheim (1996) explain positivism as a way of focusing on the observable features and accepting that reality is objectively given. Mathison (2005) has described constructivism as a philosophical standpoint which asserts that knowledge is mediated by cognition, and each individual constructs meaning based on experiences and situations. Similarly, Hurworth (2005) has described interpretivism as a philosophical standpoint relying on natural settings and the related qualitative approaches. For this study, the positivist research paradigm will be adopted as it is based on the empirical data. Scotland (2012) has demonstrated that the philosophical perspectives of research paradigms can be divided into three categories, namely ontology, epistemology and methodology.

3.4.2 Ontology

Blanche and Durrheim (2012) have described ontology as a strategy of presenting the reality of the nature which the researcher intends to investigate, mainly focusing on specific facts that are familiar about it. Maree (2007) presents ontology as the study of the form of reality in the natural setting. Ontology is the strategy of focusing on the socially constructed values and beliefs that individuals develop within a natural setting (Cohen *et al*., 2011). Cohen *et al*. (2011) further demonstrate that within positivism the ontological standpoint is the understanding that existence of things occurs independently of the knower. The study is positioned in positivist ontology as it recognises the fact that learners' knowledge, beliefs and values are socially constructed in their different environments. Hence their knowledge, beliefs and values exist independently from the researcher.

3.4.3 Epistemology

Maree (2007) presents epistemology as how things come to be known. Again epistemology is how an individual comes to know multiple realities (Cohen *et al*., 2011). Epistemology relates to how facts tend to be known or how the truth about facts or any physical laws exist (Maree, 2007). For this study the information obtained from learners represents their attitude towards Mathematics, and how these attitudes relate to their choices of mathematical subjects. Hence the researcher has no influence on the outcomes of the study.

3.4.4 Methodology

Methodology is described as the practical and accurate process chosen to establish the information collected (Blanche & Durrheim, 2012). Leedy and Ormrod (2010) describe methodology as an approach chosen by the researcher to carry out data collection for a specific research project and which includes the particular tools to be used. Therefore, methodology can be chosen as either qualitative or quantitative depending on the researcher's design. Qualitative research is an approach whereby the researcher collects, analyses and interprets data through observation or interviews from participants (Anderson, 2006). Quantitative research is a search for answers to the hypotheses using numbers and variables (Welman, Kruger & Mitchell, 2005). This shows that it is appropriate to conduct quantitative research within the positivist paradigm in order to objectively evaluate learners' attitudes towards Mathematics, and how these attitudes relate to their choices of mathematical subjects. As a result, a fairly large sample will be used and different variables will be measured.

3.5 RESEARCH DESIGN

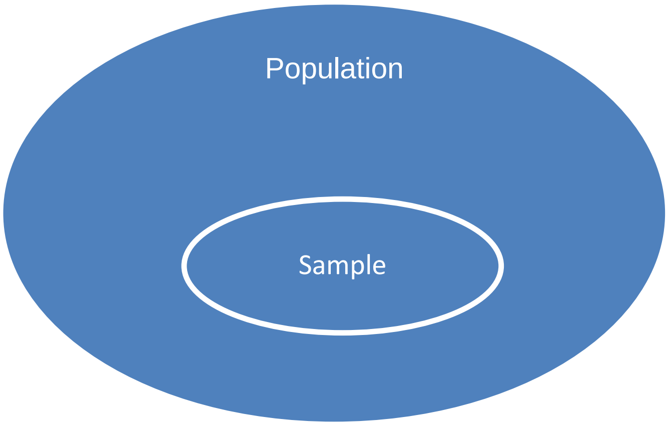
Research design is the presentation of a step-by-step process that the researcher chooses to collect data needed for getting answers to the research question (Fouché, Delport & de Vos, 2011). Babbie (2007) states that this process has to demonstrate the strategy of collecting information, the type of data to be collected and how this data will be analysed. Fouché *et al*. (2011) demonstrate that research design can be qualitative, quantitative or mixed-method research. In this study the researcher has chosen the quantitative design and hence the research tools and all other processes are going to produce quantitative data which will be analysed utilising statistical programs.

3.6 POPULATION AND SAMPLING

Strydom (2011) describes population as the term used to set boundaries for the study. Strydom goes further to describe population as individuals in the universe who possess specific characteristics (2011). This is further clarified by Gay, Millis and Airasian (2011) when they demonstrate that, from the main group that is chosen, the researcher will choose a small group to actually participate in the research. In mathematical terms population would be described as the main set. In this study the population is made of a given Grade 9 and 10 group of learners within the schools in Lejweleputswa district.

Strydom (2011) indicates that a sample is made up of a subset of a population considered for actual inclusion in the study to be conducted. This term demonstrates that a sample is made of few individuals selected from the population (Fraenkel & Wallen, 2010). A sample is a subset of the population in mathematical terms where all the elements that are found within the main set (population) have characters that are similar to each other.

Figure 3.1: Population and sample



Strydom (2011) demonstrates that the coverage of this whole population is always difficult due to resource constraints. Fraenkel and Wallen (2010), as well as Strydom (2011), categorised sampling into two kinds, namely probability and non-probability sampling. Strydom further demonstrates that probability sampling is based on randomisation, while non-probability sampling is done without randomisation.

Probability sampling has been recognised as a strategy of identifying participants from a bigger sample using randomisation (Leedy & Ormrod, 2013). Furthermore, Creswell (2012) defines probability sampling as a method used by the researcher to choose individuals from the population to represent others. Probability sampling is achieved through simple random sampling, stratified random sampling, systematic sampling and cluster sampling (Creswell, 2012; Leedy & Ormrod, 2013).

Cohen, Manion and Morrison (2011) note that non-probability sampling can be classified into different types, such as convenience, purposive, snowball and quota sampling. Convenience sampling occurs when individuals in the study volunteer to take part in the activities of data collection. In purposive sampling it is individuals with similar characteristics who are available and have demonstrated willingness to participate from the population group. Snowball sampling takes place when the researcher chooses a few members who meet the set characteristics, and gives them the opportunity to be part of the study. Finally, in quota sampling the researcher selects a sample that yields the same proportions as the population proportions on easily identified variables.

This study, therefore, will adopt a non-probability sampling as "the researcher has no way of predicting or guaranteeing that each element of the population will be represented in the sample" (Leedy & Ormrod, 2014:220). The researcher determined that purposive sampling was appropriate and in cooperation with the teachers of the sampled schools, data should be collected from those learners who would be available and willing to fill in the questionnaire on that specific day.

Lejweleputswa district has 69 schools, from which 10 schools offering Mathematics and Mathematical Literacy were selected on the basis of convenience to take part in the questionnaire. In some of the 10 schools selected, there was more than one class in a particular Grade, but the teacher chose only one class to which the questionnaire was administered. In Grade 10, the participating learners were from one class studying Mathematics and one class studying Mathematical Literacy. This was done as the researcher needed the views of those who opted for and against Mathematics. In total there were 300 questionnaires distributed to Grade 9 learners whilst 300 were distributed to Grade 10 with 150 for those learners doing Mathematics and another 150 for those doing Mathematical Literacy, assuming an average of 30 learners per class. At the end of the data collection a total of 583 learners had answered the questionnaire.

3.7 DATA COLLECTION

The researcher has chosen to follow quantitative methods and hence data was collected using quantitative techniques. In quantitative design, data generated is presented in the form of tables, graphs and different statistical coefficients that should help the researcher to answer the set questions. Research tools and techniques are described as instruments that the researcher has chosen to use to solicit views and perceptions of participants, which will later be analysed and provide answers to research questions (Leedy & Ormrod, 2014). Therefore, as this study adopted the quantitative method, research questionnaires were utilised as the research tools to solicit the required information from the learner participants.

The questionnaires were given to the participating learners to fill in. For this study, questionnaires were utilised to source information from learners concerning the learners' attitudes towards Mathematics, and how these attitudes relate to their choices of mathematical subjects in Grade 10.

3.8 DATA ANALYSIS AND REPORTING

The participants answered the closed questions that were presented to them in the questionnaire, and the data collected was analysed using statistical methods. The responses were given a code which represented that particular participant. This was done so as to ensure that each participant could be traced back in case references were needed during data capturing in a spreadsheet. After all the responses from 583 participants were entered into the spreadsheet this was given to the statistician to analyse using SSPS (Statistical Package for Social Sciences) version 21. Most quantitative researchers prefer to use SPSS as a tool to help them make sense of the data they have. Durrheim and Painter (2006) have noted that SPSS is useful when it is used in the process of interpreting and analysing data acquired using closed questionnaires.

Foster, Diamond and Jefferies (2015) present two main kinds of statistical analysis of research data, descriptive and inferential statistics, and further show that statistical analysis has two main functions, namely to describe data (descriptive statistics) and to draw inferences from the data (inferential statistics). Foster, Diamond and Jefferies (2015) describe descriptive statistics as a tool for describing the characteristics presented by the data. Leedy and Ormrod (2014) indicate that presenting summaries of the data is called descriptive statistics. Gay, Mills and Airasian (2011) state that the researcher in descriptive statistics presents the frequencies, the mean, the median and the mode. Therefore, the researcher utilises descriptive statistics to set the base for understanding the data, which then leads to inferential statistics.

Foster, Diamond and Jefferies (2015) indicate that inferential statistics includes what we know to make inferences (estimates or predictions) about what we don't know. Similarly, inferential statistics could be described as a technique of interpreting data in order to determine how possible it is that the output achieved from the sample or samples are the same results that would have been obtained from the entire population (Gay, Mills & Airasian, 2011).

3.9 ETHICAL CONSIDERATIONS

The researcher has to take into consideration ethical issues when collecting data and analysing it. Ethical considerations should be ensured so as to eliminate risk to participants taking part in the study (McMillan, 2012). Appendix 1 shows the permission granted by the Free State Department of Education and the Lejweleputswa district. During an introduction, information was given to the learners indicating that participation in the study was voluntary, and that those who wanted to participate were expected to sign a consent form before they could sit for the questionnaire. The researcher ensured that the questionnaire did not require participants' identities and also ensured confidentiality of the participants' information.

3.10 CONCLUSION

This chapter presented the processes of data collection required for understanding learners' attitudes towards Mathematics, and how these attitudes relate to their choices of mathematical subjects. The chapter started by discussing the research design and methodology used to collect data. Furthermore, issues such as the population, sampling techniques, validity, reliability and ethical issues considered during data collection were discussed. The following chapter focuses on the results that the researcher found in analysing the data. This is presented in the form of descriptive and inferential statistics.

CHAPTER 4

DATA PRESENTATION AND ANALYSIS

4.1 INTRODUCTION

The previous chapter presented the methodology and the processes of data collection, presentation and analysis for this study. It showed the different tools used and how they were used in order to generate the data necessary to answer the set research question. This chapter presents the data generated from the questionnaire administered to the learners in the sampled Lejweleputswa District secondary schools. In this chapter the biographical data of the participants is presented which is then followed by a statistical analysis of each question along with further discussion on the analyses.

4.2 BIOGRAPHICAL DATA

4.2.1 Grade

There were 583 participants in the study from both Grade 9 and 10. The participants that were in Grade 10 and doing Mathematical Literacy formed the greatest number, 37%, while 31.9% of learners in this Grade were doing Mathematics as seen in Table 4.1.

Table 4.1: Participants by grade/subject

Grade	Frequency	Percentage	Cumulative Percentage
Grade 9	181	31.0	31.0
Grade 10 Maths	186	31.9	63.0
Grade 10 Maths Literacy	216	37.0	100.0
Total	583	100.0	

4.2.2 Age

The age of the participants ranged from 14 to 22 years old. The Grade 9 participants had an average age of 16 years, and the Grade 10 Mathematics students had an average age of 16.5 years, whilst the learners in Grade 10 doing mathematical literacy had an average age of 17.5 years. This demonstrates a difference in terms of age in Grade 10 as most of the students doing Mathematics are around 16.5 years (younger learners) while those doing Mathematical Literacy are around 17.5 years of age (older learners). In general, most participants were between 15 and 18 years of age. Grade 9 had only 7 learners between the ages of 19 and 20 whilst all the learners between the ages of 21 and 22 were in Grade 10 and all doing Mathematical Literacy.

Table 4.2: Learners in different classes by age

Age		Grade 9 (% within the age)	Grade 10 Maths (% within the age)	Grade 10 Math Lit (% within the age)	Total (% within the age)
14	Count	28 (71.8)	9 (23.1)	2 (5.1)	39 (100)
	% of Total	5.0%	1.6%	0.4%	7.0%
15	Count	34 (41.0)	32 (38.6)	17 (20.5)	83 (100)
	% of Total	6.1%	5.7%	3.0%	14.8%
16	Count	50 (38.2)	41 (31.3)	40 (30.5)	131 (100)
	% of Total	8.9%	7.3%	7.1%	23.4%
17	Count	33 (24.1)	53 (38.7)	51 (37.2)	137 (100)
	% of Total	5.9%	9.4%	9.1%	24.4%
18	Count	21 (21.9)	31 (32.3)	44 (45.8)	96 (100)
	% of Total	3.7%	5.5%	7.8%	17.1%
19	Count	6 (11.8)	9 (17.6)	36 (70.6)	51 (100)
	% of Total	1.1%	1.6%	6.4%	9.1%
20	Count	1 (5.6)	2 (11.1)	15 (83.3)	18 (100)
	% of Total	0.2%	0.4%	2.7%	3.2%
21	Count	0 (0)	0 (0)	5 (100)	5 (100)
	% of Total	0.0%	0.0%	0.9%	0.9%
22	Count	0 (0)	0 (0)	1 (100)	1 (100)
	% of Total	0.0%	0.0%	.2%	.2%
Total	Count	173 (30.8)	177 (31.6)	211 (37.6)	561 (100)

Of the 583 participants, 14 did not state their gender. Of those remaining, there were 265 males (46.6%) and 304 females (53.4%). Furthermore, of all the participants in Grade 9 there were 58.8% male learners and 41.2% females. There were therefore more boys than girls in the Grade 9 Mathematics class. Similarly, in the Grade 10 Mathematics classes there were more boys (52.2%) than girls (47.8%) whereas the class situation in Mathematical Literacy revealed more girls (68.2%) with boys forming only 31.8%. Of the 265 boys that took part in this study, 18.3% were in Grade 9, while from Grade 10, 16.3% were doing Mathematics and 12.0% were doing Mathematical Literacy. From the group of girls (304) that took part, 12.8% were in Grade 9, in Grade 10, 14.9% of the girls were in Mathematics whilst 25.7% were doing Mathematical Literacy. This demonstrates a smaller number of girls in Grade 9 where Mathematics is compulsory but their number increases in Grade 10 Mathematical Literacy classes as seen in Table 4.2.

The following tables will show a clear analysis of learners' responses to each question posed in the questionnaire.

4.3 DESCRIPTIVE DATA

Excluding the biographical data questions, there were 32 questions in the questionnaire that the participants were supposed to answer by selecting from 'strongly agree', 'agree', 'not sure', 'disagree' and 'strongly disagree'. In the analysis provided below the responses given by students for 'strongly agree' and 'agree' were brought together; the responses for 'strongly disagree' and 'disagree' were also brought together. For certain questions it was necessary to separate them in order to demonstrate the participant's strong emphasis on their choice of option. This might also show that they feel strongly for or against the topic of the specific question.

Table 4.3: I did not like Mathematics in Grade 8 and 9.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	45	7.9	7.9
Agree	85	14.9	22.7
Not Sure	137	24.0	46.7
Disagree	164	28.7	75.3
Strongly Disagree	141	24.7	100.0
Total	572	100.0	

When asked if they did not like Mathematics in Grade 8 and 9, 22.8% generally agreed, whilst 53.4% felt that they liked Mathematics (Table 4.3). This is an indication that learners come to secondary school Mathematics with a positive view of the subject. Furthermore, 24% of the participants were not sure if they liked Mathematics or not; this represents approximately a quarter of the participants.

Table 4.4: I was not good in Mathematics.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	57	10.1	10.1
Agree	143	25.3	35.4
Not Sure	153	27.0	62.4
Disagree	149	26.3	88.7
Strongly Disagree	64	11.3	100.0
Total	566	100.0	

A group which constitutes 37.6% of the participants from all the Grades thought that they were good at Maths whilst 35.4% thought that they were not good at all in Mathematics (Table 4.4). This demonstrates that the confidence level of learners in the subject is average, as the percentage of those who agree and those who disagree is fairly balanced. When asked if they were good at Maths, 27% were not sure if they were good or not.

Table 4.5: I did not understand my Mathematics teacher in class.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	55	9.9	9.9
Agree	109	19.6	29.4
Not Sure	91	16.3	45.8
Disagree	165	29.6	75.4
Strongly Disagree	137	24.6	100.0
Total	557	100.0	

When considering the understanding of Mathematics as presented by the teacher, 54.2% were clear that they understood the teacher, while 29.5% demonstrated a lack of understanding of their Mathematics teacher (Table 4.5). The percentage of learners who were not sure if they understood their teachers' lessons in class is 16.3%.

Table 4.6: Ability in Mathematics is something that you either have or you have not.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	63	11.5	11.5
Agree	144	26.2	37.7
Not Sure	222	40.4	78.1
Disagree	82	14.9	93.1
Strongly Disagree	38	6.9	100.0
Total	549	100.0	

A group of 37.7% of the learners believes that an individual either has the ability to do Mathematics or not whilst a small group of 21.8% does not agree with abilities in Mathematics playing any role when you are in a Mathematics class (Table 4.6). A large number of participants (40.4%) were not sure if they had Mathematics abilities or not.

Table 4.7: It is possible to improve in Mathematics by working hard.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	311	55.1	55.1
Agree	139	24.6	79.8
Not Sure	20	3.5	83.3
Disagree	40	7.1	90.4
Strongly Disagree	54	9.6	100.0
Total	564	100.0	

Of the participants, 79.1% agreed that it is possible for an individual to improve their Mathematics performance by working hard (Table 4.7). On the other hand, 16.7% of the participants disagreed with the concept that working hard could improve personal performance in Mathematics. Only 3.5% of the participants were not sure if working hard can improve performance in Mathematics.

Table 4.8: Mathematics is important in life.

	Frequency	**Percentage**	**Cumulative Percentage**
Strongly Agree	323	56.6	56.6
Agree	165	28.9	85.5
Not Sure	18	3.2	88.6
Disagree	18	3.2	91.8
Strongly Disagree	47	8.2	100.0
Total	571	100.0	

The majority (85.6%) of participants clearly agreed that Mathematics is important in life, even though most of them were not doing Mathematics (Table 4.8). There was a small group (11.4%) who felt that Mathematics is not important in life. This indicates that even some learners who are doing Mathematical Literacy still believe that Mathematics is important in life.

Table 4.9: The career I like does not require Mathematics as a subject.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	52	9.2	9.2
Agree	50	8.9	18.1
Not Sure	151	26.8	44.9
Disagree	126	22.4	67.3
Strongly Disagree	184	32.7	100.0
Total	563	100.0	

About 55.1% of the participants noted that the careers they want required Mathematics whilst 26.8% were not sure (Table 4.9). Furthermore 18.1% were of the opinion that the careers they want did not require Mathematics.

Table 4.10: When a problem is difficult, do you try it again until you get an answer?

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	196	34.4	34.4
Agree	234	41.1	75.6
Not Sure	56	9.8	85.4
Disagree	49	8.6	94.0
Strongly Disagree	34	6.0	100.0
Total	569	100.0	

A majority of 75.6% indicated that they were able to try different problems that were considered difficult until they got them correct, whilst a very small number, 14.6%, did not agree with the statement (Table 4.10). Therefore 14.6% of the participants do not try the problem several times until they get the answer.

Table 4.11: When you were unable to solve a mathematical problem, did you think back over why you were unable to solve it?

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	98	17.3	17.3
Agree	217	38.4	55.8
Not Sure	154	27.3	83.0
Disagree	63	11.2	94.2
Strongly Disagree	33	5.8	100.0
Total	565	100.0	

When they were unable to solve the problem, 55.8% of the participants were able to think back and consider why they were unable to solve such Mathematical problems whilst 27.3% were not sure what they would normally do in such a situation (Table 4.11). About 17% of the participants were clear that they never think about the reasons for not being able to solve Mathematic problems.

Table 4.12: Do you think Mathematical knowledge is needed in everyday life?

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	272	47.8	47.8
Agree	167	29.3	77.2
Not Sure	69	12.1	89.3
Disagree	24	4.2	93.5
Strongly Disagree	37	6.5	100.0
Total	569	100.0	

From the group of participants, 77.2% agreed that knowledge of Mathematics is needed in everyday life whilst 10.7% said it is not necessary (Table 4.12). There were also 12.1% who did not think that Maths knowledge is needed in everyday life.

Table 4.13: I like it when someone in class explains Mathematics to me, and not the teacher.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	101	17.8	17.8
Agree	103	18.1	35.9
Not Sure	89	15.6	51.5
Disagree	159	27.9	79.4
Strongly Disagree	117	20.6	100.0
Total	569	100.0	

A large group of students, 48.5%, did not like anyone other than the teacher explaining the maths concepts in class. A further 35.9% stated that they would agree to have someone different from the teacher explain the maths concepts in class. (Table 4.13).

Table 4.14: My Mathematics teacher was very helpful in Grade 8 and 9.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	212	37.5	37.5
Agree	198	35.0	72.4
Not Sure	61	10.8	83.2
Disagree	52	9.2	92.4
Strongly Disagree	43	7.6	100.0
Total	566	100.0	

When asked if their Grade 8 and 9 Mathematics teachers were helpful, 72.4% agreed while 10.8% were not sure if they were of any help (Table 4.14). On the other hand, 16.8% of the participants declared that those teachers who were teaching them in Grade 8 and 9 did not help them that much.

Central University of Technology, Free State

Table 4.15: Learning Mathematics is boring.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	51	9.1	9.1
Agree	37	6.6	15.7
Not Sure	65	11.6	27.2
Disagree	155	27.6	54.8
Strongly Disagree	254	45.2	100.0
Total	562	100.0	

A large majority, 72.8% of participants, declared that Mathematics is not boring to learn, while 15.7% stated that it is boring (Table 4.15). A smaller 11.6% were unsure about whether Mathematics is boring or not.

Table 4.16: Learning Mathematics is enjoyable.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	220	39.4	39.4
Agree	190	34.1	73.5
Not Sure	73	13.1	86.6
Disagree	33	5.9	92.5
Strongly Disagree	42	7.5	100.0
Total	558	100.0	

About 73.5% of the participants considered learning Mathematics enjoyable compared with 13.4% who did not enjoy learning Mathematics (Table 4.16). A group of 13.1% were not able to state whether they had enjoyed learning Mathematics in their previous Grades.

Of the participants, 62.4% stated that calculators are necessary and essential for learning Mathematics whilst 13.2% of the participants were of the opinion that calculators are not essential for learning Mathematics (Table 4.17).

Table 4.17: Calculators are essential to learn Mathematics.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	151	27.2	27.2
Agree	196	35.3	62.4
Not Sure	136	24.5	86.9
Disagree	52	9.4	96.2
Strongly Disagree	21	3.8	100.0
Total	556	100.0	

Table 4.18: If I make mistakes, I work until I have corrected them.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	223	38.8	38.8
Agree	217	37.7	76.5
Not Sure	65	11.3	87.8
Disagree	38	6.6	94.4
Strongly Disagree	32	5.6	100.0
Total	575	100.0	

A group of learners, 75.5%, agreed that if they made a mistake they would do the problem again until they got it correct, whilst 12.2% stated they could not solve problems until they were given the solution. In this particular situation 11.3% could not say if they would work to get a solution or not (Table 4.18).

Table 4.19: I try to answer questions the teacher asks.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	184	32.9	32.9
Agree	256	45.7	78.6
Not Sure	58	10.4	88.9
Disagree	34	6.1	95.0
Strongly Disagree	28	5.0	100.0
Total	560	100.0	

Of the participants, most (78.6%) tried to answer questions presented by their teachers, whilst a small group of 11.1% did not participate in class by answering teachers' questions during lessons (Table 4.19).

Table 4.20: I do not have a mathematical mind.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	49	8.9	8.9
Agree	77	13.9	22.8
Not Sure	161	29.1	51.9
Disagree	140	25.3	77.2
Strongly Disagree	126	22.8	100.0
Total	553	100.0	

When asked if they believed whether they do or do not have a mathematical mind, 48.1% stated that they thought they had a mathematical mind, whilst 29.1% were not sure as to whether they did or not. A further 22.8% believed that they did not have a mathematical mind (Table 4.20).

Table 4.21: I like studying Mathematics at school.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	181	32.6	32.6
Agree	217	39.1	71.7
Not Sure	61	11.0	82.7
Disagree	46	8.3	91.0
Strongly Disagree	50	9.0	100.0
Total	555	100.0	

Of the participants, 71.7% agreed that they liked studying maths at school whereas 17.3% did not like studying maths. 11% of participants were not sure if they liked studying maths at school (Table 4.21).

Table 4.22: I enjoy trying to solve new mathematical problems.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	169	30.2	30.2
Agree	231	41.3	71.6
Not Sure	86	15.4	86.9
Disagree	42	7.5	94.5
Strongly Disagree	31	5.5	100.0
Total	559	100.0	

A greater number of participants, 71.6%, enjoyed trying to solve new maths problems, whilst a smaller group of 13% did not enjoy solving new maths problems (Table 4.22).

Table 4.23: I find Mathematics frightening.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	53	9.8	9.8
Agree	102	18.8	28.5
Not Sure	203	37.4	65.9
Disagree	112	20.6	86.6
Strongly Disagree	73	13.4	100.0
Total	543	100.0	

Of the participants, 28.5% stated that they found maths frightening, while 34% did not agree that they found Mathematics frightening (Table 4.23). The largest group, 37.4%, were not sure if they found Mathematics frightening.

Table 4.24: I find mathematical problems interesting and challenging.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	169	30.2	30.2
Agree	217	38.8	69.1
Not Sure	103	18.4	87.5
Disagree	42	7.5	95.0
Strongly Disagree	28	5.0	100.0
Total	559	100.0	

When asked if they found Mathematics problems interesting and challenging, 69.1% of participants agreed while 12.5% did not find them interesting and challenging (Table 4.24) and 18.4% were not sure if they could say they found these problems interesting and challenging.

Table 4.25: I find Mathematics confusing.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	68	12.2	12.2
Agree	136	24.5	36.7
Not Sure	157	28.2	64.9
Disagree	131	23.6	88.5
Strongly Disagree	64	11.5	100.0
Total	556	100.0	

Of the participants, 28.2% were not sure if Mathematics was confusing whilst 36.7% believed that it was confusing (Table 4.25) and 35.1% did not think that it was confusing.

Table 4.26: I have less trouble learning Mathematics than other subjects.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	74	13.1	13.1
Agree	161	28.6	41.7
Not Sure	174	30.9	72.6
Disagree	103	18.3	90.9
Strongly Disagree	51	9.1	100.0
Total	563	100.0	

Of the participants, 30.9% thought they were not sure if they had less trouble learning Mathematics than other subjects (Table 4.26). A larger group of the participants

(41.7%) agreed that they had less trouble learning Mathematics than other subjects. There were only 27.4% who disagreed and said that they had less trouble learning Mathematics than other subjects.

Table 4.27: I want to study Mathematics in Grade 10 so as to study Science, Health and Engineering fields in future.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	219	38.6	38.6
Agree	129	22.8	61.4
Not Sure	86	15.2	76.5
Disagree	51	9.0	85.5
Strongly Disagree	82	14.5	100.0
Total	567	100.0	

Of the participants, 61.4% agreed that they opted for maths in order to study in the science, health and engineering fields in the future, while 23.5% did not agree with this (Table 4.27). There was a group which was not sure as to whether they wanted to choose maths in order to do certain fields in the future.

Table 4.28: It takes me longer to understand Mathematics than the average person.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	87	15.3	15.3
Agree	166	29.2	44.5
Not Sure	123	21.7	66.2
Disagree	132	23.2	89.4
Strongly Disagree	60	10.6	100.0
Total	568	100.0	

44.5% agreed that it took them longer to understand maths than the average person, 33.8% did not agree and 21.7% were not sure if they took longer to understand maths than the average person (Table 4.28).

Table 4.29: I learn Mathematics best by working through some questions on my own.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	141	25.1	25.1
Agree	212	37.8	62.9
Not Sure	104	18.5	81.5
Disagree	68	12.1	93.6
Strongly Disagree	36	6.4	100.0
Total	561	100.0	

62.9% stated that they learned Mathematics best by working through some questions on their own, whereas 18.5% did not agree (Table 4.29). Of the participants there were 18.5% who were not sure if they learned best by working through some questions on their own.

Table 4.30: I learn Mathematics best when I ask the teacher for help in lessons.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	200	35.1	35.1
Agree	242	42.5	77.6
Not Sure	68	11.9	89.5
Disagree	35	6.1	95.6
Strongly Disagree	25	4.4	100.0
Total	570	100.0	

Asking the teacher for help during lessons is considered to be the best way of learning Mathematics, and 77.6% of participants agreed, while 10.5% did not think so (Table

4.30). From the responses 11.9% were not sure if they learned Mathematics best by asking for help during the Mathematics class.

Table 4.31: I learn Mathematics best when I read through worked examples in textbooks and then do exercises.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	219	38.7	38.7
Agree	207	36.6	75.3
Not Sure	71	12.5	87.8
Disagree	37	6.5	94.3
Strongly Disagree	32	5.7	100.0
Total	566	100.0	

In a similar way, 75.3% still considered reading through worked examples from textbooks, and then doing some exercises, as the best way of learning Mathematics (Table 4.31). A group of 12.2% expressed the belief that worked examples and doing exercises would not be the best way of learning Mathematics.

Table 4.32: I like it when someone in class explains Mathematics to me, and not the teacher.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	77	13.7	13.7
Agree	103	18.3	32.0
Not Sure	103	18.3	50.4
Disagree	162	28.8	79.2
Strongly Disagree	117	20.8	100.0
Total	562	100.0	

48.8% of the participants did not agree that they would prefer someone other than their teacher to explain Mathematics (Table 4.32) whereas 18.3% were not sure whether they would prefer a teacher or someone else to teach them.

Table 4.33: I prefer doing my Mathematics homework with my friends in class.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	142	25.1	25.1
Agree	198	35.0	60.1
Not Sure	49	8.7	68.7
Disagree	116	20.5	89.2
Strongly Disagree	61	10.8	100.0
Total	566	100.0	

A larger group of participants (60.1%) would prefer doing maths homework with friends and peers in class compared to 31.3% who would like to work on their maths homework alone (Table 4.33).

Table 4.34: I learn Mathematics best when I explain things to other learners in class.

	Frequency	Percentage	Cumulative Percentage
Strongly Agree	158	27.8	27.8
Agree	181	31.8	59.6
Not Sure	105	18.5	78.0
Disagree	67	11.8	89.8
Strongly Disagree	58	10.2	100.0
Total	569	100.0	

A greater number of participants (59.6%) believed that they learn Mathematics better when they explain things to other learners whilst 22% did not recognise the value and the impact of explaining content to other learners (Table 4.34).

4.4 SUBJECT DONE BY PARTICIPANTS

This section presents the analysis of participants by grades with different statements. Furthermore the Chi-Square test is performed to determine if the relationship is statistically significant or not.

4.4.1 Participants liking Mathematics in Grades 8 and 9

Table 4.35 shows that 55.3% of participants in Grade 9 liked Mathematics in this class as well as in Grade 8, while 27% demonstrated that they did not like Mathematics. There were 17.8% of this Grade 9 group who were not sure if they liked Mathematics in Grade 8 or even in the present Grade.

Of the Mathematics learners in Grade 10, 62% agreed that they had liked Mathematics in previous Grades (Grades 8 and 9) while 21.7% in this group were not sure if they liked this subject. There were 16.3% who are currently doing Mathematics although they did not like this subject in the lower Grades (Grades 8 and 9).

Table 4.35: I did not like Mathematics in Grade 8 and 9.

		I did not like Mathematics in Grade 8 and 9.					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	Count	15	32	31	44	52	174
	% within Subject	8.6%	18.4%	17.8%	25.3%	29.9%	100.0%
	% of Total	2.6%	5.6%	5.4%	7.7%	9.1%	30.4%
Grade 10 Maths	Count	13	17	40	68	46	184
	% within Subject	7.1%	9.2%	21.7%	37.0%	25.0%	100.0%
	% of Total	2.3%	3.0%	7.0%	11.9%	8.0%	32.2%
Grade 10 Maths Literacy	Count	17	36	66	52	43	214
	% within Subject	7.9%	16.8%	30.8%	24.3%	20.1%	100.0%
	% of Total	3.0%	6.3%	11.5%	9.1%	7.5%	37.4%
Total	Count	45	85	137	164	141	572
	% within Subject	7.9%	14.9%	24.0%	28.7%	24.7%	100.0%
	% of Total	7.9%	14.9%	24.0%	28.7%	24.7%	100.0%

Finally, in the group of students who were doing Mathematics literacy, 44.1% stated that they had liked Mathematics in the previous Grades (Grades 8 & 9) and 24.7% indicated that they had not liked Mathematics at all in the previous Grades.

So in this group of participants, 53.4% liked Mathematics in Grades 8 and 9, 22.8% did not like this subject in the lower Grades, and 24% of this group were not sure if they had liked Mathematics or not.

Table 4.36: Chi-Square tests: I did not like Mathematics in Grade 8 and 9.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.829[a]	8	0.002
Likelihood Ratio	23.978	8	0.002
Linear-by-Linear Association	2.341	1	0.126
N of Valid Cases	572		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 13.69.			

The statistical analysis of participants by subject and the statement "I did not like Mathematics in Grade 8 and 9" shows a Chi-Square value of 23.829, the significance of 0.002 ($p < 0.05$), and 8 as the degree of freedom (Table 4.36). Therefore, there is a relationship between the participants' subject and their feeling of liking Mathematics in Grade 8 and 9.

Table 4.37 presents the participants' responses divided by Grade and subject. In the case of Grade 9 Mathematics participants, 33.3% agreed that they were not good at Mathematics in the previous Grades, while 35.1% indicated that they were good at this subject. Around 31.6% of the participants were not sure if they were good at Mathematics in the previous Grades or not.

4.4.2 I was not good at Mathematics

Table 4.37: I was not good in Mathematics.

		I was not good at Mathematics.					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	Count	19	38	54	37	23	171
	% within Subject	11.1%	22.2%	31.6%	21.6%	13.5%	100.0%
	% of Total	3.4%	6.7%	9.5%	6.5%	4.1%	30.2%
Grade 10 Maths	Count	14	35	53	56	24	182
	% within Subject	7.7%	19.2%	29.1%	30.8%	13.2%	100.0%
	% of Total	2.5%	6.2%	9.4%	9.9%	4.2%	32.2%
Grade 10 Maths Literacy	Count	24	70	46	56	17	213
	% within Subject	11.3%	32.9%	21.6%	26.3%	8.0%	100.0%
	% of Total	4.2%	12.4%	8.1%	9.9%	3.0%	37.6%
Total	Count	57	143	153	149	64	566
	% within Subject	10.1%	25.3%	27.0%	26.3%	11.3%	100.0%
	% of Total	10.1%	25.3%	27.0%	26.3%	11.3%	100.0%

The results show that 44% of participants in Grade 10 Mathematics believed that they were good at Mathematics in the previous Grades while 26.9%, despite having chosen Mathematics in this Grade, still believed that they were not good in the previous Grades. In this group (Grade 10 Mathematics) 28.1% were not sure if they were good or not at Mathematics in the previous Grades.

Of the Mathematical Literacy students, 44.8% agreed that they were not good at Mathematics, while 34% indicated that, despite choosing mathematical literacy, they had been good at Mathematics in the previous Grades. 21.6% of this group were not sure whether or not they had been good at Mathematics in the previous Grades.

For the whole sample, 35.4% agreed that they were not good at Mathematics, while 53.3% stated that they were good Mathematics. About 27% of the participants were not sure whether or not they were good at Mathematics.

Table 4.38: Chi-Square tests: I was not good at Mathematics.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	19.697[a]	8	0.012
Likelihood Ratio	19.903	8	0.011
Linear-by-Linear Association	2.547	1	0.111
N of Valid Cases	566		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 17.22.			

Table 4.38 presents the statistical analysis of participants by subject and the statement "I was not good in Mathematics" and shows the chi square value of 19.697, the significance of 0.012 ($p < 0.05$), and 8 as the degree of freedom. Therefore, there is relationship between participants' subject and their feeling of being good at Mathematics. Those who chose Mathematics have the perception that they are good at Mathematics.

49.3% of the Grade 10 Mathematical Literacy group said that they understood their Mathematics teachers while 33.1% indicated that they did not understand their Mathematics teachers in the Grade 9 class. 17.5% of the participants were not sure if they had understood their teachers in Mathematics classes or not.

4.4.3 I did not understand my Mathematics teacher in class.

Table 4.39: I did not understand my Mathematics teacher in class.

		I did not understand my Mathematics teacher in class.					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	**Count**	13	37	29	47	39	165
	% within Subject	7.9%	22.4%	17.6%	28.5%	23.6%	100.0%
	% of Total	2.3%	6.6%	5.2%	8.4%	7.0%	29.6%
Grade 10 Maths	**Count**	17	27	25	59	53	181
	% within Subject	9.4%	14.9%	13.8%	32.6%	29.3%	100.0%
	% of Total	3.1%	4.8%	4.5%	10.6%	9.5%	32.5%
Grade 10 Maths Literacy	**Count**	25	45	37	59	45	211
	% within Subject	11.8%	21.3%	17.5%	28.0%	21.3%	100.0%
	% of Total	4.5%	8.1%	6.6%	10.6%	8.1%	37.9%
Total	**Count**	55	109	91	165	137	557
	% within Subject	9.9%	19.6%	16.3%	29.6%	24.6%	100.0%
	% of Total	9.9%	19.6%	16.3%	29.6%	24.6%	100.0%

So in this sample, 29.5% agreed that they had not understood their Mathematics teachers in class, while about 54.2% were sure that they had understood their teachers during classes. 16.3% of the participants were not sure whether they had understood their teachers during class or not.

Table 4.40: Chi-Square tests: I did not understand my Mathematics teacher in class.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.013[a]	8	0.341
Likelihood Ratio	9.122	8	0.332
Linear-by-Linear Association	1.071	1	0.301
N of Valid Cases	557		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 16.29.			

Table 4.40 shows the statistical analysis of participants by subject, the statement, "I did not understand my Mathematics teacher in class", and shows the chi square value of 9.013, the significance of 0.341 ($p > 0.05$), and 8 as the degree of freedom. Therefore there is no relationship between the participants' subject and their feeling of being good at Mathematics.

4.4.4 Ability in Mathematics is something that you either have or you have not.

Table 4.41: Ability in Mathematics is something that you either have or you have not.

		Ability in Mathematics is something that you either have or you haven`t.					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	Count	20	48	56	32	11	167
	% within Subject	12.0%	28.7%	33.5%	19.2%	6.6%	100.0%
	% of Total	3.6%	8.7%	10.2%	5.8%	2.0%	30.4%
Grade 10 Maths	Count	21	49	60	26	14	170
	% within Subject	12.4%	28.8%	35.3%	15.3%	8.2%	100.0%
	% of Total	3.8%	8.9%	10.9%	4.7%	2.6%	31.0%
Grade 10 Maths Literacy	Count	22	47	106	24	13	212
	% within Subject	10.4%	22.2%	50.0%	11.3%	6.1%	100.0%
	% of Total	4.0%	8.6%	19.3%	4.4%	2.4%	38.6%
Total	Count	63	144	222	82	38	549
	% within Subject	11.5%	26.2%	40.4%	14.9%	6.9%	100.0%
	% of Total	11.5%	26.2%	40.4%	14.9%	6.9%	100.0%

Table 4.41 above shows that 40.7% of participants in Grade 9 agreed that ability in Mathematics is something that a person either has or has not, while 25.8% stated that they did not agree that ability in Mathematics is something that a person either has or hasn't. More participants (33.5%) in this Grade 9 group were unsure whether ability in Mathematics is something innate.

A group of 41.2% of learners doing Mathematics in Grade 10 agreed that ability in Mathematics is innate, while about 35.3% in this group were unsure of this. In this group, 23.5% were doing Mathematics and did not think ability in Mathematics is something that a person either has or not. Last, in the group of students who were doing mathematical literacy, 32.2% stated that ability in Mathematics is something that a person either has or not, with 17.4% disagreeing; the majority (50%) in this group were not sure about the answer.

Therefore, in this group 37.7% of participants agreed that ability in Mathematics is something that a person either has or not, while 21.8% did not agree; most of the participants were unsure whether ability in Mathematics is something that a person either has or not.

Table 4.42: Chi-Square Tests: Ability in Mathematics is something that you either have or you have not.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.927[a]	8	0.061
Likelihood Ratio	14.803	8	0.063
Linear-by-Linear Association	0.011	1	0.915
N of Valid Cases	549		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.56.			

Table 4.42 shows the statistical analysis of participants by subject and the statement, "ability in Mathematics is something that you either have or you have not", and shows the chi square value of 14.927, the significance of 0.061 ($p > 0.05$), and 8 as the degree of freedom. Therefore, there is no relationship between participants' subject and their opinion that ability in Mathematics is something that you either have or you have not.

4.4.5 It is possible to improve personal performance in Mathematics by working hard.

Table 4.43: It is possible to improve personal performance in Mathematics by working hard.

		It is possible to improve in Mathematics by working hard.					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	Count	66	55	7	18	22	168
	% within Subject	39.3%	32.7%	4.2%	10.7%	13.1%	100.0%
	% of Total	11.7%	9.8%	1.2%	3.2%	3.9%	29.8%
Grade 10 Maths	Count	124	38	2	11	7	182
	% within Subject	68.1%	20.9%	1.1%	6.0%	3.8%	100.0%
	% of Total	22.0%	6.7%	0.4%	2.0%	1.2%	32.3%
Grade 10 Maths Literacy	Count	121	46	11	11	25	214
	% within Subject	56.5%	21.5%	5.1%	5.1%	11.7%	100.0%
	% of Total	21.5%	8.2%	2.0%	2.0%	4.4%	37.9%
Total	Count	311	139	20	40	54	564
	% within Subject	55.1%	24.6%	3.5%	7.1%	9.6%	100.0%
	% of Total	55.1%	24.6%	3.5%	7.1%	9.6%	100.0%

Table 4.43 shows that 72% of participants doing Grade 9 Mathematics agreed that it was possible to improve in Mathematics by working hard, while 23.8% stated that it was not possible to improve in Mathematics by working hard. 4.2% of the participants in Grade 9 Mathematics were not sure whether it is possible to improve in Mathematics by working hard.

Of the Mathematics learners who were in Grade 10, 89% agreed that it was possible to improve in Mathematics by working hard, while a tiny group (1.1%) were not sure if it was possible to improve in Mathematics performance by working hard. In this group

9.8% disagreed with the statement, saying it was possible to improve personal performance in Mathematics by working hard. Finally, of the students who were doing mathematical literacy, 78% stated that it was possible to improve personal performance in Mathematics by working hard, although 16.8% did not agree.

So in this sample, 79.7% agreed that it is possible to improve performance in Mathematics by working hard, while 16.5% did not agree with this. 3.5% of participants in this group were unsure whether it was possible to improve performance in Mathematics by working hard.

Table 4.44: Chi-Square tests: It is possible to improve personal performance in Mathematics by working hard.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	38.414[a]	8	0.000
Likelihood Ratio	40.774	8	0.000
Linear-by-Linear Association	4.138	1	0.042
N of Valid Cases	564		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.96.			

Table 4.44 demonstrates the statistical analysis of participants by subject and the statement, "It is possible to improve personal performance in Mathematics by working hard", and shows the chi square value of 38.414, the significance of 0.000 ($p < 0.05$), and 8 as the degree of freedom. Therefore, there is a significant relationship between participants' subject and their view that it is possible to improve personal performance in Mathematics by working hard.

4.4.6 Mathematics is important in life.

Table 4.45: Mathematics is important in life.

		Mathematics is important in life.					Total
		Strongly Agree	**Agree**	**Not Sure**	**Disagree**	**Strongly Disagree**	
Grade 9 Maths	**Count**	80	63	4	9	19	175
	% within Subject	45.7%	36.0%	2.3%	5.1%	10.9%	100.0%
	% of Total	14.0%	11.0%	0.7%	1.6%	3.3%	30.6%
Grade 10 Maths	**Count**	124	46	2	3	8	183
	% within Subject	67.8%	25.1%	1.1%	1.6%	4.4%	100.0%
	% of Total	21.7%	8.1%	0.4%	0.5%	1.4%	32.0%
Grade 10 Maths Literacy	**Count**	119	56	12	6	20	213
	% within Subject	55.9%	26.3%	5.6%	2.8%	9.4%	100.0%
	% of Total	20.8%	9.8%	2.1%	1.1%	3.5%	37.3%
Total	**Count**	323	165	18	18	47	571
	% within Subject	56.6%	28.9%	3.2%	3.2%	8.2%	100.0%
	% of Total	56.6%	28.9%	3.2%	3.2%	8.2%	100.0%

Table 4.45 shows that 81.7% of participants doing Mathematics in Grade 9 agreed that Mathematics was important in life while 16% stated that Mathematics was not important in life. 2.3% of this Grade 9 Mathematics group were not sure if Mathematics was important in life.

92.9% of the Grade 10 Mathematics learners said that Mathematics was important in life while 1.1% in this group were not sure. In the same group 6% did not think Mathematics was important in life, despite studying the subject. In the group of students who were doing Mathematics literacy, 82.2% thought that Mathematics was important in life, 12.2% did not think Mathematics was important in life, and 5.6% were unsure.

In this group of participants as a whole, 85.5% agreed that Mathematics was important in life, 11.4% did not agree and 3.2% were unsure.

Table 4.46: Chi-Square Tests: Mathematics is important in life

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	27.936[a]	8	0.000
Likelihood Ratio	28.342	8	0.000
Linear-by-Linear Association	1.189	1	0.275
N of Valid Cases	571		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.52.			

Table 4.46 shows the statistical analysis of participants by subject and the statement, “Mathematics is important in life”, and shows the chi square value of 27.936, the significance of 0.000 ($p < 0.05$), and 8 as the degree of freedom. Therefore, there is significant relationship between participants’ subject and their views on the importance of Mathematics in life.

Table 4.47 shows that 20.3% of participants in Grade 9 doing Mathematics said that the careers they envisaged did not require Mathematics as a subject, 54.1% demonstrated that the career they liked require Mathematics as a subject, and 26.5% of this Grade 9 Mathematics group were unsure.

In the case of Grade 10 Mathematics learners, 10, 9% of them agreed that the career they envisaged did not require Mathematics as a subject, 17.6% were unsure and 73% thought that the careers they liked required Mathematics as a subject.

4.4.7 The career I like does not require Mathematics as a subject

Table 4.47: The career I like does not require Mathematics as a subject.

		The career I like does not require Mathematics as a subject.					Total (%)
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	**Count**	15	20	44	44	49	172
	% within Subject	8.7%	11.6%	25.6%	25.6%	28.5%	100.0%
	% of Total	2.7%	3.6%	7.8%	7.8%	8.7%	30.6%
Grade 10 Maths	**Count**	7	10	32	41	92	182
	% within Subject	3.8%	5.5%	17.6%	22.5%	50.5%	100.0%
	% of Total	1.2%	1.8%	5.7%	7.3%	16.3%	32.3%
Grade 10 Maths Literacy	**Count**	30	20	75	41	43	209
	% within Subject	14.4%	9.6%	35.9%	19.6%	20.6%	100.0%
	% of Total	5.3%	3.6%	13.3%	7.3%	7.6%	37.1%
Total	**Count**	52	50	151	126	184	563
	% within Subject	9.2%	8.9%	26.8%	22.4%	32.7%	100.0%
	% of Total	9.2%	8.9%	26.8%	22.4%	32.7%	100.0%

In the case of the learners who were taking Mathematical Literacy, 24% thought that their envisaged careers did not require Mathematics as a subject. 40.2% thought that the careers they liked required Mathematics. A large number (35.9%) in the Grade 10 mathematical literacy group were not sure if the careers they liked required Mathematics as a subject or not.

In this sample, 18.1% agreed that the career they liked did not require Mathematics as a subject, 55.1% thought that the careers they liked required Mathematics, and 26.8% of this sample were unsure.

Table 4.48: Chi-Square tests: The career I like does not require Mathematics as a subject.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	57.498[a]	8	0.000
Likelihood Ratio	57.602	8	0.000
Linear-by-Linear Association	7.361	1	0.007
N of Valid Cases	563		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.28.			

Table 4.48 shows the statistical analysis of participants by subject and the statement, “the career I like does not require Mathematics as a subject”, and shows the chi square value of 57.498, the significance of 0.00 which is smaller than 0.05, and 8 as the degree of freedom. Therefore, there is a significant relationship between participants’ subject and their view of the requirement of Mathematics as a subject by the careers they liked.

Table 4.49 shows that 64.9% of participants in Grade 9 doing Mathematics agreed that, when a Mathematics problem was difficult, they would try it a number of times until they got a correct answer. 15% did not agree. Of this Grade 9 Mathematics group, 13.5% were not sure whether, when a Mathematics problem was difficult, they would try it again until they got a correct answer.

Of a group of Mathematics learners in Grade 10, 84.4% agreed that, when a Mathematics problem was difficult, they would try it a number of times until they got a correct answer, while 8.1% in this group were not sure. Furthermore, in this group 7.6% of the participants indicated that, when a Mathematics problem was difficult, they would not try it a number of times until they got a correct answer.

4.4.8 When a Mathematics problem is difficult, do you try it again until you get an answer?

Table 4.49: When a Mathematics problem is difficult, do you try it again until you get an answer?

		When a problem is difficult, do you try it again until you get an answer?					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	Count	47	64	23	23	14	171
	% within Subject	27.5%	37.4%	13.5%	13.5%	8.2%	100.0%
	% of Total	8.3%	11.2%	4.0%	4.0%	2.5%	30.1%
Grade 10 Maths	Count	70	87	15	7	7	186
	% within Subject	37.6%	46.8%	8.1%	3.8%	3.8%	100.0%
	% of Total	12.3%	15.3%	2.6%	1.2%	1.2%	32.7%
Grade 10 Maths Literacy	Count	79	83	18	19	13	212
	% within Subject	37.3%	39.2%	8.5%	9.0%	6.1%	100.0%
	% of Total	13.9%	14.6%	3.2%	3.3%	2.3%	37.3%
Total	Count	196	234	56	49	34	569
	% within Subject	34.4%	41.1%	9.8%	8.6%	6.0%	100.0%
	% of Total	34.4%	41.1%	9.8%	8.6%	6.0%	100.0%

Lastly in the group of learners who were doing mathematical literacy, 76.5% stated that when a Mathematics problem was difficult, they would try it a number of times until they got a correct answer, while 15% indicated that when a Mathematics problem was difficult, they would not try it a number of times until they got a correct answer. About 8.5% of participants in the Grade 10 Mathematical Literacy group were not sure if they could say whether, when a Mathematics problem was difficult, they would try it a number of times until they got a correct answer.

Therefore, in this sample 75.5% of the participants agreed that, when a Mathematics problem was difficult, they would try it a number of times until they got a correct answer. 14.6% did not agree and 9.8% of this group were unsure of what they would do.

Table 4.50: Chi-Square Tests: When a problem is difficult, do you try it again until you get a correct answer?

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	21.596[a]	8	0.006
Likelihood Ratio	22.301	8	0.004
Linear-by-Linear Association	5.473	1	0.019
N of Valid Cases	569		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.22.			

Table 4.50 shows the statistical analysis of participants by subject and the statement, "when a Mathematics problem is difficult, they will try it a number of times until they get a correct answer", and shows the chi square value of 21.596, the significance of 0.006 ($p < 0.05$), and 8 as the degree of freedom. Therefore, there is significant relationship between participants' subject and the view of trying a difficult Mathematics problem a number of times until a correct answer is obtained.

Table 4.51 shows that 68.8% of participants in Grade 9 doing Mathematics thought that mathematical knowledge was needed in everyday life, while 15% disagreed. 16.2% of this Grade 9 group were not sure if mathematical knowledge was needed in everyday life.

When looking at the Mathematics learners who are in Grade 10, 89.8% of them agreed that mathematical knowledge was needed in everyday life while 5.9% in this group were not sure. In this group, 4.3% did not think mathematical knowledge was needed in everyday life, despite currently doing Mathematics. Last, in the group of learners who were doing mathematical literacy, 73% stated that mathematical knowledge was needed in everyday life and 12.8% said that they did not think so. In the Grade 10 Mathematical Literacy group, 14.2% were not sure if mathematical knowledge was needed in everyday life.

Therefore, in this sample 77.1% of the participants thought that mathematical knowledge was needed in everyday life, 10.7% did not think mathematical knowledge was needed in everyday life, and 12.1% of this group were not sure.

4.4.9 Do you think Mathematical knowledge is needed in everyday life?

Table 4.51: Do you think Mathematical knowledge is needed in everyday life?

Subject		Do you think Mathematical knowledge is needed in everyday life?					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	Count	58	61	28	13	13	173
	% within Subject	33.5%	35.3%	16.2%	7.5%	7.5%	100.0%
	% of Total	10.2%	10.7%	4.9%	2.3%	2.3%	30.4%
Grade 10 Maths	Count	115	51	11	2	6	185
	% within Subject	62.2%	27.6%	5.9%	1.1%	3.2%	100.0%
	% of Total	20.2%	9.0%	1.9%	0.4%	1.1%	32.5%
Grade 10 Maths Literacy	Count	99	55	30	9	18	211
	% within Subject	46.9%	26.1%	14.2%	4.3%	8.5%	100.0%
	% of Total	17.4%	9.7%	5.3%	1.6%	3.2%	37.1%
Total	Count	272	167	69	24	37	569
	% within Subject	47.8%	29.3%	12.1%	4.2%	6.5%	100.0%
	% of Total	47.8%	29.3%	12.1%	4.2%	6.5%	100.0%

Table 4.52: Chi-Square tests: Do you think Mathematical knowledge is needed in everyday life?

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	40.767[a]	8	0.000
Likelihood Ratio	43.496	8	0.000
Linear-by-Linear Association	1.640	1	0.200
N of Valid Cases	569		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.30.			

Table 4.52 shows the statistical analysis of participants by subject and the question, "do you think mathematical knowledge is needed in everyday life?", and shows the chi square value of 40.767, the significance of 0.000 which is smaller than p (0.05), and 8 as the degree of freedom. Therefore, there is a significant relationship between participants' subject and their thought that mathematical knowledge is needed in everyday life.

4.4.10 I like it when someone in class explains Mathematics to me, and not the teacher.

Table 4.53 shows that 32.9% of participants in Grade 9 doing Mathematics liked it when someone else in class explained Mathematics to them rather than the teacher, while 49.4% demonstrated that they did not like it. 17.6% of this Grade 9 group were not sure if they liked it when someone else in class explained Mathematics to them rather than the teacher.

When focusing on Mathematics learners who are in Grade 10, 29.5% of them agreed that they liked it when someone else in class explained Mathematics to them rather than the teacher, while 17.7% in this group were not sure. In this group 52.7% of the participants did not like it when someone else in class explained Mathematics to them. Last, in the group of student who were doing mathematical literacy, 43.7% demonstrated that they liked it when someone else in class explained Mathematics to them rather than the teacher and 44.1% did not like it. In the Grade 10 Mathematics literacy group, 12.2% were not sure if they liked it when someone else in class explained Mathematics to them rather than the teacher.

Therefore, in this sample 35.9% of the participants preferred it when someone else in class explained Mathematics to them and not the teacher, 48.5% did not like it, and 15.6% of this group was not sure if they liked it or not.

Table 4.53: I like it when someone in class explains Mathematics to me, and not the teacher.

		I liked it when someone in class explains Mathematics to me, and not the teacher.					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	**Count**	30	26	30	52	32	170
	% within Subject	17.6%	15.3%	17.6%	30.6%	18.8%	100.0%
	% of Total	5.3%	4.6%	5.3%	9.1%	5.6%	29.9%
Grade 10 Maths	**Count**	22	33	33	56	42	186
	% within Subject	11.8%	17.7%	17.7%	30.1%	22.6%	100.0%
	% of Total	3.9%	5.8%	5.8%	9.8%	7.4%	32.7%
Grade 10 Maths Literacy	**Count**	49	44	26	51	43	213
	% within Subject	23.0%	20.7%	12.2%	23.9%	20.2%	100.0%
	% of Total	8.6%	7.7%	4.6%	9.0%	7.6%	37.4%
Total	**Count**	101	103	89	159	117	569
	% within Subject	17.8%	18.1%	15.6%	27.9%	20.6%	100.0%
	% of Total	17.8%	18.1%	15.6%	27.9%	20.6%	100.0%

Table 4.54: Chi-Square Tests: I like it when someone in class explains Mathematics to me, and not the teacher.

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13.670[a]	8	0.091
Likelihood Ratio	14.017	8	0.081
Linear-by-Linear Association	2.316	1	0.128
N of Valid Cases	569		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 26.59.			

Table 4.54 shows the statistical analysis of participants by subject and the statement, "I like it when someone in class explains Mathematics to me, and not the teacher", and shows the chi square value of 16.670, the significance of 0.091 ($p > 0.05$), and 8 as the degree of freedom. Therefore, there is no relationship between participants' subject and their perception that they liked it when someone else in class explained Mathematics to them, and not the teacher.

4.4.11 Learning Mathematics is boring

Table 4.55: Learning Mathematics is boring.

		Learning Mathematics is boring.					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	**Count**	21	13	17	46	72	169
	% within Subject	12.4%	7.7%	10.1%	27.2%	42.6%	100.0%
	% of Total	3.7%	2.3%	3.0%	8.2%	12.8%	30.1%
Grade 10 Maths	**Count**	8	5	17	52	100	182
	% within Subject	4.4%	2.7%	9.3%	28.6%	54.9%	100.0%
	% of Total	1.4%	.9%	3.0%	9.3%	17.8%	32.4%
Grade 10 Maths Literacy	**Count**	22	19	31	57	82	211
	% within Subject	10.4%	9.0%	14.7%	27.0%	38.9%	100.0%
	% of Total	3.9%	3.4%	5.5%	10.1%	14.6%	37.5%
Total	**Count**	51	37	65	155	254	562
	% within Subject	9.1%	6.6%	11.6%	27.6%	45.2%	100.0%
	% of Total	9.1%	6.6%	11.6%	27.6%	45.2%	100.0%

Table 4.55 shows that 20.1% of participants in Grade 9 doing Mathematics thought that learning Mathematics was boring, while 69.8% stated that learning Mathematics was not boring. 10.1% of this Grade 9 group who were unsure whether they could say learning Mathematics was boring.

Of the Mathematics learners in Grade 10, 7.1% of them agreed that learning Mathematics was boring, while 9.3% in this group were not sure. In this group 83.5% of them did not think that learning Mathematics was boring. Last, in the group of learners who were doing mathematical literacy, 19.4% said that learning Mathematics was boring, while 65% indicated that learning Mathematics was not boring. In the Grade 10 Mathematical Literacy group 14.7% were not sure whether learning Mathematics was boring or not.

Therefore, in this sample 15.7% of the participants agreed that learning Mathematics was boring, while 72.8% did not think learning Mathematics was boring, and 11.6% of this group were not sure whether learning Mathematics was boring or not.

Table 4.56: Chi-Square tests: Learning Mathematics is boring

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	22.113[a]	8	0.005
Likelihood Ratio	23.640	8	0.003
Linear-by-Linear Association	0.421	1	0.516
N of Valid Cases	562		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.13.			

Table 4.56 shows the statistical analysis of participants by subject and the statement, “learning Mathematics is boring”, and shows the chi square value of 22.113, the

significance of 0.005 ($p < 0.05$), and 8 as the degree of freedom. Therefore, there is a statistically significant relationship between participants' subject and their feeling that learning Mathematics is boring.

4.4.12 Learning Mathematics is enjoyable

Table 4.57: Learning Mathematics is enjoyable.

		Learning Mathematics is enjoyable.					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	**Count**	60	63	20	10	15	168
	% within Subject	35.7%	37.5%	11.9%	6.0%	8.9%	100.0%
	% of Total	10.8%	11.3%	3.6%	1.8%	2.7%	30.1%
Grade 10 Maths	**Count**	87	66	17	6	6	182
	% within Subject	47.8%	36.3%	9.3%	3.3%	3.3%	100.0%
	% of Total	15.6%	11.8%	3.0%	1.1%	1.1%	32.6%
Grade 10 Maths Literacy	**Count**	73	61	36	17	21	208
	% within Subject	35.1%	29.3%	17.3%	8.2%	10.1%	100.0%
	% of Total	13.1%	10.9%	6.5%	3.0%	3.8%	37.3%
Total	**Count**	220	190	73	33	42	558
	% within Subject	39.4%	34.1%	13.1%	5.9%	7.5%	100.0%
	% of Total	39.4%	34.1%	13.1%	5.9%	7.5%	100.0%

Table 4.57 shows that 73.2% of participants in Grade 9 doing Mathematics agreed that learning Mathematics was enjoyable, while 14.9% demonstrated that they did not think that learning Mathematics was enjoyable. 11.9% of this Grade 9 group were not sure if they could say learning Mathematics was enjoyable.

Of the Mathematics learners in Grade 10, 84.1% of them agreed that learning Mathematics was enjoyable, while 6.6% in this group were not sure whether they could say learning Mathematics is enjoyable. 9.3% of them, despite currently doing Mathematics, did not think learning Mathematics was enjoyable.

In the group of students who were doing mathematical literacy, 64.4% agreed that learning Mathematics was enjoyable, and 18.3% indicated that they did not think that learning Mathematics was enjoyable. In the Grade 10 Mathematics literacy group 17.3% were not sure if learning Mathematics was enjoyable.

Therefore, in this sample 73.5% of all the participants thought learning Mathematics was enjoyable while 13.4% did not think so, and 13.1% of this group were not sure if they could say learning Mathematics was enjoyable or not.

Table 4.58: Chi-Square Tests: Learning Mathematics is enjoyable

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	22.484[a]	8	0.004
Likelihood Ratio	23.511	8	0.003
Linear-by-Linear Association	1.885	1	0.170
N of Valid Cases	558		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 9.94.			

Table 4.58 shows the statistical analysis of participants by subject and the statement, “learning Mathematics is enjoyable”, and shows the chi square value of 22.484, the significance of 0.004 ($p < 0.05$), and 8 as the degree of freedom. Therefore, there is significant relationship between participants’ subject and their thought that learning Mathematics is enjoyable.

4.4.13 I do not have a mathematical mind

Table 4.59: I do not have a mathematical mind.

		I do not have a mathematical mind.					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	Count	21	32	42	35	36	166
	% within Subject	12.7%	19.3%	25.3%	21.1%	21.7%	100.0%
	% of Total	3.8%	5.8%	7.6%	6.3%	6.5%	30.0%
Grade 10 Maths	Count	5	21	48	51	54	179
	% within Subject	2.8%	11.7%	26.8%	28.5%	30.2%	100.0%
	% of Total	.9%	3.8%	8.7%	9.2%	9.8%	32.4%
Grade 10 Maths Literacy	Count	23	24	71	54	36	208
	% within Subject	11.1%	11.5%	34.1%	26.0%	17.3%	100.0%
	% of Total	4.2%	4.3%	12.8%	9.8%	6.5%	37.6%
Total	Count	49	77	161	140	126	553
	% within Subject	8.9%	13.9%	29.1%	25.3%	22.8%	100.0%
	% of Total	8.9%	13.9%	29.1%	25.3%	22.8%	100.0%

Table 4.59 shows that 32% of participants in Grade 9 doing Mathematics thought that they did not have a mathematical mind, while 42% demonstrated that they had a mathematical mind. 25.3% of this Grade 9 group were not sure if they had a mathematical mind.

The Mathematics learners group in Grade 10 had 14.5% of participants agreeing that they did not have a mathematical mind while 26.8% in this group were not sure whether they could say whether or not they had a mathematical mind. In this group, 58.7% of the participants thought they had a mathematical mind.

In the group of students who were doing mathematical literacy, 22.6% demonstrated that they did not have a mathematical mind and 43.3% indicated that they had a mathematical mind. In the Grade 10 Mathematics Literacy group, 34.1% were not sure if they could say they had a mathematical mind or not.

Therefore, in this sample 22.8% of the participants agreed that they did not have a mathematical mind, 48.1% thought they did, and 29.1% of this group were not sure if they had a mathematical mind or not.

Table 4.60: Chi-Square tests: I do not have a mathematical mind

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	28.129[a]	8	0.000
Likelihood Ratio	30.035	8	0.000
Linear-by-Linear Association	0.076	1	0.783
N of Valid Cases	553		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 14.71.			

Table 4.60 shows the statistical analysis of participants by subject and the statement, “I do not have a mathematical mind”, and shows the chi square value of 28.129, the significance of 0.000 which is smaller than p = 0.05, and 8 as the degree of freedom. Therefore, there is significant relationship between participants’ subject and the thought that they did not have a mathematical mind.

4.4.14 I like studying Mathematics at school

Table 4.61: I like studying Mathematics at school.

		I like studying Mathematics at school.					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	Count	48	64	21	18	19	170
	% within Subject	28.2%	37.6%	12.4%	10.6%	11.2%	100.0%
	% of Total	8.6%	11.5%	3.8%	3.2%	3.4%	30.6%
Grade 10 Maths	Count	74	79	13	12	4	182
	% within Subject	40.7%	43.4%	7.1%	6.6%	2.2%	100.0%
	% of Total	13.3%	14.2%	2.3%	2.2%	.7%	32.8%
Grade 10 Maths Literacy	Count	59	74	27	16	27	203
	% within Subject	29.1%	36.5%	13.3%	7.9%	13.3%	100.0%
	% of Total	10.6%	13.3%	4.9%	2.9%	4.9%	36.6%
Total	Count	181	217	61	46	50	555
	% within Subject	32.6%	39.1%	11.0%	8.3%	9.0%	100.0%
	% of Total	32.6%	39.1%	11.0%	8.3%	9.0%	100.0%

Table 4.61 shows that 65.8% of participants in Grade 9 doing Mathematics liked studying Mathematics at school, while 21.8% said that they did not like studying Mathematics at school. 12.8% of this Grade 9 group were not sure if they liked studying Mathematics at school.

Of the Mathematics learners in Grade 10, 84.1% agreed that they liked studying Mathematics at school, while 7.1% in this group were not sure if they liked studying Mathematics at school. In this group 8.8% of them did not like studying Mathematics at school.

In the group of learners who were doing Mathematics literacy, 65.6% demonstrated that they liked studying Mathematics at school, with 21.2% indicating that they did not like studying Mathematics at school. In the Grade 10 Mathematical Literacy group, 13.3% were not sure if they liked studying Mathematics at school or not.

Therefore, in this sample 71.7% of the participants liked studying Mathematics at school, while 17.3% did not like studying Mathematics at school, and 11% of this group were not sure if they liked studying Mathematics at school or not.

Table 4.62: Chi-Square tests: I like studying Mathematics at school

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	26.604[a]	8	0.001
Likelihood Ratio	30.168	8	0.000
Linear-by-Linear Association	.105	1	0.745
N of Valid Cases	555		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 14.09.			

Table 4.62 shows the statistical analysis of participants by subject and the statement, “I like studying Mathematics at school”, and shows the chi square value of 26.604, the significance of 0.001 ($p < 0.05$), and 8 as the degree of freedom. Therefore, there is no relationship between participants’ subject and their perception of liking studying Mathematics at school or not.

4.4.15 I find mathematical problems interesting and challenging

Table 4.63: I find mathematical problems interesting and challenging.

		I find mathematical problems interesting and challenging.					Total
		Strongly Agree	**Agree**	**Not Sure**	**Disagree**	**Strongly Disagree**	
Grade 9 Maths	**Count**	43	60	43	18	8	172
	% within Subject	25.0%	34.9%	25.0%	10.5%	4.7%	100.0%
	% of Total	7.7%	10.7%	7.7%	3.2%	1.4%	30.8%
Grade 10 Maths	**Count**	67	82	19	6	6	180
	% within Subject	37.2%	45.6%	10.6%	3.3%	3.3%	100.0%
	% of Total	12.0%	14.7%	3.4%	1.1%	1.1%	32.2%
Grade 10 Maths Literacy	**Count**	59	75	41	18	14	207
	% within Subject	28.5%	36.2%	19.8%	8.7%	6.8%	100.0%
	% of Total	10.6%	13.4%	7.3%	3.2%	2.5%	37.0%
Total	**Count**	169	217	103	42	28	559
	% within Subject	30.2%	38.8%	18.4%	7.5%	5.0%	100.0%
	% of Total	30.2%	38.8%	18.4%	7.5%	5.0%	100.0%

Table 4.63 shows that 59.9% of participants in Grade 9 doing Mathematics agreed that they found mathematical problems interesting and challenging, while 15.2% said that they did not find mathematical problems interesting and challenging. 25% of this Grade 9 group were not sure if they could say that they found mathematical problems interesting and challenging.

Looking at Mathematics students who were in Grade 10, 82.8% of them agreed that they found mathematical problems interesting and challenging while 10.6% in this group were not sure. In this group there were 6.6% who, despite currently doing Mathematics, did not find mathematical problems interesting or challenging.

In the group of learners who were doing mathematical literacy, 64.7% said that they found mathematical problems interesting and challenging, with 15.5% indicating that they did not find mathematical problems interesting and challenging. In the Grade 10 Mathematical Literacy group, 19.8% were unsure of their opinion.

Therefore, in this group of participants 69% agreed that they found mathematical problems interesting and challenging, 12.5% did not find mathematical problems interesting and challenging, and 18.4% of this group were not sure.

Table 4.64: Chi-Square Tests: I find mathematical problems interesting and challenging

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	27.009[a]	8	0.001
Likelihood Ratio	28.410	8	0.000
Linear-by-Linear Association	0.090	1	0.765
N of Valid Cases	559		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.62.			

Table 4.64 shows the statistical analysis of participants by subject and the statement, “I find mathematical problems interesting and challenging”, and shows the chi square value of 27.009, the significance of 0.001 ($p < 0.05$), and 8 as the degree of freedom. Therefore, there is significant relationship between participants’ subject and whether or not they found mathematical problems interesting and challenging.

4.4.16 I want to study Mathematics in Grade 10 so as to study Science, Health and Engineering fields in future

Table 4.65: I want to study Mathematics in Grade 10 so as to study Science, Health and Engineering fields in future.

		I want to study Mathematics in Grade 10 so as to study Science, Health and Engineering fields in future.					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	Count	59	45	36	11	24	175
	% within Subject	33.7%	25.7%	20.6%	6.3%	13.7%	100.0%
	% of Total	10.4%	7.9%	6.3%	1.9%	4.2%	30.9%
Grade 10 Maths	Count	120	41	8	7	8	184
	% within Subject	65.2%	22.3%	4.3%	3.8%	4.3%	100.0%
	% of Total	21.2%	7.2%	1.4%	1.2%	1.4%	32.5%
Grade 10 Maths Literacy	Count	40	43	42	33	50	208
	% within Subject	19.2%	20.7%	20.2%	15.9%	24.0%	100.0%
	% of Total	7.1%	7.6%	7.4%	5.8%	8.8%	36.7%
Total	Count	219	129	86	51	82	567
	% within Subject	38.6%	22.8%	15.2%	9.0%	14.5%	100.0%
	% of Total	38.6%	22.8%	15.2%	9.0%	14.5%	100.0%

Table 4.65 shows that 59.4% of participants in Grade 9 doing Mathematics agreed that they would study Mathematics in Grade 10 so as to take up professions in Science, Health and Engineering in future, while 20% demonstrated that they would study Mathematics in Grade 10 but not for this purpose. 17.8% of this Grade 9 group were not sure if they would study Mathematics in Grade 10 so as to take up professions in Science, Health and Engineering.

Responses from Mathematics learners who are in Grade 10 showed that 87.5% of them agreed that they were studying Mathematics in Grade 10 so as to take up professions in Science, Health and Engineering while 4.3% in this group were not sure if their choice to study Mathematics in Grade 10 was due to their desire to take up professions in Science, Health and Engineering. 8.1% of the participants who studied Mathematics in Grade 10 did not intend to take up professions in Science, Health and Engineering.

In the group of learners who were doing mathematical literacy, 39.9% demonstrated that, if given a second chance they would study Mathematics in Grade 10 so as to take up professions in Science, Health and Engineering with 39.9% indicating that, no matter what, they would not do that. In the Grade 10 Mathematics literacy group 20.2% were not sure that, if given a second chance, they would study Mathematics in Grade 10, so as to take up professions in Science, Health and Engineering.

In this sample, 61.4% indicated that they would study Mathematics in Grade 10 so as to take up professions in Science, Health and Engineering while 22.8% did not think that they would study Mathematics in Grade 10 so as to take up professions in Science, Health and Engineering. 15.2% of this group were not sure if they would study Mathematics in Grade 10 specifically to take up professions in Science, Health and Engineering.

Table 4.66: Chi-Square Tests: I want to study Mathematics in Grade 10 so as to study Science, Health and Engineering fields in future

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	121.285[a]	8	0.000
Likelihood Ratio	127.507	8	0.000
Linear-by-Linear Association	23.049	1	0.000
N of Valid Cases	567		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.74.

Table 4.66 shows the statistical analysis of participants by subject and the statement, "I want to study Mathematics in Grade 10 so as to study Science, Health and Engineering fields in future", and shows the chi square value of 121.285, the significance of 0.000 ($p < 0.05$), and 8 as the degree of freedom. Therefore, there is significant relationship between participants' subject and their view that they would study Mathematics in Grade 10 to take up professions in Science, Health and Engineering.

4.4.17 It takes me longer to understand Mathematics than the average person

Table 4.67: It takes me longer to understand Mathematics than the average person.

		It takes me longer to understand Mathematics than the average person.					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	Count	30	59	37	37	14	177
	% within Subject	16.9%	33.3%	20.9%	20.9%	7.9%	100.0%
	% of Total	5.3%	10.4%	6.5%	6.5%	2.5%	31.2%
Grade 10 Maths	Count	17	52	38	48	28	183
	% within Subject	9.3%	28.4%	20.8%	26.2%	15.3%	100.0%
	% of Total	3.0%	9.2%	6.7%	8.5%	4.9%	32.2%
Grade 10 Maths Literacy	Count	40	55	48	47	18	208
	% within Subject	19.2%	26.4%	23.1%	22.6%	8.7%	100.0%
	% of Total	7.0%	9.7%	8.5%	8.3%	3.2%	36.6%
Total	Count	87	166	123	132	60	568
	% within Subject	15.3%	29.2%	21.7%	23.2%	10.6%	100.0%
	% of Total	15.3%	29.2%	21.7%	23.2%	10.6%	100.0%

Table 4.67 shows that 50.2% of participants in Grade 9 doing Mathematics agreed that it takes them longer to understand Mathematics than the average person, while 28.8% did not agree. 20.9% of this Grade 9 group were not sure if it takes them longer to understand Mathematics than the average person.

Of the group of Mathematics learners who were in Grade 10, 37.7% of them agreed that it took them longer to understand Mathematics than the average person while 20.8% in this group were not sure. In this group, 41.5% of them did not agree that it took them longer to understand Mathematics than the average person.

In the group of learners who were doing mathematical literacy, 45.6% said that it took them longer to understand Mathematics than the average person with 31.3% indicating that it did not take them longer to understand Mathematics than the average person. In the Grade 10 Mathematics literacy group, 23.1% were not sure if it took them longer to understand Mathematics than the average person.

In this sample 44.5% agreed that it took them longer to understand Mathematics than the average person while, 33.6% did not agree and 21.7% of this group were unsure if it took them longer to understand Mathematics than the average person.

Table 4.68: Chi-Square Tests: It takes me longer to understand Mathematics than the average person

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	15.592[a]	8	0.049
Likelihood Ratio	15.783	8	0.046
Linear-by-Linear Association	0.078	1	0.779
N of Valid Cases	568		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 18.70.

Table 4.68 shows the statistical analysis of participants by subject and the statement, “It takes me longer to understand Mathematics than the average person”, and shows the chi square value of 15.592, the significance of 0.049 ($p < 0.05$), and 8 as the degree of freedom. Therefore, there is significant relationship between participants’ subject and their feeling that it took them longer to understand Mathematics than the average person.

4.4.18 I learn Mathematics best by working through some questions on my own

Table 4.69: I learn Mathematics best by working through some questions on my own.

		I learn Mathematics best by working through some questions on my own.					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	**Count**	41	66	24	24	17	172
	% within Subject	23.8%	38.4%	14.0%	14.0%	9.9%	100.0%
	% of Total	7.3%	11.8%	4.3%	4.3%	3.0%	30.7%
Grade 10 Maths	**Count**	51	75	31	18	5	180
	% within Subject	28.3%	41.7%	17.2%	10.0%	2.8%	100.0%
	% of Total	9.1%	13.4%	5.5%	3.2%	0.9%	32.1%
Grade 10 Maths Literacy	**Count**	49	71	49	26	14	209
	% within Subject	23.4%	34.0%	23.4%	12.4%	6.7%	100.0%
	% of Total	8.7%	12.7%	8.7%	4.6%	2.5%	37.3%
Total	**Count**	141	212	104	68	36	561
	% within Subject	25.1%	37.8%	18.5%	12.1%	6.4%	100.0%
	% of Total	25.1%	37.8%	18.5%	12.1%	6.4%	100.0%

Table 4.69 shows that 62.2% of participants in Grade 9 doing Mathematics agreed that they learned Mathematics best by working through some questions on their own while 23.9% said that they did not think that works. 14% of this Grade 9 group were

not sure if they learned Mathematics best by working through some questions on their own.

When looking at Mathematics learners who are in Grade 10, 70% of them agreed that they learned Mathematics best by working through some questions on their own while 17.2% in this group were not sure if they did. In this group 12.8% of them did not think that they learned Mathematics best by working through some questions on their own.

In the group of student who were doing Mathematical Literacy. 57.4% demonstrated that they learned Mathematics best by working through some questions on their own, with 19.1% indicating that they did not learned Mathematics best by doing this. In the Grade 10 Mathematics Literacy group 23.4% were not sure if they learned Mathematics best by working through some questions on their own.

In this sample, 62.9% agreed that they learned Mathematics best by working through some questions on their own while 18.5% did not agree and 18.5% of this group were not sure if they learned Mathematics best by working through some questions on their own or not.

Table 4.70: Chi-Square Tests: I learn Mathematics best by working through some questions on my own

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	15.580[a]	8	0.049
Likelihood Ratio	16.112	8	0.041
Linear-by-Linear Association	0.005	1	0.942
N of Valid Cases	561		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.04.

Table 4.70 shows the statistical analysis of participants by subject and the statement, "I learn Mathematics best by working through some questions on my own", and shows the chi square value of 15.580, the significance of 0.049 ($p < 0.05$), and 8 as the degree of freedom. Therefore, there is no relationship between participants' subject and their feeling that they learned Mathematics best by working through some questions on their own.

4.4.19 I learn Mathematics best when I ask the teacher for help in lessons

Table 4.71: I learn Mathematics best when I ask the teacher for help in lessons.

		I learn Mathematics best when I ask the teacher for help in lessons.					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	**Count**	54	77	20	12	12	175
	% within Subject	30.9%	44.0%	11.4%	6.9%	6.9%	100.0%
	% of Total	9.5%	13.5%	3.5%	2.1%	2.1%	30.7%
Grade 10 Maths	**Count**	69	82	24	8	1	184
	% within Subject	37.5%	44.6%	13.0%	4.3%	0.5%	100.0%
	% of Total	12.1%	14.4%	4.2%	1.4%	.2%	32.3%
Grade 10 Maths Literacy	**Count**	77	83	24	15	12	211
	% within Subject	36.5%	39.3%	11.4%	7.1%	5.7%	100.0%
	% of Total	13.5%	14.6%	4.2%	2.6%	2.1%	37.0%
Total	**Count**	200	242	68	35	25	570
	% within Subject	35.1%	42.5%	11.9%	6.1%	4.4%	100.0%
	% of Total	35.1%	42.5%	11.9%	6.1%	4.4%	100.0%

Table 4.71 shows that 74.9% of participants in Grade 9 doing Mathematics agreed that they learn Mathematics best when they ask their teachers for help in lessons, while 13.8% did not agree with this. 11.4% of this Grade 9 group were not sure if they learned Mathematics best when they ask their teachers for help in lessons.

Looking at Mathematics learners who are in Grade 10, 82.1% of them agreed that they learned Mathematics best when they ask their teachers for help in lessons, while 13% in this group were not sure if they did. In this group there were 4.8% of them who did not agree with the statement.

In the group of learners who were doing Mathematics literacy, 75.8% agreed that they learned Mathematics better when they asked their teachers for help in lessons, with 12.8% indicating that they did not learn Mathematics better when they asked their teachers for help in lessons. In the Grade 10 Mathematics Literacy group, 11.4% were not sure if they learned Mathematics better by asking their teachers for help in lessons.

In this sample, 77.6% agreed that they learned Mathematics better when they asked their teachers for help in lessons, while 10.5% did not think they learned, and 11.9% of this group were not sure if they learned Mathematics better when they asked their teachers for help.

Table 4.72: Chi-Square Tests: I learn Mathematics best when I ask the teacher for help in lessons

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13.251[a]	8	0.104
Likelihood Ratio	16.713	8	0.033
Linear-by-Linear Association	0.448	1	0.503
N of Valid Cases	570		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.68.			

Table 4.72 shows the statistical analysis of participants by subject and the statement, “I learn Mathematics best when I ask the teacher for help in lessons”, and shows the chi square value of 13.251, the significance of 0.104 ($p > 0.05$), and 8 as the degree

of freedom. Therefore, there is no relationship between participants' subject and their feeling that they learn Mathematics best when they ask their teachers for help in lessons.

4.4.20 I learn Mathematics best when I read through worked examples in textbooks and then do exercises

Table 4.73: I learn Mathematics best when I read through worked examples in textbooks and then do exercises.

		I learn Mathematics best when I read through worked examples in textbooks and then do exercises					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	**Count**	58	66	25	14	12	175
	% within Subject	33.1%	37.7%	14.3%	8.0%	6.9%	100.0%
	% of Total	10.2%	11.7%	4.4%	2.5%	2.1%	30.9%
Grade 10 Maths	**Count**	77	71	22	9	5	184
	% within Subject	41.8%	38.6%	12.0%	4.9%	2.7%	100.0%
	% of Total	13.6%	12.5%	3.9%	1.6%	0.9%	32.5%
Grade 10 Maths Literacy	**Count**	84	70	24	14	15	207
	% within Subject	40.6%	33.8%	11.6%	6.8%	7.2%	100.0%
	% of Total	14.8%	12.4%	4.2%	2.5%	2.7%	36.6%
Total	**Count**	219	207	71	37	32	566
	% within Subject	38.7%	36.6%	12.5%	6.5%	5.7%	100.0%
	% of Total	38.7%	36.6%	12.5%	6.5%	5.7%	100.0%

Table 4.73 shows that 70.8% of participants in Grade 9 doing Mathematics agreed that they learned Mathematics best when they read through worked examples in textbooks and then did exercises while 14.9% demonstrated that this did not work for them. 12.3% of this Grade 9 group were not sure if they learned Mathematics best when they read through worked examples in textbooks and then did exercises.

Of Mathematics learners who were in Grade 10, 80.4% of them agreed that they learned Mathematics best when they read through worked examples in textbooks and then did exercises while 12% in this group were not sure. In this group, 7.6% did not agree that they learned Mathematics best when they read through worked examples in textbooks and then did exercises.

In the group of learners who were doing mathematical literacy, 74.4% said that they learned Mathematics best when they read through worked examples in textbooks and then did exercises with 14% indicating that they did not. In the Grade 10 Mathematical Literacy group 11.6% were not sure if they learned Mathematics best when they read through worked examples in textbooks and then did exercises.

Therefore, of the sample in this study, 53.4% agreed that they learned Mathematics best when they read through worked examples in textbooks and then did exercises, while 22.8% did not. 24% of this group were not sure either way.

Table 4.74: Chi-Square Tests: I learn Mathematics best when I read through worked examples in textbooks and then do exercises

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.911[a]	8	0.350
Likelihood Ratio	9.563	8	0.297
Linear-by-Linear Association	0.759	1	0.384
N of Valid Cases	566		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 9.89.			

Table 4.74 shows the statistical analysis of participants by subject and the statement, “I learn Mathematics best when I read through worked examples in textbooks and then do exercises”, and shows the chi square value of 8.911, the significance of 0.350 (p >

0.05), and 8 as the degree of freedom. Therefore, there is no relationship between participants' subject and their perception that they learned Mathematics best when they read through worked examples in textbooks and then did exercises.

4.4.21 I learn Mathematics best when I explain things to other learners in class

Table 4.75: I learn Mathematics best when I explain things to other learners in class.

		I learn Mathematics best when I explain things to other learners in class.					Total
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
Grade 9 Maths	**Count**	40	62	35	17	23	177
	% within Subject	22.6%	35.0%	19.8%	9.6%	13.0%	100.0%
	% of Total	7.0%	10.9%	6.2%	3.0%	4.0%	31.1%
Grade 10 Maths	**Count**	63	54	32	23	11	183
	% within Subject	34.4%	29.5%	17.5%	12.6%	6.0%	100.0%
	% of Total	11.1%	9.5%	5.6%	4.0%	1.9%	32.2%
Grade 10 Maths Literacy	**Count**	55	65	38	27	24	209
	% within Subject	26.3%	31.1%	18.2%	12.9%	11.5%	100.0%
	% of Total	9.7%	11.4%	6.7%	4.7%	4.2%	36.7%
Total	**Count**	158	181	105	67	58	569
	% within Subject	27.8%	31.8%	18.5%	11.8%	10.2%	100.0%
	% of Total	27.8%	31.8%	18.5%	11.8%	10.2%	100.0%

Table 4.75 shows that 57.6% of participants in Grade 9 doing agreed that they learned Mathematics best when they explained things to other learners in class, while 22.6% said that they did not learn much. 19.5% of this Grade 9 group were not sure if they learned Mathematics best when they explained things to other learners in class.

Of the Mathematics learners who are in Grade 10, 63.9% of them agreed that they learned Mathematics best when they explained things to other learners in class, while 17.5% in this group were not sure. In this group 18.6% indicated that they did not learn Mathematics best when they explained things to other learners in class.

In the group of learners who were doing Mathematics Literacy, 57.4% demonstrated that they learned Mathematics best when they explained things to other learners in class with 24.4% indicating that they did not learn much. In the Grade 10 mathematical literacy group, 18.2% were not sure if they learned Mathematics best when they explained things to other learners in class.

Therefore, in this sample 58.9% agreed that they learned Mathematics best when they explained things to other learners in class, while 22% did not and 18.5% of this group were not sure.

Table 4.76: Chi-Square Tests: I learn Mathematics best when I explain things to other learners in class

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.848[a]	8	0.158
Likelihood Ratio	12.209	8	0.142
Linear-by-Linear Association	0.018	1	0.895
N of Valid Cases	569		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 18.04.			

Table 4.76 shows the statistical analysis of participants by subject and the statement, "I learn Mathematics best when I explain things to other learners in class", shows the Chi-Square value of 11.848, the significance of 0.158 ($p > 0.05$), and 8 as the degree

of freedom. Therefore, there is no relationship between participants' subject and their feeling that they learned Mathematics best when they explained things to other learners in class.

This section has demonstrated that the answers provided by the participants for some statements were related to the subjects that they were doing. A majority of statements had a strong relationship with the subject, some had a weak relationship, with a few clearly having no relationship at all.

4.5 SUMMARY

This chapter presented a descriptive data analysis with the main focus on the responses that participants presented for each question and how each of these questions related to the subject's grade. The data shows that most of the participants' responses to the statements were related to their grade or subjects. The next chapter further analyses the data by focusing on the factor analysis and how it relates to the biographical data.

CHAPTER 5

DATA PRESENTATION FROM FACTOR ANALYSIS

5.1 INTRODUCTION

The previous chapter presented part of the data analysis for this study, focusing on the descriptive data and the relationship between the participants' responses and their subjects. This chapter continues the presentation of data generated through the questionnaire administered to the learners in Lejweleputswa District secondary schools. In this chapter the focus is mainly on the factor analysis and its relationship with the different participants' biographical information.

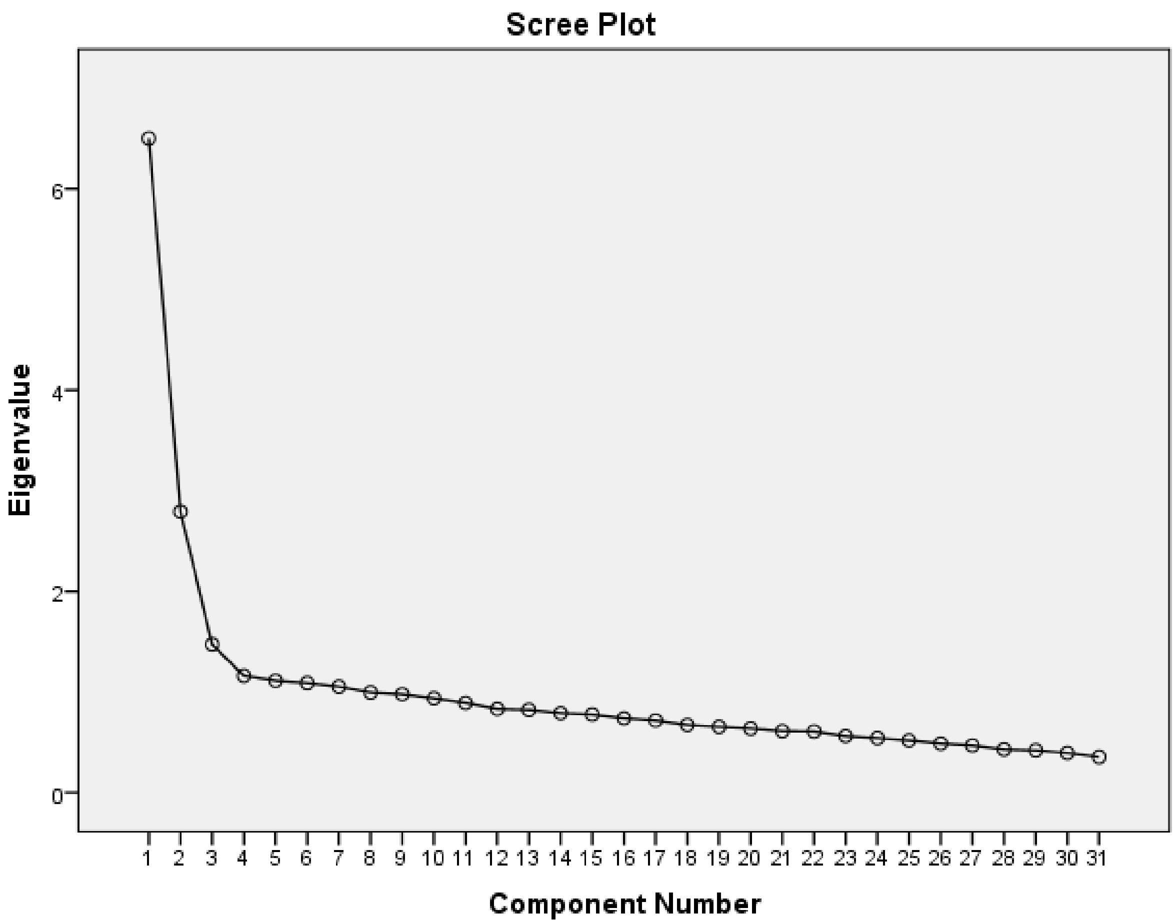
5.2 FACTOR ANALYSIS INTRODUCED

Delport and Roestenburg (2011) present factor analysis as a process of determining the underlying factors based on the items in the questionnaire. Again, factor analysis allows the researcher to determine if any variables can be described by a few factors (Fraenkel & Wallen, 2010). Therefore, factor analysis helps the researcher to place the many variables into a manageable group. In this study, factor analysis was used to reduce and group the statements in specific factors. Researchers have to make a decision on the number of factors to keep (Hayton, Allen & Scarpello, 2004). The first step then for a researcher after running factor analysis is to make a decision about the number of factors to consider.

5.3 SCREE PLOT

Courtney (2013) indicates that the scree test helps the researcher to identify the correct number of factors to adopt. I group related statements to form a factor and check its reliability. Yong and Pearce (2013) indicate that the scree test is highly reliable when there are more than 200 participants. In this sample there were more than 500 participants. Figure 5.1 shows the first 4 factors on a steep line of the graph which then drastically changed the gradient after the fourth factor.

Figure 5.1: Scree Plot of Eigenvalues



5.4 FACTOR PRESENTATION

This section presents the factors and their Cronbach's alpha coefficients. George and Mallery (2011) presents Cronbach's alpha reliability coefficient as a number between 0 and 1. This number (the Cronbach's alpha coefficient) presents the test of reliability between different statements which have been grouped together to form the questionnaire used (Bindak, 2013). Tavakol and Dennick (2011) indicate that a high Cronbach's alpha value indicates that the items are highly related to each other or they are testing a related theme. Furthermore, McMillan and Schumacher (2010) indicate that the agreement of answers to questions is determined through Cronbach's alpha. Hence Cronbach's alpha should be calculated for every factor produced during the factor analysis (McMillan & Schumacher, 2010; Tavakol & Dennick, 2011) in order to determine the reliability of items in each factor.

Most researchers who use the quantitative method use Cronbach's alpha to test for reliability (Bindak, 2013). The Cronbach's alpha coefficient demonstrates the consistency between items. As mentioned, the value of Cronbach's alpha reliability coefficient has normally been found to range between 0 and 1 (George & Mallery, 2011). Any value greater than 0.9 has been described as demonstrating excellent reliability (George & Mallery, 2011). Furthermore, any coefficient less than 0.9 but greater than 0.7 demonstrates good reliability. A Cronbach's alpha coefficient which is less than 0.7 but greater than 0.6 shows acceptable reliability between the statements or questions. Any Cronbach's alpha coefficient less than 0.6 but greater than 0.5 presents low reliability between items.

In this study the factors generated are presented with their Cronbach's alpha coefficient. The factors are also given names based on their loadings which means the statement with the highest value has more impact on the factor in general (Baah, Johnson & Twenefour, 2015).

5.4.1 Factor 1: Mathematics' relevance and personal feeling towards it

This factor has been constructed from the statements which focused on the learners' view of Mathematics as being important in life, being enjoyable and being needed in everyday life. There are seven statements from the questionnaire that were found under this factor. This factor is named "Mathematics relevance and personal feeling towards it".

- Mathematics is important in life.
- My Mathematics teacher was very helpful in Grade 8 and 9.
- It is possible to improve in Mathematics by working hard.
- Do you think Mathematical knowledge is needed in everyday life?
- Calculators are essential to learn Mathematics.
- Learning Mathematics is enjoyable.
- Learning Mathematics is boring.

The statistical analysis of the reliability of these seven statements produced the Cronbach's alpha coefficient as 0.748. This is one of the factors that has been chosen and will be used in the next analysis as it was the first and was within the top six factors presented by the scree test.

Table 5.1: Reliability statistics for Factor 1

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.748	0.763	7

5.4.2 Factor 2: Perceived personal understanding in Mathematics

This factor checked the learners' personal evaluation of the understanding of Mathematics and how they generally feel about it. The statements that were grouped in this factor are:

- I did not like Mathematics in Grade 8 and 9.
- I did not understand my Mathematics teacher in class.
- I was not good in Mathematics.
- It takes me longer to understand Mathematics than the average person.

The statistical analysis of the reliability of these statements grouped to form Factor 2 (Perceived personal understanding in Mathematics) produced the Cronbach's alpha coefficient as 0.720. This is the second factor that was chosen and will be used in the following data analysis discussions as it was within the top six factors that were presented by the scree test.

Table 5.2: Reliability Statistics for Factor 2

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.720	0.722	4

5.4.3 Factor 3: Enjoyment of dealing with Mathematics

One of the factors focused on the learner's enjoyment of working on different Mathematics activities in class. These statements included:

- I did not like Mathematics in Grade 8 and 9.
- I did not understand my Mathematics teacher in class.
- I was not good in Mathematics.
- It takes me longer to understand Mathematics than the average person.
- I do not have a mathematical mind.
- The career I like does not require Mathematics as a subject.

The statistical analysis of the reliability of these statements grouped to form Factor 3 (Enjoyment of dealing with Mathematics) produced the Cronbach's alpha coefficient as 0.626. This is the third factor chosen and will be used in the following data analysis discussions as it was within the top six factors that were presented by the scree test.

Table 5.3: Reliability statistics for Factor 3

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.626	0.628	6

5.4.4 Factor 4: Personal engagement in Mathematics

This factor has been constructed from the statements which focused on the learners' perceived personal engagement in Mathematics lessons and the statements that were grouped here included:

- I do my Mathematics homework with my friends in the class.
- I learn Mathematics best when I explain things to other learners in class.
- I learn Mathematics best when I ask the teacher for help in lessons.
- I learn Mathematics best when I read through worked examples in textbooks and then do exercises

The statistical analysis of the reliability of these statements grouped to form Factor 4 (Personal engagement in Mathematics) produced the Cronbach's alpha coefficient as 0.646. This is therefore the fourth factor chosen and will be used in the following data analysis discussions as it was within the top six factors that were presented by the scree test.

Table 5.4: Reliability statistics for Factor 4

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.646	0.651	4

5.4.5 Factor 5: Mathematics and personal career

This factor has been made of the statements which focused on the learner's careers and their relation to Mathematics. These statements included:

- I find mathematical problems interesting and challenging.
- I want to study Mathematics in Grade 10 so as to study Science, Health and Engineering fields in future.
- I enjoy trying to solve new mathematical problems.
- I like studying Mathematics at school.
- I have less trouble learning Mathematics than other subjects.

The statistical analysis of the reliability of these statements grouped to form Factor 5 (Mathematics and personal career) produced the Cronbach's alpha coefficient as

0.690. This is the fifth factor chosen and will be used in the following data analysis discussions as it was within the top six factors that were presented by the scree test.

Table 5.5: Reliability statistics for Factor 5

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.690	0.694	5

5.4.6 Factor 6: Personal ability

This factor has been named ‘personal ability’ as the statements and questions in this factor focused on learner’s personal evaluation of their ability. They included the following:

- When you were unable to solve a mathematical problem, did you think back over why you were unable to solve it?
- If I make mistakes, I work until I have corrected them.
- When a problem is difficult, do you try it again until you get an answer?

The statistical analysis of the reliability of these statements grouped to form Factor 6 (Personal ability) and produced the Cronbach’s alpha coefficient as 0.693. This is the sixth factor that was chosen and will be used in the following data analysis discussions as it was within the top six factors that were presented by the scree test.

Table 5.6: Reliability statistics for Factor 6

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.693	0.690	3

5.4.7 Summary

This section presented the different factors that were generated from factor analysis. Only six factors were established and developed by grouping related statements together. Therefore in this study the following section provides the statistical analysis of these six factors as presented above and compares them with the participants' age, gender and the subject they are doing.

5.5 AGE AND FACTORS

This section presents the relationship between the six factors and the participants' ages. When making conclusions it is necessary to determine if the views presented are based on certain personal biographic information.

The analysis of factors and age are presented in Table 5.8. The learners' view of Mathematics' relevance in their lives and their personal feelings towards the subject compared to their age presents a Pearson Chi-Square of 489.072 with the degree of freedom being 552 and the significance at 0.974 ($p > 0.05$). The participants' ages, therefore, had no impact on the learners' view of the relevance of Mathematics in their lives and their personal feelings towards the subject. The learners' ages therefore do not influence their choice of Mathematics or Mathematical Literacy in Grade 10.

The learners' perceived personal understanding of Mathematics compared to their age presents a Pearson Chi-Square of 308.70 with the degree of freedom being 288 and the significance $p = 0.192$, which is greater than 0.05 (Table 5.8). Therefore the participants' age had no impact on the learners' perceived role of personal understanding of Mathematics regarding their choice of Mathematics or Mathematical Literacy in Grade 10.

The learners' perceived enjoyment of dealing with Mathematics and their age presents a Pearson Chi-Square of 164.768 (Table 5.7) with the degree of freedom being 176 and the significance at 0.718 ($p > 0.05$). The participants' age, therefore, had no impact on the learners' view of enjoyment of dealing with Mathematical problems and hence their views on the choice of Mathematics or Mathematics Literacy in Grade 10 are independent of their age.

The learners' view of their personal engagement in Mathematics and their age presents a Pearson Chi-Square of 161.281 (Table 5.7) with the degree of freedom being 176 and the significance at 0.780 ($p > 0.05$). There is, therefore, no statistical relationship between the learners' ages and their personal engagement in Mathematics. The learners' ages are observed to have no influence on their view of the impact of personal engagement in the choice of Mathematics or Mathematical Literacy in Grade 10.

The statistical analysis of the learners' Mathematics relation to their desired career and their age presents a Pearson Chi-Square of 152.215 (Table 5.8) with the degree of freedom being 120 and the significance at 0.025 ($p < 0.05$). The choice of Mathematics or Mathematical Literacy in Grade 10 is therefore based on the Mathematics requirement in the desired career of the learners and their age had a statistical relationship.

The learners choice of Mathematics or Mathematical Literacy in Grade 10 based on their view of their personal ability in the subject and their age presents a Pearson Chi-Square of 58.015 (Table 5.8) with the degree of freedom being 64 and the significance at 0.687 ($p > 0.05$). Therefore the choice of Mathematics or Mathematical Literacy in Grade 10 is based on learners' perceived personal ability and their age does not have any statistical relationship.

Table 5.7: Age and factors

		Pearson Chi-Square			Likelihood Ratio			Linear-by-Linear Association			
Age	**N of Valid Cases**	**Value**	**Df**	**Asymp. Sig. (2-sided)**	**Value**	**Df**	**Asymp. Sig. (2-sided)**	**Value**	**df**	**Asymp. Sig. (2-sided)**	**Comment**
Mathematics relevance and personal feeling towards it	568	489.077[a]	552	0.974	404.847	552	1.000	0.875	1	0.350	a. 598 cells (94.9%) have expected count less than 5. The minimum expected count is .00.
Personal understanding of Mathematics	569	308.701[a]	288	0.192	257.055	288	0.905	10.739	1	0.001	a. 291 cells (87.4%) have expected count less than 5. The minimum expected count is .00.
Enjoyment of dealing with Mathematics	569	164.768[a]	176	0.718	150.244	176	0.921	0.006	1	0.938	a. 170 cells (82.1%) have expected count less than 5. The minimum expected count is .00.
Personal engagement in Mathematics	563	161.281[a]	176	0.780	154.602	176	0.876	0.470	1	0.493	a. 165 cells (79.7%) have expected count less than 5. The minimum expected count is .00.
Mathematics and personal career	569	152.215[a]	120	0.025	125.004	120	0.359	0.012	1	0.912	a. 110 cells (76.4%) have expected count less than 5. The minimum expected count is .00.
Personal ability	569	58.015[a]	64	0.687	57.934	64	0.690	3.173	1	0.075	a. 50 cells (61.7%) have expected count less than 5. The minimum expected count is .01.

5.6 GENDER AND FACTORS

The learners' view of Mathematics' relevance in their lives and their personal feelings towards the subject compared to the participants gender presents a Pearson Chi-Square of 71.926 (Table 5.8) with the degree of freedom being 69 and the significance at 0.381 ($p > 0.05$). Hence learners' perceived Mathematics relevance in their lives and their personal feelings towards the subject as a factor contributing towards the learners' choices of Mathematics or Mathematical Literacy in Grade 10 is not related to their gender.

The learners' personal understanding of Mathematics compared to their gender presents a Pearson Chi-Square of 42.981 (Table 5.8) with the degree of freedom being 36 and the significance at 0.197 ($p > 0.05$). Hence learners perceived personal understanding of Mathematics as a factor contributing towards the learners' choices of Mathematics or Mathematical Literacy in Grade 10 is not related to their gender.

The learners' perceived enjoyment of dealing with Mathematics and the participants' gender present a Pearson Chi-Square of 23.501 (Table 5.8) with the degree of freedom being 22 and the significance at 0.374 ($p > 0.05$). Hence learners' perceived enjoyment of dealing with Mathematics as a factor contributing towards the learners' choices of Mathematics or Mathematical Literacy in Grade 10 is not related to their gender.

The learners' view of their personal engagement in Mathematics and their gender present a Pearson Chi-Square of 19.620 (Table 5.8) with the degree of freedom being 22 and the significance at 0.607 ($p > 0.05$). Hence learners' perceived personal engagement in Mathematics as a factor contributing towards the learners' choices of Mathematics or Mathematical Literacy in Grade 10 is not related to their gender.

The statistical analysis of the learners' Mathematics requirement in the desired career and their gender present a Pearson Chi-Square of 28.740 (Table 5.8) with the degree of freedom being 15 and the significance at 0.017 ($p < 0.05$). Hence learners' views of Mathematics being a requirement in their desired career as a factor contributing towards their choice of Mathematics or Mathematical Literacy in Grade 10 are related to their gender.

The learners' choice of Mathematics or Mathematical Literacy in Grade 10 based on their view of their personal ability in the subject and their gender present a Pearson Chi-Square of 14.179 (Table 5.8) with the degree of freedom being 64 and the significance at 0.077 ($p > 0.05$). Hence learners' perceived personal ability in Mathematics as a factor contributing towards their choice of Mathematics or Mathematical Literacy in Grade 10 is not related to their gender.

Table 5.8: Gender and factors

		Pearson Chi-Square			Likelihood Ratio			Linear-by-Linear Association			
Gender	**N of Valid Cases**	**Value**	**Df**	**Asymp. Sig. (2-sided)**	**Value**	**df**	**Asymp. Sig. (2-sided)**	**Value**	**df**	**Asymp. Sig. (2-sided)**	**Comment**
Mathematics relevance and personal feeling towards it	567	71.926[a]	69	0.381	89.437	69	0.050	0.022	1	0.882	a. 110 cells (78.6%) have expected count less than 5. The minimum expected count is .46.
Personal understanding of Mathematics	568	42.981[a]	36	0.197	49.530	36	0.066	9.398	1	0.002	a. 44 cells (59.5%) have expected count less than 5. The minimum expected count is .46.
Enjoyment of dealing with Mathematics	568	23.501[a]	22	0.374	24.278	22	0.333	0.017	1	0.896	a. 21 cells (45.7%) have expected count less than 5. The minimum expected count is .46.
Personal engagement in Mathematics	561	19.620[a]	22	0.607	20.888	22	0.528	0.624	1	0.430	a. 23 cells (50.0%) have expected count less than 5. The minimum expected count is .47.
Mathematics and personal career	568	28.740[a]	15	0.017	29.622	15	0.013	0.313	1	0.576	a. 15 cells (46.9%) have expected count less than 5. The minimum expected count is .93.
Personal ability	566	14.179[a]	8	0.077	14.322	8	0.074	0.531	1	0.466	a. 2 cells (11.1%) have expected count less than 5. The minimum expected count is 4.18.

5.7 SUBJECT DONE AND FACTORS

The learners' view of Mathematics' relevance in their lives and their personal feelings towards the subject compared to the subject done by the participants presents a Pearson Chi-Square of 173.636 (Table 5.9) with the degree of freedom being 140 and the significance at 0.028 ($p < 0.05$). Hence learners' perception of Mathematics' relevance in their lives, and their personal feelings towards the subject, as factors contributing towards the learners' choice of Mathematics or Mathematical Literacy in Grade 10 are related to the subject done by the participants.

The learners' personal understanding of Mathematics compared to the subject done by the participants presents a Pearson Chi-Square of 89.779 (Table 5.9) with the degree of freedom being 72 and the significance at 0.076 ($p > 0.05$). Hence the learners' perceived personal understanding of Mathematics as a factor contributing towards the learners' choice of either Mathematics or Mathematical Literacy in Grade 10 is not related to the subject done by the participants.

The learners perceived enjoyment of dealing with Mathematics and the subject done by the participants presents a Pearson Chi-square of 49.689 (Table 5.9) with the degree of freedom being 44 and the significance at 0.257 ($p > 0.05$). Hence the learners' perceived enjoyment of dealing with Mathematics as a factor contributing towards the learners' choices of Mathematics or Mathematical Literacy in Grade 10 is not related to the subject done by the participants.

The learners' view of their personal engagement in Mathematics, and the subject done by the participants, presents a Pearson Chi-Square of 50.508 (Table 5.9) with the degree of freedom being 44 and the significance at 0.232 ($p > 0.05$). Hence the learners' perceived personal engagement with Mathematics as a factor contributing towards their choice of either Mathematics or Mathematical Literacy in Grade 10 is not related to the subject done by participants.

The statistical analysis of the learners' Mathematics requirement in the desired career and the subject done by the participants presents a Pearson Chi-Square of 69.444 (Table 5.9) with the degree of freedom being 30 and the significance at 0.000 ($p < 0.05$). Hence the learners' view of Mathematics being a requirement in the desired career as a factor contributing towards their choice of Mathematics or Mathematical Literacy in Grade 10 is related to the subject done by the participants.

The learners' choice of Mathematics or Mathematical Literacy in Grade 10 based on their view of their personal ability in the subject and the subject done by the participants present a Pearson Chi-Square of 27.994 (Table 5.9) with the degree of freedom being 16 and the significance at 0.032 ($p < 0.05$). Hence learners' perceived personal ability in Mathematics as a factor contributing towards their choice of Mathematics or Mathematical Literacy in Grade 10 is related to the subject done by the participants.

Table 5.9: Subject done and the factors

		Pearson Chi-Square			Likelihood Ratio			Linear-by-Linear Association			
Subject	**N of Valid Cases**	**Value**	**df**	**Asymp. Sig. (2-sided)**	**Value**	**df**	**Asymp. Sig. (2-sided)**	**Value**	**df**	**Asymp. Sig. (2-sided)**	**Comment**
Mathematics' relevance and personal feeling towards it	581	173.636[a]	140	0.028	193.392	140	0.002	2.156	1	0.142	a. 179 cells (84.0%) have expected count less than 5. The minimum expected count is .31.
Personal understanding of Mathematics	582	89.779[a]	72	0.076	98.620	72	0.020	0.516	1	0.473	a. 69 cells (62.2%) have expected count less than 5. The minimum expected count is .31.
Enjoyment of dealing with Mathematics	582	49.698[a]	44	0.257	56.575	44	0.097	0.028	1	0.867	a. 39 cells (56.5%) have expected count less than 5. The minimum expected count is .31.
Personal engagement in Mathematics	575	50.508[a]	44	0.232	57.260	44	0.087	0.966	1	0.326	a. 36 cells (52.2%) have expected count less than 5. The minimum expected count is .31.
Maths and personal career	582	69.444[a]	30	0.000	73.817	30	0.000	1.598	1	0.206	a. 24 cells (50.0%) have expected count less than 5. The minimum expected count is .62.
Personal ability	580	27.994[a]	16	0.032	31.318	16	0.012	1.248	1	0.264	a. 5 cells (18.5%) have expected count less than 5. The minimum expected count is 2.78.

5.8 SUMMARY

This chapter has presented the data analysis that determines the factors contributing towards the learners' choice of Mathematics or Mathematical Literacy. There are six factors which have been found to prevail in this data; they were further analysed as to whether they were related to the biographical data of the participants or not. Some of these factors demonstrated a statistical relationship with a few of the factors. The next chapter will focus on the discussions required in order to provide answers for the set research questions, and draw conclusions which will demonstrate actions needed (Recommendations).

CHAPTER 6

DISCUSSION, CONCLUSION AND RECOMMENDATION

6.1 INTRODUCTION

The previous two chapters presented the data analysis for this study, based on the statistical analysis of the participants' responses from the questionnaire used. This chapter is intended to deal with the general discussion which will focus on answering the specific research questions that were presented in Chapter 1. This chapter therefore continues to draw conclusions based on these results and furthermore puts forward the recommendations which will follow.

6.2 DEALING WITH THE RESEARCH AIM AND OBJECTIVE

To be able to start the discussion and draw appropriate conclusions it is necessary to look at the aims and objectives of the research. This study aimed at investigating learners' attitudes towards Mathematics and how these attitudes relate to their choices of mathematical subjects, either Mathematics or Mathematical Literacy in Grade10. Furthermore the aim was broken down into the following objectives. The study intended to:

- Investigate Grade 9 and 10 learners' attitudes towards Mathematics.
- Determine how these attitudes relate to their choices of mathematical subjects in Grade 10.
- Investigate the strategies that could be utilised to improve learners' attitudes towards Mathematics and hence increase enrolments in Grade 10.

- Provide recommendations to the Department of Basic Education on the intervention strategies or activities that could be put into place to improve learners' attitudes towards Mathematics.

The following sections are intended to fulfil the objectives presented above, provide conclusions, and put forward the recommendations based on the findings of this study.

6.3 THE HIGH SCHOOL LEARNERS' ATTITUDES TOWARDS MATHEMATICS

The different statements and questions presented in the questionnaire were designed in order to establish the learners' attitudes towards Mathematics. This was done by establishing a ranking order utilising the participants' choice of 'agree' and 'strongly agree'.

Table 6.1: Rank order to demonstrate learners' attitude towards Mathematics

1.	Mathematics is important in life.	85,5
2.	It is possible to improve in Mathematics by working hard.	79,7
3.	I try to answer the Mathematics questions the teacher asks.	78,6
4.	I learn Mathematics best when I ask the teacher for help in lessons.	77,6
5.	Do you think Mathematical knowledge is needed in everyday life?	77,1
6.	If I make mistakes, I work until I have corrected them.	76,5
7.	When a Mathematics problem is difficult, do you try it again until you get an answer?	75,5
8.	I learn Mathematics best when I read through worked examples in textbooks and then do exercises.	75,3
9.	Learning Mathematics is enjoyable.	73,5
10.	My Mathematics teacher was very helpful in Grade 8 and 9.	72,5
11.	I like studying Mathematics at school.	71,7
12.	I enjoy trying to solve new mathematical problems.	71,5

Based on the results, Table 6.1 shows that the majority (85.5%) of the participants agree that Mathematics is important in life. The studies by Tezer and Karasel (2010) and also by Yilmaz *et al*. (2010) showed that most learners have a positive attitude towards Mathematics if its importance in life is demonstrated. This is followed by the statement indicating that it is possible for an individual to improve their performance in Mathematics by working hard (79.7%). About 78.6% agreed that they try to answer questions asked by the teacher during the Mathematics class. The next statement, yielding 77.6%, was about the learners' view as to whether Mathematics is best learned by asking the teacher for help in lessons. Based on the choices made by the participants, it can be seen that, despite some of them not doing Mathematics, they still consider Mathematics essential and recognise specific factors as important in their effective learning of Mathematics.

Table 6.2: Least chosen statements

1.	Learning Mathematics is boring.	15,7
2.	The career I like does not require Mathematics as a subject.	18,1
3.	I did not like Mathematics in Grade 8 and 9.	22,8
4.	I do not have a mathematical mind.	22,8
5.	I find Mathematics frightening.	28,6
6.	I did not understand my Mathematics teacher in class.	29,5
7.	I like it when someone in class explains Mathematics to me, and not the teacher.	32,0
8.	I was not good at Mathematics.	35,4
9.	I find Mathematics confusing.	36,7
10.	Ability in Mathematics is something that you either have or you have not.	37,7
11.	I have less trouble learning Mathematics than other subjects.	41,7
12.	It takes me longer to understand Mathematics than the average person.	44,5

Only 15.7% of the participants stated that Mathematics is boring and this is why some of them opted not to do Mathematics in Grade 10 (see Table 6.2). Furthermore, 18.1% of the participants demonstrated that their decision not to do Mathematics in Grade 10 was not based on the perceived requirement of Mathematics in the careers of their choice. Very few participants (22.8%) actually did not like Mathematics in Grades 8 and 9, and felt that they did not have the necessary mental ability to deal with Mathematics (see Table 6.2).

Therefore the learners in these groups had a positive attitude towards Mathematics, even though more than half were doing Mathematical Literacy. This demonstrates that both learners doing Mathematics and those not doing Mathematics still valued Mathematics and even enjoyed it.

6.4 LEARNERS' ATTITUDES INFLUENCING THEIR CHOICE OF MATHEMATICS OR MATHEMATICAL LITERACY IN GRADE 10

The factors below are seen to be expanding on the three components presented which are Cognitive, Affective and Behavioural. The study has been able to expand the three into six which are related to the three that were provided.

6.4.1 Mathematics' relevance and personal feeling towards it.

The participants demonstrated the strongest attitude based on the relevance of Mathematics and their personal feeling towards Mathematics. They demonstrated this in a factor which had statements like "Mathematics is important in life" which has also been noted to have the highest number of participants both agreeing and also strongly agreeing with it. Köğce et al, (2009) have demonstrated that all learners start schooling with a positive attitude towards Mathematics but their school experience tends to impact on this over time, as has been demonstrated in chapter 1 Table 1.1. Similarly most learners could not motivate or provide concrete reasons for their indication that Mathematics is useful in life (Kloosterman & Clougan, 1994). Therefore the learners' perception of the relevance of Mathematics, and their personal feeling, impact on their choice of Mathematics.

6.4.2 Perceived personal understanding in Mathematics

The learners' perceived personal understanding has been noted to play an important role in the choice of Mathematics. This finding is in line with the findings from Tahar, *et al*. (2010) who also found that learners who did not do well academically in Mathematics lacked the desire to continue, and hence this impacts on their choice of subjects to take.

6.4.3 Enjoyment of dealing with Mathematics

Learners' enjoyment of working with different Mathematics activities in class has been noted as another factor that contributes to their attitudes towards Mathematics and hence also results in their choice of Mathematics when given the opportunity. Enjoying Mathematics was also presented by Tahar *et al*. (2010) as one of the factors impacting on learners' attitude towards Mathematics.

6.4.4 Personal engagement in Mathematics

This factor relates to learners' personal evaluation with regard to engagement with different problems and activities in Mathematics. This demonstrates that those learners who were struggling during Mathematics classes would not choose Mathematics when given the chance.

6.4.5 Mathematics and personal career

This study found that a learner's choice of Mathematics is influenced by their view of the requirement of this subject for their careers of choice. Similarly, Rice *et al*. (2013) have noted the view learners have on the impact of Mathematics on their career choice. Therefore, learners' attitudes towards Mathematics result from the perceived requirement of Mathematics for their chosen subjects.

6.4.6 Personal ability

This factor shows that learners' perceived personal abilities impact on their attitude towards Mathematics. Similarly, learners' personal ability is the recognition of a relationship between their perceived potential and the achievement of a specific academic level. Mohd *et al.* (2011) have showed that there is a relationship between learners' attitudes towards Mathematics and the academic achievements of students. Learners who perform well are observed to have a positive attitude towards Mathematics. Even though Reddy *et al*. (2012) noted that in their study there was no relationship between a learners ability to make a decision to continue with the subject and a positive attitude, in this study it has been found as a factor impacting on the learners' choice of Mathematics.

Personal ability, therefore, is also observed to contribute to the development of attitudes towards Mathematics, which results in learners opting not to take Mathematics in Grade 10.

6.4.7 Summary

This section has demonstrated that these six observed factors generated from factor analysis relate to findings from other researchers. Some were, however, more specific as they brought a more detailed breakdown of some factors previously found. Therefore, in this study, the following section provides the statistical analysis of these six factors as presented above and compares them with a participants' gender, age and subject chosen.

6.5 THE FACTORS RELATING TO GENDER, AGE AND SUBJECT DONE BY THE LEARNERS

The factors 'Mathematics relevance and personal feeling towards it' and 'personal ability' have been noted to relate to the subject that the students are doing. This demonstrates that the group of participants doing Mathematics and the group of participants doing Mathematical Literacy in Grade 10 had different views on the relevance of Mathematics and their personal ability. This then shows that the choice of Mathematics or Mathematical Literacy is due to their view of personal ability and also due to their view of the relevance of the subject.

Mathematics and personal career have been noted to have a relationship with gender, age and subject chosen by learners. Even though the studies by Mohd *et al.*(2011) and Köğce *et al*.(2009) have found that there were differences between the attitudes of male and female learners towards Mathematics, the results from this study demonstrate that there is relationship. They further demonstrate that in secondary schools sex-role stereotypes have a great impact on girls and hence they were observed to not participate actively in Mathematics classes.

The subject chosen by the participants has been found to relate to three factors which are Mathematics' relevance and personal feeling towards it, Mathematics and personal career (perceived usefulness of Mathematics), and participants' perceived personal ability. This means that learners who are doing Mathematics viewed Mathematics' relevance differently from those doing Mathematical Literacy. Similarly those doing Mathematical Literacy also had a different feeling towards Mathematics. The two groups of learners (Mathematics and Mathematical Literacy) viewed the requirement of Mathematics in their careers differently which accounts for the reason why one group opted not to do Mathematics. Lastly there was a positive linear relationship observed between perceived personal abilities and choice of subjects; those doing Mathematics were clear that they had decided on it because they perceived that they had the potential to do it.

Similarly, three factors were observed to have no relationship with the participants' age, gender and the subjects they are doing. These factors are:

- Enjoyment of dealing with Mathematics;
- Personal understanding of Mathematics; and,
- Personal engagement in Mathematics.

Table 6.3: Factors relationship, with gender, age and subject done by participants

	Age	Gender	Subject	
Mathematics' relevance and personal feeling towards it	X	X	√	1/2
Personal understanding of Mathematics (personal confidence)	X	X	X	0/3
Enjoyment of dealing with Mathematics	X	X	X	0/3
Personal engagement in Mathematics	X	X	X	0/3
Maths and personal career (perceived usefulness of Mathematics)	√	√	√	3/0
Personal ability	X	X	√	1/2
	1/5	1/5	3/3	

These demonstrate that participants' enjoyment of dealing with Mathematics problems is not based on or related to their age, gender and the subjects they are doing. This is a factor that relates to the learners' choice but those doing Mathematical Literacy and those doing Mathematics all had the same feeling when engaging with Mathematics problems. The learners' attitudes towards Mathematics has been observed to be the same among male and females (Mohd *et al*., 2011; Köğce *et al*., 2009; Mohamed & Waheed, 2011) as observed here. This study has also been able to add a factor which has been observed to vary between male and female learners which is their view of Mathematics and personal career choice.

6.6 CONCLUSION

Based on the data presented in this study, the following conclusions have been made:

- Learners' attitudes which relate to the relevance of Mathematics influence their choices between Mathematics or Mathematical Literacy in Grade 10. This has been noted to vary based on which subject the learners are doing. Those doing Mathematics viewed this factor differently from those doing Mathematical Literacy.
- Learners have been observed to choose between Mathematics or Mathematical Literacy in Grade 10 based on their perceived understanding of Mathematic concepts. So more of those learners who believed that they understood Mathematics concepts would have opted for Mathematics in Grade 10 than those who lacked confidence in the subject.
- Learners who were not able to improve their engagement with Mathematics problems were observed to be unlikely to choose Mathematics and rather choose Mathematical Literacy
- Teachers' levels of Mathematics knowledge and the teaching methodology does over time affect the learners' attitude towards the subject. The manner in which the subject is presented to the learner is important as this affects to which attitude will develop in the learner.

6.7 RECOMMENDATIONS

The recommendations here could also serve as strategies that can be adopted to improve the enrolment rates of learners in Grade10 Mathematics. Based on the results the following recommendations are made:

- Teachers, parents and all stakeholders (business and partners such as the South African Mathematics Foundation, Association of Mathematics Educators of South Africa, institutes of higher learning, etc.) involved in Mathematics should work together towards the improvement of learners' personal feeling towards Mathematics. This can be achieved through:
  - exposing learners to Mathematics related careers
  - encouraging participation in Olympiads and relevant supportive partnerships, and
  - providing continuous support and guidance to learners in Mathematics-related activities
- Teachers should take a proactive role in ensuring that learners:
  - develop confidence towards Mathematics, and also in Mathematics classes
  - enjoy Mathematics by adopting different teaching approaches that will actively engage them, and
  - develop the required understanding of basic Mathematics concepts
- The teaching of Mathematics should involve amongst others:
  - emphasise be based on foundational knowledge of by building from easy to complex and finally abstract concepts
  - differentiated teaching approach to cater for different learning styles
  - integrating ICT technology to provide further clarification of concepts
  - teach concepts in context to make the subject a living subject where real life problems are solved
  - additional exercises to be done after normal schools hours to enhance understanding

- engaging learners in their learning activities-learner cantered, and
- providing continuous motivation and acknowledging every learners` effort in class.

Finally, there is a need for further research which focuses on the statements presented in the questionnaire, in order to improve their reliability (Cronbach's alpha coefficient). Two factors had Cronbach's alpha coefficients greater than 0.7 with an acceptable reliability between the statements while others had coefficients between 0.5 and 0.6 which represents low reliability between items. This research would ensure that stronger relationships between factors are established leading to the generation of improved factors necessary for conclusions.

6.7 SUMMARY

The chapter presented a discussion on the findings with the intention of meeting the research aims and the set objectives. Furthermore when the objectives were met the research questions were also answered. Finally, the chapter presented the conclusions and recommendations based on the findings from the data provided by the participants.

REFERENCES

Akinsola, M. K. & Olowojaiye, F. B. (2008). Teacher instructional methods and student attitudes towards mathematics. International Electronic Journal of Mathematics Education, 3(1): 61-73.

Anderson, J. (2006). The relationship between student perceptions of team dynamics and simulation game outcomes: an individual-level analysis. Journal of Education for Business, Nov/Dec, 85-90.

Ashby, B. (2009). Exploring children's attitudes towards mathematics. In M. Joubert (ed) Proceedings of the British Society for Research into Learning Mathematics 29 (1) March 2009.

Atanasova-Pachemska, T., Lazarova, L., Arsov, J., Pacemska, S. & Trifunov, Z. (2015). Determination of the Factors That Form the Students' Attitude towards Mathematics. IstraživanjeMatematičkogObrazovanja, 12, 1–8.

Baah, E. M., Twenefour, F. B. K., & Johnson, J. K. A. (2015). A Statistical Model of Organizational Performance using Factor Analysis – A case of a Bank in Ghana. International Journal of Mathematics and Statistics Studies, 3(1), pp 38-46.

Babbie, E. (2007). Conducting qualitative field research. In The practice of social research (11th ed.). U.S.A.: Thomson Wadsworth.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84, 191-215.

Bandura, A. (1989). Human agency in social cognitive theory. American Psychologist, 44, 1175-1184.

Baron, R. A. & Byrne, D., (1984). Social psychology understanding human interaction, Boston: Allyn & Bacon.

Bindak, R. (2013). Relationship between Randomness and Coefficient Alpha: A Monte Carlo Simulation Study. Journal of Data Analysis and Information Processing, 1, 13-17.

Burnham, J. R. (2011). A Case Study of Mathematics Self-Efficacy in a Freshman Engineering Mathematics Course. A thesis submitted in Washington State University.

Cohen, L., Manion, L., & Morrison, K. (2011). Research Methods in Education, 7th ed. USA and Canada: Routledge.

Corzo, J., & Contreras, O. (2011). Understanding and Facing Discipline - Related Changes in the English as a Foreign Language Classroom at Public Schools. The Nature of Recognition in TEFL Teachers' Lives, 13(2).

Courtney, M.G.R. (2013). The number of factors to retain in EFA: Using the SPSS R-Menu v2.0 to make more judicious estimations. Practical Assessment, Research and Evaluation, 18(8), 1–14.

Creswell, J. W. (2012). Qualitative inquiry and research design: Choosing among five traditions (3rd ed.). Thousand Oaks, CA: Sage.

De Vos, A.S., Strydom, H., Fouchè, C.B. & Delport, C. S. L. (2009). Research at Grass Roots: For the Social Sciences and Human Service Professions. 3rd ed. Pretoria: Van Schaik Publishers.

Department of Basic Education, (2011A). Curriculum and Assessment Policy Statement: Mathematics. Pretoria, Government Printers.

Department of Basic Education, (2011B). Curriculum and Assessment Policy Statement: Mathematical Literacy. Pretoria, Government Printers.

Department of Basic Education, (2013A). National Protocol of Assessment. Pretoria, Government Printers.

Department of Basic Education (2013B). Programme and Promotion requirements of the National Senior Certificate Grades R-12. Pretoria, Government Printers.

Department of Basic Education, (2016). National Senior Certificate (NSC) Diagnostic Report. Pretoria, Government Printers.

Department of Education (2014). Report on the Annual National Assessment of 2014. Pretoria, Government Printers.

Di Martino, P., & Zan, R. (2010). 'Me and Maths': Towards a definition of attitude grounded on students' narratives. Journal of Mathematics Teacher Education, 13(1), 27–48.

Durrheim, K. & Painter, D. (2006). Collecting quantitative data: sampling and measuring. In Blanche M. T., Durrheim K. and D. Painter, Research in Practice, 2nd Ed (pp 131-159). Cape Town, University of Cape Town Press.

Durrheim, K. (1999). Quantitative measurement. In M. Terre Blanche & K. Durrheim (Eds.), Research in practice: Applied methods for the social Sciences (pp. 72-95). Cape Town, SA: University of Cape Town Press.

Eagly, A. H., & Chaiken, S. (1993). The Psychology of Attitudes. Orlando: Harcourt Brace Jovanovich College Publishers.

Effandi, Z. & Normah, Y. (2009). Attitudes and Problem-solving Skills in Algebra among Malaysian College Students. European Journal of Social Sciences, 8:232-245.

Ernest, P. (2004). Images of mathematics, values and gender. In S. Johnston-Wilder & B. Allen (Eds.), Mathematics education: exploring the culture of learning. Routledge.

Farooq, M. S. & Shah, S. Z. U. (2008). Students' attitude toward Mathematics. Pakistan Economic and Social Review, 48(1), 75-83.

Fouché, C.B. & De Vos, A.S. (2011). Formal formulations. In: De Vos, A.S., Strydom, H., Fouché, C.B. & Delport, C.S.L. (eds). Research at grass roots: for the social sciences and human service professions (89-100). Pretoria: Van Schaik Publishers.

Foster, L., Diamond, I. & Jefferies, J. (2015). Beginning Statistics: An Introduction for Social Scientists. 2nd edition. London: Sage Publication Ltd.

García-Santillán, A., Moreno-García, E., Carlos-Castro, J., Zamudio-Abdala, J. H., & GarduñoTrejo, J. (2012). Cognitive, affective and behavioural components that explain attitude toward statistics. Journal of Mathematics Research, 4 (5), 8–16.

Gay, L. R., Millis, G. E. & Airasian, P. W. (2011). Educational Research: Competences for Analysis and Applications. 10th Ed. New York: Pearson Education International.

García-Santillán, A., Edel-Navarro, R., Chávez, M. E., Aldana, D., & Cornejo, P. (2012). Students' perceptions toward financial mathematics teaching process: An empirical study on engineering undergraduate students. International Journal of Business and Social Science, 3(14), 73-82.

Gauteng Department of Education, 2016. Employment of Foreign Educators, Departmental Circular 02/2016. Retrieved on 22 May 2017 from http://www.education.gpg.gov.za/Document5/Documents/Circular%202%20of%202016.pdf.

George, D. & Mallery, P. (2003). SPSS for windows step by step: A sample guide & reference. Boston; Allyn & Bacon.

Guskey, T. R. (1988). Teacher efficacy, self-concept, and attitudes toward the implementation of instructional innovation. Teaching and Teacher Education, 4(1), 63-69.

Hannula, M.S. (2002). Attitude towards Mathematics: Emotions, Expectations and Values-Educational Studies in Mathematics, 49:25-46.

Hurworth, R. (2005). Interpretivism. In Mathison, S. (Ed.), Encyclopaedia of Evaluation (pp. 210-211). Thousand Oaks, CA: Sage Publications, Inc.

Fraenkel, J. R., Wallen, N. E. & Hyun, H. (2010). How to design and Evaluate Research in Education. London, McGraw Hill Higher Education.

Jain, V. (2014). 3D Model of Attitude. International Journal of Advanced Research in Management and Social Sciences, 3(3), 1 – 12.

Klein, M. (2004). The premise and promise of inquiry based mathematics in pre-service teacher education: A poststructuralist analysis. Asia-Pacific Journal of Teacher Education, 32(1), 35-47.

Kloosterman, P. & Cougan, C. M. (1994). Students' Beliefs about Learning School Mathematics. Elementary School Journal 94. Retrieved on 23 April 2016 from https://www.researchgate.net/publication/240558634_Students%27_Beliefs_about_Learning_School_Mathematics.

Köğce, D., Yıldız, C., Aydın, M. & Altındağ, R. (2009). Examining Elementary School Students‟ Attitudes towards Mathematics in Terms of Some Variables, Procedia Social and Behavioral Sciences, 1(1), 291-295.

Ladd, G. W., Birch, S. H., & Buhs, E. S. (1999). Children's social and scholastic lives in kindergarten: Related spheres of influence? Child Development, 70, 1373–1400.

Leedy, P. D. & Ormrod, J. E. (2010). Practical Research. Planning and Design. (9thed). New Jersey: Pearson Education, Inc.

Leslie, P. S. & Gerald, P. (1996).Theories of Mathematics Learning. International Congress on Mathematics Learning.

Lyons, T. & Quinn, F. (2010). Choosing science: understanding the declines in senior high school science enrolments. National Centre of Science, ICT and Mathematics Education for Rural and Regional Australia (SiMERR Australia), Australia. Retrieved on 12 March 2016 from https://eprints.qut.edu.au/68725/.

Maat, S. & Zakaria, E. (2010). The Learning environment, teacher's factor and student's attitudes towards mathematics amongst engineering technology students. International journal of Academic Research, 2(2), 16-20.

Maio, G. & Haddock, G. (2010). The Psychology of attitude and attitude change. London: SAGE Publications Ltd.

Marchisa, L. (2011). Factors that influence secondary school students' attitude to Mathematics. Social and Behavioural Sciences 29, 786–793.

Maree, K. (2007). First Step in Research. Pretoria: Van Schawk Publishers.

Mata, M., L., Monteiro, V., & Peixoto, F. (2012). Attitudes towards Mathematics: Effects of Individual, Motivational, and Social Support Factors. ISPA, Instituto Universitario, UIPCDE, Rua Jardim do Tabaco, Lisboa, Portugal.

Mathison, S. (2005). Encyclopedia of evaluation. Columbia, Sage Publications Inc.

McMillan, J. H. & Schumacher, S. (2010).Research in Education-Evidence –Based Inquiry, Seventh edition, Pearson Education Inc.

McMillan, M. (2012). Ethics and Social Media: Four Key Considerations for Investment Professionals. Enterprising Investor. Open Access Library Journal, 3(7). Retrieved on 12 March 2016 from http://www.scirp.org/(S(vtj3fa45qm1ean45vvffcz55))/reference/ReferencesPapers.aspx?ReferenceID=1840729.

Mensah, J. K., Okyere, M. & Kuranchie, A. (2013). Student attitude towards Mathematics and performance: Does the teacher attitude matter? Journal of Education and Practice, 4(3), 132-139.

Mohamed, L. & Waheed, H. (2011). Secondary Students' Attitude towards Mathematics in a Selected School of Maldives. International Journal of Humanities and Social Science, 1(15), pp 277-281.

Mohd, N., Mahmood, T. F. P. T., & Ismail, M. N. (2011). Factors that influence students in mathematics achievement. International Journal of Academic Research, 3(3), 49-54.

Moreno, R. & Mayer, R. E. (1999). Gender differences in responding to open-ended problem-solving questions. Learning and Individual Differences, 11(4): 355-364.

Nicolaidou, M. & Philippou, G. (2003). Attitudes towards mathematics, self-efficacy and achievement in problem solving. In M. A. Mariotti, (Ed.) European Research in Mathematics Education (1-11). University of Pisa, Pisa, Italy.

Obodo, G. C. (2006). Developing positive attitudes and interest of mathematics students in Nigerian secondary schools. In S.O. Ale and L.O. Adetula (Eds). Reflective and Intellective Position Papers on Mathematics Education Issues. Abuja: Marvelous Mike Press.

Pajares, F., & Urdan, T. C. (2006). Self-efficacy beliefs of adolescents. Greenwich, Conn: IAP - Information Age Pub., Inc.

Reed, B., & Case, J. (2003). Factors influencing learners' choice of Mechanical Engineering as a career. African Journal of Research in Mathematics, Science and Technology Education, 7, 73-83.

Reddy, V., Prinsloo, C., Arends, F., Visser, M., Winnaar, L., Feza, N., Rogers, S., Janse van Rensburg, D., Juan, A., Mthethwa, M., Ngema, M. & Maja, M. (2012) Highlights from TIMSS 2011: the South African perspective. Retrieved on 18 June 2016 from http://www.hsrc.ac.za/en/research-outputs/ktree-doc/12417.

Relich, J., Way, J. & Martin, A. (1994). Attitudes to teaching mathematics: Further development a of a measurement instrument. Mathematics Education Research Journal, 6(1), 56-69.

Rice, L., Barth, J. M., Guadagno, R. E., Smith, G. P. A. & McCallum, D. M., (2013). The Role of Social Support in Students' Perceived Abilities and Attitudes Toward Math and Science. Journal of Youth Adolescence, 42:1028–1040.

Rodeiro, C. L. V. (2007). A Level Subject Choice in England: Patterns of Uptake and Factors Affecting Subject Preferences. University of Cambridge. Retrieved on 12 March 2016 from http://www.cambridgeassessment.org.uk/images/111069-a-level-subject-choice-in-england-patterns-of-uptake-and-factors-affecting-subject-preferences.pdf.

Rosetta, Z. & Martino, P.D. (2007). Attitude towards Mathematics: Overcoming the Positive /Negative Dichotomy-The Montana Mathematics Enthusiast, Monograph 3,157-168.

Scotland, J. (2012). Exploring the philosophical underpinnings of research: Relating to ontology and epistemology to the methodology and methods of the scientific, interpretive and critical research paradigms. English Language Teaching, 5(9):9-16.

Singh K., Granville M., & Dika, S. (2002). Mathematics and science achievement: effects of motivation, interest, and academic engagement. Journal of Educational Research, 95(6), 323-332.

Stein, K. M., Grover, B., & Henningsen, M. (1996). Building Student Capacity for Mathematical Thinking and Reasoning: An Analysis of Mathematical Tasks Used in Reform Classrooms. London: Sage Publications Ltd.

Strydom, H. (2011). Participatory action research. In: De Vos, A.S., Strydom, H., Fouché, C. B. & Delport, C. S. L. (eds). Research at grass roots: for the social sciences and human service professions (491-506). Pretoria: Van Schaik Publishers.

Sue, S. (2012). Crippling shortage of maths, science teachers. Daily News, 28 May.

Tahar, N. F., Ismail, Z., Zamani, N. D., & Adnan, N. (2010). Students' Attitude toward Mathematics: The Use of Factor Analysis in Determining the Criteria. Procedia-Social and Behavioral Sciences, 8, 476–481.

Terre-Blanche, M., & Durrheim, K. (2012). Research in practice: Applied methods for the social sciences. Cape Town, University of Cape Town Press.

Tezer, M. & Karasel, N. (2010). Attitudes of primary school 2nd and 3rd grade students towards mathematics course. Procedia Social and Behavioural Sciences, 2, 5808-5812.

Ünlü, M, & Ertekin, E. (2013). The relationship between mathematics teaching self-efficacy and mathematics self-efficacy. Social and Behavioral Sciences 106, 3041-3045.

Welman, J.C., Kruger, S.J., & Mitchell, B. (2005). Research Methodology. (3rd ed.). Cape Town: Oxford University Press.

Wigfield, A., Eccles, J., Schiefele, U., Roeser, R. & Davis-Kean, P. (2006). Development of achievement motivation, in Handbook of Child Psychology, N. Eisenberg, W. Damon, R. M. Lerner, N. Eisenberg, W. Damon, and R. M. Lerner, Eds., vol. 3 of Social , Emotional, and Personality Development, (6^{th} ed.), 933-1002. New Jersey, John Wiley & Sons, Hoboken.

Yilmaz, C., Altun, S. A. & Ollkun, S. (2010). Factors affecting students‟ attitude towards math: ABC theory and its reflection on practice. Procedia Social Science and Behavioural Sciences, 2, 4502-4506.

Yong, A. & Pearce, S. (2013). A beginner's guide to factor analysis: focusing on exploratory factor analysis. Tutorials in Quantitative Methods for Psychology, 9:79–94.

APPENDIX 1: PERMISSION TO CONDUCT RESEARCH IN THE LEJWELEPUTSWA DISTRICT

education
Department of Education
FREE STATE PROVINCE

Enquiries: BP Mojau
Reference: 16/4/1/38- 2013

Tel: 051 404 9287
Fax: 086 725 7588
E-mail: research@edu.fs.gov.za

2013 – 09 – 10

55 Lantana Str
Riebeckstad
Welkom

Dear SG MOTSOANE

REGISTRATION OF RESEARCH PROJECT

1. This letter is in reply to your application for the registration of your research project.

2. Research topic: **Learners attitude towards Mathematics in Grade 9 and their effect on learners' choice of subject in Grade 10: A case study conducted in Lejweleputswa District.**

3 Your research project has been registered with the Free State Education Department.

4. Approval is granted under the following conditions:-

4.1 The name of participants involved remains confidential.

4.2 The questionnaires are completed and the **interviews are conducted outside normal tuition time**.

4.3 This letter is shown to all participating persons.

4.4 A bound copy of the report and a summary on a computer disc on this study is donated to the Free State Department of Education.

4.5 Findings and recommendations are presented to relevant officials in the Department.

5. The costs relating to all the conditions mentioned above are your own responsibility.

6. **You are requested to confirm acceptance of the above conditions in writing to:**

DIRECTOR: STRATEGIC PLANNING, POLICY AND RESEARCH,
Old CNA Building, Charlotte Maxeke Street OR Private Bag X20565,
BLOEMFONTEIN, 9301

We wish you every success with your research.

Yours sincerely

MJ MOTHEBE
DIRECTOR: STRATEGIC PLANNING, POLICY AND RESEARCH

3irectorate: Strategic Planning, Policy & Research - Private Bag X20565, Bloemfontein, 9300 – Room 301, Old CNA building, Maitland Street, Bloemfontein 9300 - **Tel: 051 404 9283** / Fax: **086 6678 678** **E-mail: research@edu.fs.gov.za**

www.fsdoe.fs.gov.za

APPENDIX 2: APPLICATION LETTER TO THE PROVINCIAL EDUCATION DEPARTMENT

55 Lantana Street

Riebeeckstad 9459

12 August 2013

Dear Sir/Madam

Re: Request to conduct a research questionnaire at the school.

I hereby request to conduct a Mathematics related research questionnaire and interviews to the selected Grade 9 and 10 learners at your school.

Research topic: Learners` Attitudes towards Mathematics in Grade 9 and their Effect on Learners' Choice of Subjects in Grade 10: A Case Study Conducted in Lejweleputswa district.

I am working as a Mathematics Subject Advisor in Lejweleputswa district and presently a registered M.Ed student at the Central University of Technology in Welkom.

Yours faithfully

Motsoane S.G

………………….

12/08/2013

APPENDIX 3: RESEARCH QUESTIONNAIRE

Research Questionnaire

ABOUT THE QUESTIONNAIRE:

This is not a class test. The intention of this questionnaire is to find out what attitudes learners have towards Mathematics and how do they inform their choice of subjects in Grade 10. There are no right or wrong answers to any question in this questionnaire; the essential thing is for you to express your opinion about interactions in Mathematics lessons. Whatever you express in this questionnaire will be kept confidential and that is why you are not required to write you name anywhere. Finally at the end of each section there is a space provided for any comments you would like to add.

SECTION A

AGE:____________ **SEX**:_____________

GRADE:_____________ **MATHEMATICS:** ______________

MATHEMATICAL LITERACY:__________________

SECTION B

• Please answer all questions.

• Please make a circle on the answer(s) that you think represent you better. If you make a mistake, cross (X) out the wrong answer and circle the correct one.

	Strongly Agree	Agree	Not sure	Disagree	Strongly Disagree
1. I did not like Mathematics in Grade 8 and 9.	**1**	**2**	**3**	**4**	**5**
2. I was not good in Mathematics.	**1**	**2**	**3**	**4**	**5**
3. I did not understand my Mathematics teacher in class.	**1**	**2**	**3**	**4**	**5**
4. Ability in Mathematics is something that you either have or you haven`t.	**1**	**2**	**3**	**4**	**5**
5. It is possible to improve in Mathematics by working hard.	**1**	**2**	**3**	**4**	**5**
6. Mathematics is important in life.	**1**	**2**	**3**	**4**	**5**
7. The career I like does not require Mathematics as a subject.	**1**	**2**	**3**	**4**	**5**
8. When a problem is difficult, do you try it again until you get an answer?	**1**	**2**	**3**	**4**	**5**
9. When you were unable to solve a mathematical problem, did you think back over why you were unable to solve it?	**1**	**2**	**3**	**4**	**5**
10. Do you think Mathematical knowledge is needed in everyday life?	**1**	**2**	**3**	**4**	**5**

11. I liked it when someone in class explains Mathematics to me, and not the teacher.	**1**	**2**	**3**	**4**	**5**
12. My Mathematics teacher was very helpful in Grade 8 and 9.	**1**	**2**	**3**	**4**	**5**
13. Learning Mathematics is boring.	**1**	**2**	**3**	**4**	**5**
14. Learning Mathematics is enjoyable.	**1**	**2**	**3**	**4**	**5**
15. Calculators are essential to learn Mathematics.	**1**	**2**	**3**	**4**	**5**
16. If I make mistakes, I work until I have corrected them.	**1**	**2**	**3**	**4**	**5**
17. I try to answer questions the teacher asks.	**1**	**2**	**3**	**4**	**5**
18. I do not have a mathematical mind.	**1**	**2**	**3**	**4**	**5**
19. I like studying Mathematics at school.	**1**	**2**	**3**	**4**	**5**
20. I enjoy trying to solve new mathematical problems.	**1**	**2**	**3**	**4**	**5**
21. I find Mathematics frightening.	**1**	**2**	**3**	**4**	**5**
22. I find mathematical problems interesting and challenging.	**1**	**2**	**3**	**4**	**5**
23. I find Mathematics confusing.	**1**	**2**	**3**	**4**	**5**
24. I have less trouble learning Mathematics than other subjects.	**1**	**2**	**3**	**4**	**5**
25. I want to study Mathematics in Grade 10 so as to study Science, Health and Engineering fields in future.	**1**	**2**	**3**	**4**	**5**
26. It takes me longer to understand Mathematics than the average person.	**1**	**2**	**3**	**4**	**5**
27. I learn Mathematics best by working through some questions on my own.	**1**	**2**	**3**	**4**	**5**
28. I learn Mathematics best when I ask the teacher for help in lessons.	**1**	**2**	**3**	**4**	**5**
29. I learn Mathematics best when I read through worked examples in textbooks and then do exercises	**1**	**2**	**3**	**4**	**5**
30. I liked it when someone in class explains Mathematics to me, and not the teacher.	**1**	**2**	**3**	**4**	**5**
31. I you do your Mathematics homework with your friends in class.	**1**	**2**	**3**	**4**	**5**
32. I learn Mathematics best when I explain things to other learners in class.	**1**	**2**	**3**	**4**	**5**