UNIVERSITY OF KWAZULU-NATAL

Maths Anxiety and Communication Apprehension as Barriers to learning Mathematics

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A dissertation submitted in partial fulfilment of the academic requirements for the degree of Master of Education, School of Science, Mathematics and Technology Education Faculty of Education

November 2011

DECLARATION

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ACKNOWLEDGEMENTS

Without the assistance and cooperation of several individuals this dissertation would not have been possible. I am deeply indebted to the following people who have inspired me throughout this research:

- I am very grateful to the learners that took the time to complete the questionnaire and participated in the focus group interview for their valuable contribution to this study.
- I am extremely grateful to my supervisor, Dr. Sally Hobden, for her guidance.
- I would like to thank my family. I appreciate the patience and understanding of my children: Jeeoshni, Kershen and Lushen. My appreciation also goes to my husband, Raymond, for his support.
- I am thankful to my mum, Mrs.L.Reddy for instilling the value of studying. You have been my inspiration.
- I thank my sister, Rani Naidoo for all her encouragement and assistance.
- Finally, my gratitude goes to my only daughter Jeeoshni, for a MacBook that made working on the dissertation most convenient.

Dedicated To

Jeeoshni, Kershen and Lushen

ABSTRACT

As learners progress through the educational system their interest in mathematics diminishes. Although mathematics is designed to challenge learners, it has produced a high number of failures. Mathematics is most often measured by speed and accuracy of learners' computation with little emphasis on problem solving and pattern finding. Whilst there are not many opportunities for learners to work on rich mathematical tasks that require divergent thinking as well. Such an approach limits the use of creativity in the classroom and reduces mathematics to a set of skills to master and rules to memorise. In doing so, causes many learners to become anxious and apprehensive. Thus their curiosity and enthusiasm for mathematics disappear, as they get older. Keeping learners interested and engaged in mathematics by recognising and valuing their mathematical creativity may reverse this negative tendency. 97 learners from Riverview High School took part in the study. Three different instruments were used to collect data: Mathematics Anxiety Scale (MAS), Personal Report of Communication Apprehension (PRCA-24) and a focus group interview. The MAS questionnaire was used to measure the level of mathematics anxiety experienced by the learners. The PRCA-24 questionnaire is a self-report measure of communication apprehension. The underlying factors were established that were influential in determining the levels of maths anxiety and communication apprehension in individual learners. The results of the study suggest that learner' ability and attitude played an important role that would lead to the large failure rate in mathematics. Analysis and interpretation of the findings lead to the following conclusions being reached: (a) perceptions of mathematics as being a difficult subject (b) learners negative attitude in mathematics (c) fear for the subject, (d) learners self-efficacy beliefs in mathematics, (e) peer behaviour and (f) teacher behaviour. The research study findings suggest that learner' ability and attitude played an important role. These attitudes contribute directly to the existence of maths anxiety and communication apprehension in learners which impacts on their academic performance. The results of the study suggest that learners experience varying levels of maths anxiety and communication apprehension that impacts on their performance in Mathematics, which are barriers to learning mathematics.

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INTRODUCTION

1.1 The importance of Mathematics in Education

One of the aims of Mathematics education is to further develop learners' knowledge, competency and interest in the subject area. Achievement in Mathematics is revered in society. Success in Mathematics is viewed as a measure of mental intelligence. More opportunities are open to learners who excel in Mathematics than those who do not. Consequently, much emphasis is placed on Mathematics and Mathematics education in school and in society. However, Mathematics is a challenging subject that is associated with a high failure rate in the National Senior Certificate (NSC) Examination as indicated in Table 1.1.

Success in high school Mathematics tends to be highly valued in South Africa. The Mathematics offered at secondary schools provides different course offerings to learners based on their achievement levels. In grade 10, learners choose either Mathematics or Mathematical Literacy.

1.2 Background

For a number of years, the South African media has reported a high Mathematics failure rate in the National Senior Certificate (matriculation) examinations. Learners who opt for Mathematics have had a higher failure rate than their Mathematical Literacy counterparts. The results of the 2010 matric final examination show that, while 86% of the learners who sat for the examination passed Mathematical Literacy, the pass rate for Mathematics was the lowest of all subjects written, at 47.4%. The results of the 2011 matric final examination show that, while 85.9% of the learners who sat for the examination passed Mathematical Literacy, the pass rate for Mathematics was the lowest of all subjects written, at 46.3% Table 1.1 provides an overall picture of the results for Mathematics and Mathematical Literacy in 2010 (DoE, 2011) and 2011 (DoE, 2012).

Table1.1 **National results in Mathematics and Maths Literacy for 2010 and 2011**

Mathematics subject	Total 2010	Total 2011	Number passed 2010	Number passed 2011	% failed 2010	% failed 2011
Mathematics	263 034	224 635	124 749	104 033	52.6%	53.7%
Maths Literacy	280 836	275 380	241 576	236 548	14%	14.1%

The Third International Mathematics and Science Study (known as TIMSS 1995) placed South Africa last out of 41 countries in terms of Mathematics performance, with a mean score of 351. The mean score was significantly lower than the international benchmark of 513. A later TIMSS-R study conducted in 1999 indicated no improvement by South African Mathematics and science learners (Reddy, 2006). This survey revealed that South Africa had the lowest score in Mathematics out of the 6 participating African countries and 27 other western countries (Reddy, 2006).

The poor performance of South African grade 12 Mathematics learners indicates that school-leavers are not adequately equipped with the Mathematics knowledge that they need to be active participants in a highly technological society. In 2011 the Minister of Basic Education, Angelina Matsie Motshekga launched the *Action Plan to 2014: Towards the Realisation of Schooling 2025*. This is described as the first long-term plan for the education sector that will contribute in concrete ways to the realisation of a better schooling system (DoE, 2011). In particular, the Action Plan is designed to improve learner achievement in Mathematics. Learners' negative experience of Mathematics instruction at school is cause for concern. The high failure rate in Mathematics in th the National Senior Certificate examination is an indication that there are some shortcomings in the teaching and learning of Mathematics in South African schools.

1.3 Maths Anxiety and Communication Apprehension

Maths Anxiety (MA) has been closely related to performance in Mathematics courses (Hembree, 1990 & Ma, 1999) and high MA also influences college success and career choices. Only a small number of Mathematics learners are eligible for the study of science-based professions (Reddy, 2006) at tertiary level. Learners with high MA tend to avoid educational paths and careers that require Mathematics competence. Ma

(1999) found that the relationship between MA and Mathematics achievement is significant. It has also been established that once MA takes shape, its relationship with Mathematics achievement is consistent across grade levels. Tobias (1995) identifies a lack of confidence when working in mathematical situations as the cause of MA. Highly Mathematics anxious individuals are less fluent in computation, less knowledgeable about Mathematics, and less likely to have discovered special strategies and relationships within Mathematics. Fennema and Sherman (1976) describe MA as involving strong feelings of fear and apprehension when faced with the possibility of dealing with a mathematical problem.

Apprehension about oral communication is probably the most common form of Communication Apprehension (CA) and fear of oral communication was reported as being the primary fear (McCroskey, 1982). Thus both MA and CA are barriers to learning in Mathematics education.

1.4 Role of Mathematics

Mathematics is a key subject that extends beyond school. It has often been referred to as the most important subject (DoE, 2002). Mathematics plays a major role in our daily lives. Schools are charged with the task of anticipating the needs and changes in technology and preparing learners to meet the challenges of a dynamic society (DoE, 2002). Mathematics is a tool for solving real, daily problems. According to the Revised National Curriculum Statement (2002), Mathematics is a human activity that involves observing, representing and investigating patterns and quantitative relationships in physical and social phenomena and between mathematical objects themselves. Being mathematically literate enables one to contribute and participate with confidence in society. The teaching of Mathematics also seeks to promote values that not only build personal development, but a national South African identity very different from that created by apartheid education (DoE, 2002).

The DoE (2002) emphasises that the goal is to produce learners who will be inspired by these values, and who will act in the interests of society on the basis of respect for democracy, equality, human dignity, life and social justice. The Mathematics curriculum as prescribed in the Revised National Curriculum Statement (2002) seeks to create a lifelong learner who is confident and independent, literate, numerate,

multi-skilled, compassionate, respects the environment and has the ability to participate in society as a critical and active citizen. Educators and various role players in Mathematics education need to take cognisance that Mathematics aims to develop the following in the learner: a critical awareness of how mathematical relationships are used in social, environmental, cultural and economic relations; an appreciation for the beauty and elegance of Mathematics; and a spirit of curiosity and a love for Mathematics (DoE, 2002). In order to create and maintain a love for Mathematics, educators need to help learners overcome MA and CA. In this highly technological era, Mathematics is vital in order that learners are well equipped to meet the demands and challenges of our globalised society.

1.5 Rationale of Study

National and international studies in Mathematics have confirmed that South African Mathematics learners' performance is the lowest in the world. This is of paramount concern to both teachers and learners. There is a dire need to mobilise and eliminate the pitfalls that have resulted in Mathematics reaching rock bottom in South Africa. Poor performance in Mathematics, the decrease in the number of learners who wish to study Mathematics at tertiary level and the highly technological era we live in, require a mathematically literate generation. This research will be of value to all role players in education because it seeks to highlight crucial issues that influence teaching and learning in the Mathematics class. Since Mathematics has the highest failure rate in the National Senior Certificate Examination in 2010 and 2011, it is essential to explore MA and CA in Mathematics learners as this study will add to the body of knowledge.

1.6 Observation

As a Mathematics teacher, 1 am interested in understanding reasons for the large percentage of learners who perform poorly in this subject in comparison with other subjects every year. It is difficult to isolate the reasons for the many learners who perform poorly in the NSC examination in Mathematics. In my many years of teaching Mathematics, I have found that learners are apprehensive and anxious in Mathematics. MA is prevalent among the majority of learners. This anxiety has become a challenge in the teaching and learning of Mathematics. It is even more challenging when learners are apprehensive about communicating during

Mathematics lessons. Understanding MA might provide insights into ways of improving the success of learner performances in Mathematics. My concern lies in attempting to understand learners' experiences of MA and CA in order to implement a change in the *status quo* during the teaching and learning of Mathematics. In my experience, some learners do well during Mathematics lessons and assignments yet fail to perform well in examinations. There are diverse reasons for the poor performance in Mathematics. It is imperative that the variables which may contribute to the learners poor performance in mathematics be taken into consideration.

1.6.1 Maths Anxiety (MA)

MA is a complex construct that has been defined by Fennema and Shermann (1976) as a state of anxiety that is aroused in situations involving Mathematics. Unlike other subjects, Mathematics has a built in fear factor known as "math anxiety," which can start as early as primary school (Tobias,1995). The added pressures associated with Mathematics can overwhelm learners. Elements such as the competency of the learners, parental pressure to succeed, and the teacher's attitude, may create MA within the learner (Tobias, 1995). MA may be caused by many factors such as: negative Mathematics experiences, lack of parental encouragement, negative attitudes, lack of self-esteem and confidence, a poor classroom environment, and the teaching approach. Learners who experience MA often perform poorly in Mathematics-related situations (Ma, 1999).

1.6.2 Communication Apprehension (CA)

McCroskey (1982) defines CA as an individual level of fear or anxiety associated with either real or anticipated oral communication with another person. Fear of oral communication was reported as the number one fear of Americans in a recent nationwide survey of adults. Results from data collected from nearly 20 000 college students at Michigan State University, Illinois State University, and West Virginia University over the past eight years, show that between 15% and 20% of American college students suffer from CA. The causes of CA may stem from situational settings, for example, speaking in the classroom . Thus, a classroom that does not pose a threat to learners should be created in order to alleviate CA in Mathematics.

1.6.3 Parents

Parents are aware that success in Mathematics will offer many more opportunities and options at tertiary level and in career choices. Consequently, parents of learners who do not perform well in Mathematics will often pressure the learners and make unreasonable demands on them.

2.4.1 Teachers and classroom environments

Teachers may be required to work with classes that include some learners who lack the prerequisites for Mathematics in a particular grade. In addition, it is imperative that teachers teach at a fast pace in order to complete the Mathematics syllabus. Weak learners may require additional help from the teacher. MA and CA in such a classroom would be detrimental to the teaching and learning of Mathematics.

Since the cause of CA may stem from situational settings for example, speaking in the classroom, a classroom that poses less of a threat to learners should be created. Some of the collaborative activities in the classroom are aimed at getting the learners to participate more in group discussions and make them less anxious in expressing their point of view. Collaborative learning in a classroom can be defined as classroom learning techniques that require learners to work together in groups or pairs in learning tasks (Colbeck, Campbell & Bjorklund, 2000). Collaborative activities enable learners to optimise opportunities, and to interact and cooperate with one another as they work towards a common goal (Colbeck *et al*., 2000). Colbeck *et al.* (2000) add that regardless of learners' different proficiencies and personalities, they seem to work better in groups because they can exchange more opinions and ideas. Learners will feel less anxious when they work in groups. Learning Mathematics in a less apprehensive setting can result in effective learning. Collaborative activities in the classroom help to enhance learners' spoken skills and so reduce the learners' apprehension about speaking in a group discussion or any speaking activities inside their classroom (Osman, Nayan, Mansor, Maesin & Shafie, 2010). It is expected that learners' spoken skills will improve and that their level of MA and CA will be reduced when collaborative activities are introduced in the classroom.

1.7 Problem Statement

In my experience of teaching of Mathematics, I have found that learners seemed to

have an inherent negativity towards Mathematics. The added pressures associated with the subject often overwhelm Mathematics learners. Mathematics learners are subjected to external factors such as large classes, difficult content, and the fast pace of instruction, parental pressure, secondary school requirements and declining grades. Some learners lack a sense of enthusiasm. It is a challenge to get some learners to pay attention in the Mathematics class. This challenge seems to be growing bigger over time. On the other hand, some learners with high motivation enjoy doing Mathematics, remain focused and become absorbed in their mathematical problem solving activities. The large percentage of learners who fail Mathematics every year in the National Senior Certificate Eamination has become a contentious issue in the education sector.

1.8 Research Questions

Although it is difficult to isolate the causes of the high number of failures, this study will hopefully contribute to some understanding of this phenomenon. An understanding of MA and CA associated with Mathematics may give insights into ways of improving the success of learners in Mathematics. Consequently this study will investigate: (a) what are secondary school learners' attitudes towards Mathematics? (b). What are secondary school Mathematics learners' levels of CA? (c) How do secondary school learners account for their levels of MA and CA?

1.9 Research Study

As a Mathematics educator, one of my visions is to inculcate a passion for Mathematics in learners. I would not want this to be an unattainable goal. For teaching and learning to be successful, goals have to be realistic. To achieve this goal, the first step is to understand the barriers that learners confront in the Mathematics class. This may provide insights into ways of improving the success of learners.

Rich, detailed and diverse data on issues pertaining to learners' attitudes, experiences and CA in learning Mathematics were provided during the course of this research study. This research report consists of five chapters. Chapter one provide a brief background on MA and CA and briefly outlined the issues surrounding Mathematics.

Chapter two consists of a literature review separated into two sections. The first

section will describe MA and CA. The different classifications and causes of MA and CA will be discussed. The second section will describe the theories surrounding Mathematics. It will also provide a framework for the (a) affective factors that influence Mathematics learning, (b) attribution theories in the area of affect including self-efficacy, attitudes of Mathematics learners and how they can be developed (c) the development of a positive learner environment to improve learning in Mathematics (d) the social cognitive theory, and (e) gender theory.

Chapter three describes the methodology used in this study. The instrument used to measure MA: The Mathematics Attitude Scale (MAS) for adolescents and the instrument used to measure CA: The Personal Communication Apprehension (PRCA -24) Scale is described.

Chapter four presents the results of the data obtained from the study. Chapter five concludes with the findings of the research study, suggestions and implications for further research.

CHAPTER 2

Literature Review

This chapter details the literature review and theoretical framework surrounding research on MA and CA and its relation to Mathematics education. The chapter begins by describing MA. This is followed by a discussion on the different classifications of MA and its causes. The following section deals with the issues surrounding CA in the study of Mathematics. The literature relating to MA and CA is discussed, including different classifications of MA and possible sources of MA. This is followed by a discussion on the various causes of CA and the stigmatisation that learners endure due to this particular phenomenon. A study by McCroskey (1982) examines the relationship between CA and concepts such as self-esteem, social personality variables, and gender. This chapter also details with the theoretical framework arising out of research on MA and CA.

2.1 Focus of the Study

The purpose of this literature review is to present the key concepts that underpin the study, and to identify and discuss the literature surrounding these concepts. From the discussion of the literature, and a survey of similar studies, a theoretical framework is derived to guide the data analysis. The review will be discussed under the following key areas: (a) the affective domain and its influence on learner perceptions, (b) MA, (c) self-efficacy which involves the beliefs of learners and their effect on learners' attitude to Mathematics, (d) confidence, (e) attitudes to Mathematics and their relation to teaching and learning, (f) CA, (g) the correlation between MA and achievement in Mathematics, (h) the impact of CA and (i) factors affecting MA and CA. The role of Mathematics in education is clarified, and an explanation of the concepts affective domain, attitude, anxiety, confidence, beliefs and CA is provided by reviewing the theoretical definitions proposed by various researchers. A highly selective literature review that has a direct bearing on MA and CA will then be presented. The different theoretical perspectives on attitude and the role that they play in influencing learner perceptions to Mathematics will be discussed. The findings of these studies will be analysed to highlight concerns in the field of Mathematics and to offer an objective

critique of the various points of view. This chapter will also include a discussion on self-efficacy beliefs and how they impact on learner perceptions about Mathematics.

Studies examined in this review of the literature were limited to those published in the past 29 years due to the nature of the research topic (1982-2011), although the researcher would have preferred to focus on the past five years. This is not to suggest that there were no valuable studies on MA prior to 1982. Those studies were not included because they do not represent recent trends. Studies were included if their analyses were (a) appropriately rigorous, (b) replicable and (c) supported by valid and reliable measures.

2.2 Key Concepts

2.2.1 *The Affective Domain*

The term 'affective domain' in this research study refers to the emotional aspects of learning, such as feelings and emotions which impact on performance in Mathematics. Leder & Forgasz (2006) suggest that the affective domain is ever present in the Mathematics classroom, but is often an incidental accompaniment to mathematical learning. It has also been noted that the affective domain is critically important in all teaching and learning, but especially in Mathematics (Leder & Forgasz, 2006; McLeod, 1992). The concept of MA has recently received increased attention due to the fact that it affects a large number of learners and in turn threatens performance and participation (Leder & Forgasz, 2006). There is growing recognition that affective factors play a critical role in the teaching and learning of Mathematics. One affective factor that has received more attention than any other factor is anxiety towards Mathematics (McLeod 1992). Leder & Forgasz, (2006) explain that the interconnected nature of concepts such as affect, feelings, emotions, and attitudes and their link to behaviour can be seen in definitions spanning some 50 years. Learners' experiences are the focal point. This focus is important because teachers' personal beliefs, attitudes, theories and experiences play a pivotal role in learning. McLeod (1992, p. 576) explains, "The affective domain refers to a wide range of beliefs, feelings and moods that are generally regarded as going beyond the domain of cognition". It is because affect goes beyond cognition that McLeod (1992) states that it is more difficult to describe and measure. She describes the affective domain using three components: emotions, attitudes and beliefs. McLeod (1992) distinguishes

between these components, describing emotions as the most intense and least stable, beliefs as the most stable and least intense, and attitudes as somewhere in between. McLeod (1992) states that beliefs, attitudes and emotions represent increasing levels of affective involvement, decreasing levels of cognitive involvement, increasing levels of intensity of response, and decreasing levels of response stability. Therefore, teacher experiences and perceptions about Mathematics are important. Learners' and teachers' identities and experiences shape the teaching and learning decisions of learners in Mathematics. The National Council of Teachers of Mathematics (1989) emphasises that there is an urgent need to change learners' negative attitudes towards Mathematics and that the objectives of Mathematics education must be transformed to meet the critical needs of our society. Mathematics education, which includes the examination of attitudes, values, and the feelings of learners will reduce anxiety and increase interest in Mathematics. It will also help the learner to integrate Mathematics more effectively into his or her life. Davis (1992) emphasises that teachers should establish an epistemology, which is closely related to trying to build on learners' own ways of thinking.

2.2.2 *Maths Anxiety (MA)*

Having read articles on MA, MA can be defined by Bessant (1995), Ma (1999) and Tobias (1995) as the general lack of comfort that someone might experience, along with feelings of tension and anxiety, that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of life and academic situations It can be argued that having understood the literature by Bessant (1995) and Tobias (1995), MA spans domains such as anxiety and emotions which can cause one to forget how to solve problems and lose one's self-confidence. This condition may be accompanied by debilitating test stress, low self esteem, fear of failure and negative attitudes toward Mathematics learning (Bessant, 1995). MA includes aspects that are cognitive, for example, worry; attitudinal for example dislike and emotional for example fear (Ma, 1999). The first years of secondary school have also been identified as a key period in the development of MA (Hembree, 1990). These moments of anxiety occur in the Mathematics classroom and have a negative effect on the learner. Hembree (1990) states that the feelings associated with anxiety are helplessness and uncertainty in the face of danger as in the Mathematics classroom, the perceived danger could take the form of a non-routine problem, a test or an

assignment. MA in terms of test anxiety and general MA have an emotional impact on learners. Learners who experience some level of MA become more anxious when confronted with tests, assessments or exams. These negative emotions can cause learners to lose faith in their Mathematics ability. Hembree (1990) finds that high achievement is linked to a reduction in MA.

Ma (1999) notes that MA can be facilitative or debilitative. When MA is facilitative it alters learners' behaviour in a positive way. Some theorists Tobias (1995) and Ma, (1999) believe that a small degree of anxiety is beneficial and can impact positively on learners' performance. When MA goes beyond a certain point, it begins to undermine performance and becomes debilitative (Ma, 1999). At the cognitive level, two theoretical models exist to explain MA. The interference model describes MA as a disturbance in the recall of prior mathematical knowledge (Ma, 1999) and therefore, a high level of MA will block any information associated with Mathematics which can result in learners performing poorly in Mathematics. The second theoretical model as described by Ma (1999) is the deficit model, which as proposed by Tobias (1995), attributes MA to previous poor performance such as recalling negative mathematical experiences creates MA. Researchers (Hembree, 1990; Tobias, 1995; Bessant, 1995 and Ma, 1999) are of the view that different categorisation of MA exist and those individuals who experience high levels of MA have greater difficulty in Mathematics.

Hembree (1990) argues that the higher the MA, the lower the achievement in Mathematics and a moderate level of anxiety has a positive impact, with higher Mathematics results. This suggests that MA is debilitating for the majority of the learners. Having read the articles by Hembree (1990), Ma (1999) and the book by Tobias (1995), MA can be defined as tension and anxiety that impact negatively on learners' performance in Mathematics as a result of their experiences in Mathematics. MA may cause poor performance (Hembree, 1990) or poor performance may cause MA (Tobias, 1985). The competence explanation by Fennema (1989), explains that Mathematics performance is an interaction of affect (attitudes and MA) and behaviour during learning tasks.

2.2.3 Self-efficacy / Beliefs

According to Bandura, (1997, p. 2) self-efficacy "is the belief in one's capabilities to organise and execute the courses of action required to manage prospective situations". In other words, self-efficacy is a person's belief in his or her ability to succeed in a particular situation such as in a Mathematics class. Bandura (1997) describe these beliefs as determinants of how people think and behave, as the self-system. Learners' attitudes, abilities, and skills in Mathematics comprise the self-system. This system plays a major role in how situations are perceived and how one behaves in response to different situations. Self-efficacy plays an essential role in the learning of Mathematics. Bandura (1997) states that performing a task successfully strengthens one's sense of self-efficacy. However, failing to adequately deal with a task or challenge can undermine and weaken self-efficacy. Bandura (1997) adds that expectations of personal efficacy are based on four major sources of information: performance accomplishment, vicarious experience, verbal persuasion, and physiological states. Learners who become extremely nervous in Mathematics may develop a weak sense of self-efficacy. Self-efficacy is one's belief in one's ability to complete a task. If the learner has a low self-efficacy belief, it is most likely that their performance will be poor (Fennema & Sherman, 1976; Bandura, 1986 & Fennema, 2000). Learners may develop negative perceptions towards subjects and courses. Self-efficacy expectations dictate the level of effort a learner is willing to expend when faced with a difficult problem in Mathematics.

McLeod (1992) states that beliefs play a key role in the construction of emotion and the development of attitudes. She also suggests that beliefs develop over time, and that learners develop beliefs that are in line with their personal experiences. These personal experiences may happen in the setting of the Mathematics classroom. There is no single, exact definition of the term 'belief'. McLeod (1992) categorises learners' beliefs into four categories related to the object of belief: beliefs about Mathematics, beliefs about self, beliefs about Mathematics teaching, and beliefs about the context in which Mathematics education occurs. Learners' beliefs about Mathematics may include the belief that Mathematics is difficult. The beliefs that learners hold are affected by their role models particularly parents (Parson, Alder & Kaczala, 1982). Parson *et al* (1982) found that parents' beliefs about their children's ability in Mathematics were a more critical mediator for the child's self-concept than the

child's Mathematics performance. They add that parents' beliefs about their own mathematical abilities can have an impact on their children's beliefs. For Mathematics education to be successful, parental support and understanding are essential. McLeod (1992) argues that there will only be improvements in Mathematics education once the affective responses of both children and adults have changed. As teachers set an example for their learners every day, their beliefs about themselves and their learners have an impact on learner beliefs in their classroom. Teacher beliefs also have an impact on their own instructional practices in the Mathematics class.

2.2.4 *Confidence*

The term 'confidence' relates to beliefs about one's self and about one's efficacy to act within a social setting, in this case the Mathematics classroom. Research on confidence and causal attributions in relation to Mathematics tends to focus on beliefs about the self (McLeod, 1992). Schoenfeld (1989) describes the role of self-concept in Mathematics education and notes that research has consistently revealed correlations between confidence and achievement. Confidence in Mathematics breeds success and those individuals who have high levels of confidence in their ability to learn Mathematics perform much higher than those with low levels (Schoenfeld, 1989). According to Pajares & Schunk (2001) individuals tend to participate in tasks that they feel confident and competent in and avoid tasks that they believe they are not that competent or confident in. This correlation could exist because the strength of people's convictions in their own effectiveness is likely to affect whether they will even try to cope with given situations (Bandura, 1997). Learners who have a poor self-concept in Mathematics will need help with changing their beliefs in order to build their confidence levels. According to the Revised National Curriculum Statement (DoE, 2002) the teaching and learning of Mathematics aims to develop in the learner the necessary confidence and competence to deal with any mathematical situation, without being hindered by a fear of Mathematics. It is vital for teachers to instil confidence in learners and to allow them to develop positively in the Mathematics class.

Learners' self-perceptions are important with respect to their experiences. Studies by Kanai & Norman (1997) indicate that as learners progress to high school, boys have more confidence in their Mathematics abilities than girls, even when the girls perform

better than the boys. Leder (1992) found that learners perceive teachers to be more helpful and encouraging to boys than girls. This is a general gender stereotype that is difficult to overcome. Besides the gender stereotypes about Mathematics, there are general social stereotypes as well. Tobias (1995) notes that some people believe that Mathematics ability is mystical and attribute a talent for Mathematics to genetic factors. A common belief is that people either have or do not have a mathematical mind. Mathematics teachers may contribute to this myth. If the teacher claims an entirely happy history of learning Mathematics, he or she may contribute to the idea that some people, specifically the teacher, are gifted in Mathematics (Tobias, 1995). Tobias (1995) argues that learners who are stereotyped as either being incompetent in Mathematics are more likely to experience MA.

Tobias (1995) is also of the view that these highly influential self-affects are connected to learners' self-esteem, self-worth and/or personal control with respect to Mathematics. The role of self-beliefs in Mathematics education is made clear by McLeod (1992), who explains that research has consistently shown correlations between confidence and achievement. This correlation could exist because the strength of the learners' conviction in their own effectiveness is likely to affect whether they will even try to cope with given situations (Bandura, 1997). Learners who have greater confidence are resilient and will persevere to improve their performance in Mathematics. Self-confidence is another aspect of self-perception that has been found to have a stronger correlation with achievement in Mathematics than with other variables (Fennema, 2000). Learners who are confident in their ability to do Mathematics, will have a high expectation that they will achieve in a given task, assessment or exam. Those learners who have a low confidence in Mathematics have a low expectation in their ability to perform the task successfully.

2.2.5 *Attitude*

Attitude is the tendency of learners to act positively or negatively in a Mathematics class. Mcleod (1992) refers to attitude as affective responses, which involve positive and negative feelings that are relatively stable. Attitudes also refer to feelings that develop over a period of time when learners experience repeated instances of success or failure. The term 'attitude' is used in the more general sense to include beliefs about Mathematics and beliefs about oneself. In this study, attitude refers to feelings

that indicate a positive or negative disposition to Mathematics. McLeod (1992) identifies two ways in which attitude is formed. The first is when learners experience many negative experiences in Mathematics. When these negative experiences accumulate, learners develop a negative attitude to Mathematics. This accumulation of negative experiences is detrimental to the learners. For example, a learner, who experiences consistent failure in algebra or geometry, may develop a negative attitude to Mathematics in general (Mcleod, 1992). A learner's state of mind has a great influence on his or her perception of Mathematics. Negative perceptions about Mathematics and the presence of MA (Tobias, 1995) impact negatively on learners' attitudes. Coleman & Conrad (2007) evaluate the negative perceptions of learners towards Mathematics. The importance of attitude is increasingly being accepted (Coleman & Conrad, 2007; Depaolo & Mclaren 2006). Depaolo & Mclaren (2006) examined attitude and performance in both business statistics and calculus and suggested that attitudes play an important role in Mathematics performance and hence should be addressed. However, McLeod (1992) cautions that the term 'attitude' does not seem adequate to describe some of the more intense feelings that learners exhibit in the Mathematics classroom, such as anxiety, confidence, frustration and satisfaction.

2.2.6 *Communication Apprehension (CA)*

According to McCroskey (1982), CA refers to an anxiety syndrome associated with either real or anticipated communication with another person or persons that may take the form of oral communication. McCroskey (1982) states that CA is a severe personal problem for the individuals suffering from it which has a major impact in the learning environment and that impact is negative. Although some learners may desire to communicate with others and see the importance of doing so, they may be impeded by their fear or anxiety. There are four different types of CA: trait-like, generalised-context, personal-group, and situational (McCroskey, 1982). *Trait-like* CA can be described as a relatively enduring, personality-type orientation towards a given mode of communication across a wide variety of contexts. *Generalised-context* CA is similar to trait-like; however, it may occur in one situation and not another. *Personal-group* CA repeatedly occurs when an individual interacts with a certain person or group. Finally, *situational* CA occurs where one can be with the same individual or group, but the situation itself causes the apprehension. The causes of CA

that may stem from situational settings such as the Mathematics classroom can pose a threat to learners and can create anxiety about speaking during class discussions, when they are asked to give an explanation of a mathematical calculation. Learners who are well exposed to the English language may have little problem communicating their ideas in a Mathematics class as compared to those who lack exposure to the English language. It is imperative that educators are aware that learners have different family and educational backgrounds and as a result they may have different levels of CA. Learners who do not have appropriate communication skills or whose communication is culturally or racially divergent may also develop CA. Self-esteem and CA have an inverse relationship between social-communicative anxiety and self-esteem (McCroskey, 1982). It has been found that "this relationship is one of the most consistent in the literature of social-communicative anxiety" (McCroskey, 1982, p. 132). Learners who are keenly aware of themselves while speaking, or who feel that they are being watched by others can also suffer apprehension. If a learner anticipates a negative outcome, she/he might experience apprehension. According to McCroskey (1982) most people who are communicatively apprehensive, are neither skill deficient nor different from others; typically, they are normal people who are simply afraid to communicate. The other component that has an effect on learners' level of CA is the learners' social personality. This is the personality of learners in social situations as in the Mathematics class. Learners may develop a fear or anxiety about communicating that stem from their basic personality.

According to McCroskey (1982) CA is problematic when anxiety reaches levels that interfere with goal attainment. Inherently CA is emotionally based, although it also involves attitudinal and behavioural components. Another anxiety-related construct is shyness that is belief-based and attitudinal. All incorporate elements of avoidance behaviour (McCroskey, 1982). McCroskey (1982) argues that responding can be *via* thinking, feeling and behaving and that these anxiety avoidance constructs are related. Learners' fear of negative evaluation permeates self-perceptions, external orientations and behaviours, which lead to low self-esteem (McCroskey, 1982). Such emotional responses make learners' anxiety increase. As anxiety increases it becomes more aversive and debilitating, interfering with social interaction demands (McCroskey, 1982). High levels of CA and MA in learners require that consideration be given to

relevant curriculum design and delivery, and the use of techniques designed to reduce CA and anxiety, because apprehension and anxiety is present on entry to higher education (Joyce, Hassall, Montaño, Antonio & Anes, 2006). Learners should be given the opportunity to explore and share their ideas with their classmates. They should be exposed to working in groups collaboratively in order to enhance their speaking ability (Osman *et al*. 2010). When learners work collaboratively in groups, they tend to experience disagreement and conflict over certain goals, tasks and solving mathematical problems. When they are dissatisfied with other learners' ideas, they tend to challenge them. At this stage, participation may increase dramatically and learners who rarely talk may begin to express their opinions. Communication takes place and the 'shy' participants who are reluctant to participate at the beginning of the lesson will be motivated to defend their arguments and at the same time be more involved in the discussion (Osman, *et al*., 2010). Collaborative learning activities in the Mathematics classroom can help learners generate more ideas and experience less stress in expressing themselves in class.

2.3 Affective factors and achievement

2.3.1 *Correlation between Maths Anxiety and achievement in Mathematics*

A review of research suggests that low achievers in mathematics experience maths anxiety. Ma (1999) found that the relationship between mathematics anxiety and mathematics achievement is significant. Coleman and Conrad, (2007) evaluated the negative perceptions of learners towards required statistics and research methods courses. Their study examines the mathematical skills learners develop during secondary schooling and also raises the dilemmas faced by lecturers in mathematical and statistical courses at tertiary institutions. Learners' negative perceptions towards subjects and courses are carried through into their post-matric studies. The consequences of MA can include (a) the inability to do Mathematics-related tasks, (b) a decline in Mathematics achievement, (c) the avoidance of Mathematics and Mathematics-related tasks, (d) the selective omission of college majors and careers that involve Mathematics, and (e) the growth of feelings related to guilt and shame (Ma, 1999). Ma's (1999) meta-analysis yielded a negative relationship between anxiety toward Mathematics and the Mathematics achievements of elementary and secondary school learners. An earlier meta-analysis by Hembree (1990) found a correlation between MA and performance amongst post secondary school learners

where individuals with higher MA experienced decreased Mathematics achievement. Two theoretical models for testing MA and its effects have been discussed in the literature: an interference model and a deficit model. The interference model suggests that anxiety interferes with learners' recall of prior knowledge of Mathematics, while the deficit model implies that poor performance can be attributed to weak study habits or test taking skills and thus leads to high anxiety levels (Hembree, 1990; Tobias, 1995). Hembree (1990) also conducted a meta-analysis of gender differences in learners at a college. Hembree's (1990) study found that women displayed higher levels of MA than men. Learners with little or no MA scored significantly higher in self-confidence and motivation, as well as enjoyment, compared to learners with high MA. According to Tobias (1995) millions of adults are blocked from professional and personal opportunities because they fear or perform poorly in Mathematics. For many, these negative experiences persist throughout their adult lives. The literature on the impact of MA on achievement has shown that it has a negative impact on career choice, Mathematics achievement and learners' performance.

2.4.1 Impact of Communication Apprehension on achievement in Mathematics

According to Joyce *et al.* (2006), the perception that people who talk less are less competent and less intelligent than talkative learners greatly affects how they are responded to in school. For example, since teachers may tend to expect those who talk less to do less well in school, they may treat these learners as if they were less intelligent. Learners who talk less may be less likely to be called on in class, receive less attention from teachers and ask for help less frequently than talkative people. With little interaction, the learner who talks less has fewer opportunities to correct mistakes and to receive reinforcement in the Mathematics class.

Research suggests that CA affect learners' achievement (Joyce *et al.* 2006 & Osman *et al*. 2010) . For example, in the classroom, much of the final assessment depends on learner participation; learners who experience CA are less likely to participate in class activities, and these learners' assessments are apt to be lower than those of talkative learners. As this type of evaluation affects the achievement of the learner who talks less throughout school, it ultimately has an effect on the learner's general learning. Osman *et al*. (2010) argue that it is natural for people to avoid things that they fear; communication apprehensive people tend to be less willing to

communicate. A lack of opportunity and even discrimination lead to less learning for the less talkative learner in the long run, although they are no less intelligent than the talkative learner. Osman *et al*. (2010) are of the view that generally, learners who talk less tend to fare poorly in school while talkative learners fare better. No matter what its source is, CA causes learners discomfort; it may lead the learner to avoid communication and it can result in learners being ineffective in their communication during Mathematics lessons.

Studies indicate that learners with high CA have lower academic achievement than low CA learners. McCroskey (1982) states that the most obvious effects are that learners will seek to avoid the class, if possible and the learners' CA will interfere with performance in Mathematics. McCroskey (1982) found that learners who were highly apprehensive scored significantly lower in assessments and exams in Mathematics. High communication apprehensive learners achieve less and like school less than those who are low communication apprehensive. CA has a major impact on learners' behaviour and also impacts on many learners' attitudes and their achievement. It is clear that CA is associated with both negative attitudes and lower achievement. Research on the expectations of teachers shows a major difference in expectations (McCroskey, 1982). This research by McCroskey, (1982) indicate that teachers expect low CA learners, as opposed to high CA learners, to do better in all academic subjects. Low CA learners have a much more promising future in education and have much better relationships with their peers. Studies conducted by Osman *et al*. (2010) and McCroskey (1982) suggest, therefore, that the causal link between learners with CA and achievement is the communication withdrawal behaviour of learners with high CA in comparison and the communication seeking behaviour of the learners with low CA. Learners need to communicate in order to learn.

2.3.3 *Factors affecting Mathematics Anxiety and Communication Apprehension*

There may be underlying factors that are influential in determining the levels of MA and CA in individual learners. These could include negative perceptions, gender stereotypes, academic ability, the classroom environment, a self-efficacy history of negative experience and previous educational background. The negative perceptions of learners towards Mathematics as well as the presence of MA (Tobias, 1995) have also been examined in the literature. Moreover, the importance of attitude is

increasingly being accepted (Coleman & Conrad, 2007; Depaolo & Mclaren 2006). Coleman & Conrad, (2007) evaluated the negative perceptions of graduate students towards the required statistics and research methods courses. Depaolo & Mclaren (2006) examine the attitude and performance in both business statistics and calculus courses and suggest that attitudes play an important role in Mathematics performance and hence should be addressed. Studies by Depaolo & Mclaren (2006) and Coleman & Conrad, (2007) have shown that negative perceptions of learners relate negatively to learners' performance in tests, in Mathematics achievement and grades in Mathematics.

The gender-related factor is the "male-advantaging" stereotypes, which include beliefs that males are naturally more skilled at or interested in technical domains that are believed to be necessary to be successful in computer science and Mathematics (Correll, 2001). While there are ample reasons to doubt the truth of these beliefs, the beliefs themselves can shape the decisions of learners to persist on the path towards selecting their career choices and beyond. Correll (2001) present empirical evidence supporting two main paths by which negative perceptions influence self-assessment of task ability. First, gender stereotypes can actually undermine task performance. If one performs less well in a test that is diagnostic of some ability, one will likely come to see oneself as having less of that ability. Second, gender beliefs can influence the standard that is used to evaluate one's task performance. If we judge our task performance using a harsher performance standard, we will be less likely to see ourselves as having task ability than if we had used a more lenient standard (Correll 2001). The implication is that, if left unchecked, gender stereotypes will contribute to MA and CA.

Bandura (1997) points out that a person may feel certain that an action will lead to a particular outcome but may doubt his or her ability to successfully perform the action. This distinction is most appropriate for situations in which outcomes or reinforcers are loosely tied to actions because of environmental contingencies (Bandura, 1997). Learners may limit their ability in Mathematics in association with self-efficacy related perceptions, and possibly reduce their academic ability. Bandura (1997) proposed models predict that learner self efficacy-related beliefs mediate the effects of prior academic performance on MA and performance in Mathematics. The model

is based on research, which found a positive relation linking learners' prior Mathematics ability perceptions to their current perceptions of Mathematics.

MA is prevalent in academic situations where it can cause one to forget and lose one's self-confidence (Tobias, 1995). Many learners who experience MA or CA can isolate one or several instances where they were subjected to an embarrassing experience in a Mathematics class. Research confirms that the pressure of timed tests and the risk of embarrassment have long been recognised as sources of unproductive tension among many students (Tobias, 1995). According to Spikell (1993) three practices that are a regular part of the traditional Mathematics classroom and cause great anxiety in many students are imposed authority, public exposure and time deadlines.

Studies have shown learners learn best when they are active rather than passive learners (Spikell, 1993). Learners have different learning styles. Everyone is capable of learning, but may learn in different ways. Therefore, lessons must be presented in a variety of ways. For example, different ways to teach a new concept include play-acting, cooperative groups, visual aids, hands on activities and technology (Spikell, 1993). Much anxiety happens in the classroom due to the lack of consideration of the different learning styles of learners (Spikell, 1993).

Mathematics experiences are important elements in the creation of MA. Learners' prior negative experiences in the Mathematics class, with their peers and at home when learning Mathematics are often transferred and cause a lack of understanding of Mathematics (Tobias, 1995). Learners come into secondary schools with a lot of negative ideas about Mathematics and Tobias (1995) explains that this anxiety begins with a particular incident. She described that for many people, this moment occurs sometime during their school career when they encounter a mathematics problem that seems impossible.

2.4 THEORETICAL FRAMEWORK

2.4.1 Theory of self-efficacy

59Bandura's theory of self-efficacy (1986) introduce a theory of social learning which directly involves the goals that learners pursue. Learners develop a variety of attitudes toward Mathematics as a result of their experiences. Bandura (1986) states that

learners act on what they believe they can do and what they expect the 'outcomes' to be. Self-efficacy research has shown that learners, who perceive themselves to be efficacious, perform differently from those who perceive themselves to be less efficacious. Bandura (1986) emphasises that learners who anticipate failure in a Mathematics task, and experience strong emotional feelings of stress and fear, have low self-efficacy in Mathematics. The theory of self-efficacy has important implications with regard to motivation. Bandura's (1986) basic principle is that learners are likely to engage in activities to the extent that they perceive themselves to be competent in those activities. With regard to Mathematics, this means that learners will be more likely to attempt, persevere, and to be successful at tasks for which they have a sense of efficacy. When learners fail, this may occur because they lack the skills to succeed or because they have the skills but lack the sense of efficacy to use these skills well. Bandura (1986) suggests that one of the most important aspects of self-efficacy is the learners' perception of self-efficacy. In other words, learners will learn better if they believe that they are good at thinking strategies in a productive manner.

While it is important to enhance the self-efficacy of the learners themselves, self-efficacy theory also has important implications for other role players (Bandura, 1986). Instructional efficacy, as described by Bandura (1986) is the teachers' beliefs in their personal efficacy to motivate and promote teaching and learning that affects the type of learning environments they create and the level of academic progress their learners achieve. Teachers who have a high sense of instructional efficacy in Mathematics devote more instructional time to academic learning, give learners more help when they need it and are more likely to praise learners for their successful accomplishments. Teachers with higher self-efficacy are more likely to employ strategies that support their learners and motivate and encourage the learners. Bandura (1986) states that different teachers are likely to have varied perceptions of their collective self-efficacy. Teachers who judge themselves as having high self-efficacy are likely to provide an environment that will promote similar feelings and high levels of productivity among their learners. Learners base their attitudes to a large extent on the perceptions that they hold about their teacher. Bandura (1986)'s findings showed that learners develop a more positive attitude toward Mathematics when the teacher is perceived to be supportive and helpful. Bandura (1986) also showed that positive

attitude was encouraged when teachers emphasised the understanding of work.

According to Pajares & Schunk, (2001) high self-efficacy beliefs in learners tend to encourage feelings of calmness and confidence in the way they approach a task. Learners who are self-efficacious have the tendency to be self-confident and they are able to persevere to obtain success. Learners with low self-efficacy lack confidence and morale (Pajares & Schunk, 2001). Low self-efficacy tends to perpetuate itself. Self-reinforcement would include feelings of satisfaction or displeasure about behaviour gauged by personal performance standards. Pajares (2002) found that low self-efficacy and test-anxiety significantly influence learners' academic performance. The basic problem in anxiety or fear reaction is not emotional distress, but the belief that one cannot cope effectively with a particular situation. Learner modelling, the most effective technique for getting rid of undesirable behaviour, enables them to become progressively more dependent on their own efforts that increase their sense of self-efficacy.

2.4.2 The Social Cognitive Theory (SCT)

Bandura (1997) bases his theory on the acquisition of complex behaviours on a triangular diagram illustrating the interactive effect of various factors. Figure 2.1 illustrates these three factors which are behaviour, the environment, and the internal events that influence perceptions and actions. The relationship between these three factors is known as reciprocal determinism.

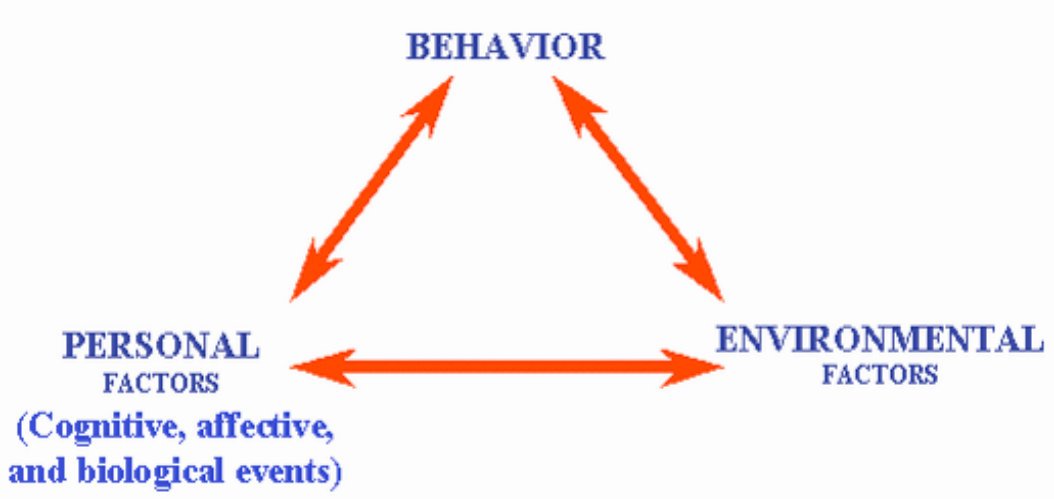

Figure 2.1 **The Social Cognitive Theory (SCT)**

Social Cognitive Theory (SCT) explains how learners acquire and maintain certain behavioural patterns, while also providing the basis for intervention strategies (Bandura 1997). Evaluating behavioural change depends on the factors: environment, person and behaviour. *Environment* refers to the factors that can affect learners' *behaviour*. Social environment include family members, friends and teachers. Environments that provide learners with interesting activities that motivate them and offer challenging tasks within their abilities inspire them to engage in such activities. Interesting resource materials can be used as stimuli to encourage learner thinking. An environment that is learner friendly and supports responsive behaviour encourages learners' intellectual development. It is evident in Figure 2.1 that the three factors, environment, personal and behaviour, are constantly influencing learners. *Observational learning* occurs when learners watch the actions of another person and the reinforcement that the person receives (Bandura, 1997). Observing teachers, parents and their peers easily influences learners. The characteristic of such observations is an important factor in determining the degree to which attention is paid to the model by the learner. Those who lack self-esteem and self-confidence are more prone to adopt the behaviour of models that are negative in nature.

Bandura (1997) identified three types of reinforcers of behaviour: direct reinforcement, vicarious reinforcement, and self-reinforcement. The learner would directly experience direct reinforcement. Vicarious reinforcement would be the consequences of the behaviour of the model. An emotional response can be classically conditioned by vicarious means. Vicarious experience is observing others perform threatening activities without adverse consequences. This can also enhance learners' personal self-efficacy by demonstrating that examples in Mathematics can be solved with a little effort and persistence. Vicarious experience can be enhanced through live modelling (observing others perform an activity), or symbolic modelling. Bandura (1997) notes that verbal persuasion leads learners to believe they can successfully accomplish a task or behaviour through the use of suggestion, exhortation, or self-instruction. However, because verbal persuasion is not grounded in personal experience, it is a weaker inducer of efficacy and may be extinguished by histories of past failures. Bandura (1997) is also of the opinion that emotional arousal can enhance perceived self-efficacy in learners by diminishing arousals such as fear, stress, and physical agitation, since these are associated with decreased performance,

reduced success, and other avoidance behaviours. Teachers can have a major influence on learners by using verbal persuasion and emotional arousal to improve learners' self-efficacy.

The SCT has generated research in the field of education to improve teaching and learning, especially in Mathematics education. Moreover, this theory has been especially prominent in studies of educational constructs such as academic achievement, attributions of success and failure, goal setting, social comparisons, memory, problem solving, career development and teaching and teacher education (Pajares, 2002).

2.4.3 *Theory of Constructivism*

Constructivism is a theory of how people learn. Constructivism advocates that learners are active participants in their own learning. Bruner's (1966) constructivist theory is a general framework for instruction based upon the study of cognition. Bruner (1966) argues that constructivism allows learners to construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences. Kanai & Norman (1997) emphasise that when learners encounter something new, they reconcile it with previous knowledge and experience. Teachers must allow learners to ask questions, and explore and assess what they know in the Mathematics class. Learners also need to be encouraged to use different techniques such as experiments, problem solving and using authentic data so that they get to create knowledge and reflect on their understanding in Mathematics. The teacher should be seen as a facilitator rather than someone who delivers knowledge (Kanai & Norman, 1997). The teacher needs to encourage learners to acquire knowledge for themselves and achieve their full potential. Constructivism emphasises the need to get learners to be self-motivated and to hone in on their skills, ability, knowledge and understanding.

The view of constructivism put forward by Bruner (1966) is that learners engage in discovery learning, obtaining knowledge by themselves. Bruner (1966) is of the opinion that in a constructivist Mathematics classroom, *learning is constructed.* Learners come to learning situations with already formulated knowledge, ideas, and understandings in Mathematics. Bruner (1966) is of the view that in a constructivist

Mathematics classroom, *learning is constructed.* Learners will integrate new experiences and interpretations to construct their own personal meaning with this previous knowledge. *Learning is active* when the learner creates new understanding for her/himself (Bruner, 1966). The teacher guides knowledge, but allows the learners to experiment, manipulate, ask questions and try things that don't work. *Learning is reflective when* teachers create opportunities for learners to question and reflect on their own learning processes, either individually or in group discussions (Bruner, 1966). The teacher should also create activities that lead the learner to reflect on his or her prior knowledge and experiences in Mathematics. Bruner (1966) explains that *learning is collaborative* when the Mathematics teacher allows collaboration among learners because learners learn from their peers. When learners review and reflect on their learning processes together, they can learn strategies and methods from one another. When there is collaboration, communication takes place and the 'shy' learners who were reluctant to participate at the beginning of the lesson will be motivated to be more involved. It is essential that the use of collaborative learning activities in the Mathematics classroom enables learners to generate more ideas and to experience less stress in expressing themselves in the class. *Learning is inquiry or problem-based* when the main activity in a constructivist Mathematics classroom is solving problems (Bruner,1966). Learners use inquiry methods to ask questions, investigate aspects of geometry or algebra and use a variety of resources to find solutions and answers. Bruner (1966) argues that *learning is evolving* when learners have mathematical knowledge that they may later see as inappropriate, or insufficient to explain new methods of solving a problem. As learners explore a topic or problem, they draw conclusions and modify their methods to support new methods of problem solving.

Kanai & Norman, (1997) emphasise that constructivism modifies the role of the teacher so that teachers help learners to construct knowledge rather than reproduce mathematical knowledge. The constructivist teacher provides tools such as problem-solving and inquiry-based learning activities so that learners can formulate and test their ideas, draw conclusions and inferences, and convey their knowledge in a collaborative learning environment (Bruner, 1966). Constructivist teachers encourage learners to assess how the activity is helping them gain understanding in Mathematics. By questioning themselves and their peers, learners become expert learners as they

learn how to learn. The learners then have the tools necessary to become life-long learners in Mathematics.

2.4.4 *Gender Theory*

Chafetz (2006) states that gender theory consists of two types of forces that sustain gender inequality: coercive and voluntary forces. Coercive forces revolve around the extent to which males have the advantage over females and are able to use this advantage to their benefit. Voluntary forces follow from coercive forces because once a system favouring males exists, it constrains the options that females have (Chafetz, 2006). Pajares & Schunk, (2001) cite the work of several researchers whose findings show that gender differences in Mathematics self-efficacy beliefs are still a reality. Girls are more likely to attribute the reason for their good Mathematics performance to effort rather than ability (Chafetz, 2006). Common to the thought of 19th and 20th century social theorists such as Spencer, Durkheim, Tonnies, Simmel and Weber, was the assumption that the public domain was a male only affair since the beginning of time (Chafetz, 2006). Women were not only "innately different … in their intellectual, emotional and moral capacity" and thus naturally inclined towards domestic activity, but were actually incapable of tasks "beyond the care of husband and children" (Chafetz, 2006, p.4). Learners in the Mathematics class should be given productive activities and should be reminded that they must break away from traditions and norms that restrict women to child rearing, food gathering and preparation.

More recent literature has argued that the salience of gender may be greater in some social interactions or contexts than in others (Chafetz, 2006). A domain associated with masculinity, such as a Mathematics course, is a key context in which gender is likely to be a salient factor (Correll, 2001) and in which girls might look to their same-gender peers for cues about behaviour. Thus, while both boys and girls respond to social influences and pressures during high school, girls' social relationships and interactions have been shown to have more pronounced implications for their academic choices, particularly in certain areas. Both teachers and learners may subscribe to theories about gender. At its core, the feminist theory holds that the genders are equal (Chafetz, 2006), but that males enjoy greater access to resources than females. Thus inequality is "produced socio-culturally and is not immutable" (p.

966). In dealing with such important issue within a social context such as learner interaction, ignoring gender differences would be an oversight. Correll (2001) states that it may be that boys are less responsive to group phenomena than girls because boys draw less of their identity from membership of a social group and are less aware of the social group. Collaborative work in Mathematics would help, to a certain extent, to reinforce learners' identity without gender stereotyping.

Correll (2001) emphasises that the "male-advantaging" stereotypes include beliefs that men are naturally more skilled at or interested in technical domains that are believed to be necessary to be successful. While there are ample reasons to doubt the truth of these beliefs, the beliefs themselves can shape the decisions of men and women to follow certain careers. Gender stereotypes can undermine task performance. If a learner performs less well in an assessment of some ability, then that particular learner will likely come to see herself as having less of that ability. Correll (2001) argues that gender beliefs can influence the standard that we use to evaluate our task performance. Stereotyping Mathematics, as a predominantly male domain is an important variable in understanding the complexities of gender and Mathematics achievement, stereotyping Mathematics may account for poor performance of girls (Fennema & Sherman, 1976). The implication is that, if teachers do not help to overcome gender stereotypes in the Mathematics class, we will contribute to the under-representation of women in various career paths.

How do these differences in gender manifest in education? Teachers must ensure that equal priority is given to girls and boys in the Mathematics class. When ideologies, norms and stereotypes portray males and females differently, socialisation will tend to reinforce these differences (Chafetz, 2006). The mindset of parents needs to be changed as well, and boys and girls should be encouraged to do well in Mathematics to ensure good careers. All role players need to reinforce the correct attitude in learners so that they move away from gender stereotypes, which have been a bone of contention for many decades and generations. It can be argued by Chafetz (2006) and Correll (2001) that stereotypes also has an impact on the standard learners use to decide whether their performance indicates that they have sufficient ability. The common idea is that when one knows that others do not expect one to be good at a given type of task, one would judge his or her own performance by a more stringent

standard. An important feature of these models is that they all consider the concept and identification of MA and CA.

The common threads running through all the models that were discussed is for all role players to understand the dilemma learners confront with regards to MA and CA in the Mathematics class. The implications for implementing the various theoretical framework into the Mathematics class are very important. A positive learning environment will improve teaching and learning in Mathematics. It is important that the learning styles and preferences of learners are effective. Educators must be aware of factors such as MA and CA that may impede effective learning. An example of the application of Bruner's (1966) constructivism theory in the classroom are as follows: learners are actively involved, environment is democratic, activities are interactive and learner-centered and the educator facilitates a process of learning in which learners are encouraged. Learners need to feel safe and a supportive environment is essential. Mathematics educators need to highlight the importance of recognising individual learning styles. The learning environment is significant because it has an impact in either encouraging or impeding a positive learning experience for learners. A range of theories, concepts and approaches can be used to build and manage effective teaching and learning. It is important for educators to identify effective methods of teaching models from the theoretical framework and be able to integrate thinking skills into their teaching of Mathematics This is why it is important that the models should be integrated into the Mathematics class to alleviate the negative impacts of MA and CA that learners may experience.

2.5 Summary

Research in the areas of MA and CA points to their effect on learners' attitude to Mathematics. The perceptions, experiences and attitude of learners in the Mathematics classroom is very important in the teaching and learning process. This study focuses on learners' perceptions and experiences in the Mathematics class in order to enable teachers to understand the challenges learners confront in Mathematics.

CHAPTER 3

RESEARCH METHODOLOGY

Chapter three details the methodology used to obtain the data for this study. This chapter provides a detailed account of the research process, which led to the collection of data. The data that was obtained provided answers to the main research questions. This chapter discusses the research context, the research design, the rationale behind the research methodologies and data collection instruments, the data collection process, ethical considerations, the participants and the techniques that were used in the analysis and interpretation of the data.

3.1 Research Context

The research was conducted at Riverview High School on the north coast of KwaZulu-Natal. Riverview High School is well established and caters predominantly for learners from the north coast and surrounding areas. Most of the learners come from an average socio-economic background. The school also has a small percentage of learners who come from nearby informal settlements. In some families both parents are employed, some are single parents who are working class and some learners' parents are unemployed. The school consists of 800 learners. Class sizes are between 35 and 45 learners. The class sizes cannot be reduced because the school fees are too low to employ more teachers. Riverview High School has produced excellent results in the Senior Certificate examination in the past years.

3.2 Reason for the Study

This study sought to establish learners experiences of MA and CA in the maths class. The research questions were developed in order to determine the research methods and data collection instruments that would be the most appropriate to gather the data that was needed. Fennema-Sherman Mathematics Attitudes Scales, which has clearly been the most popular instrument in research about attitudes toward Mathematics (Fennema & Sherman, 1976). These questions provided a focused means of investigating the research area (Cohen, Manion & Morrison, 2005). The following questions were drawn up to obtain preliminary data (a) what are secondary school learners' attitudes towards Mathematics? (b) What are secondary school

Mathematics learners' levels of CA? and (c) How do secondary school learners account for their levels of MA and CA? As a researcher, I aim to capture the reality of the learners' experiences and thoughts about MA and CA in Mathematics. One of the aims of Mathematics education is to further develop learners' knowledge, competency and interest in the subject. It was found that learners had negative attitudes towards Mathematics (Osman, *et al*., 2010). From my own teaching experience, it was observed that some learners do well during Mathematics lessons and assignments; yet fail to perform well in examinations. Although there are many diverse reasons for poor performance in Mathematics, two prevalent variables worth considering are MA and CA. Since some research has been done in the area of MA and CA among secondary school Mathematics learners, this study is aimed to add to that body of knowledge.

3.3 Research Methodology

Mixed methods research is used in this research study which involves both qualitative and quantitative methods. A typical type of study that employs this approach would be the use of a survey to first establish attitudes of participants towards a topic and then follow up with an interview to learn about individual perspectives on this topic (Maree, 2010). These methods will help to identify the strengths and weaknesses of the learners in Mathematics. They provide a focused means of investigating the research area (Cohen *et al*., 2005). Pinpointing the facts needed to make these decisions will help to identify the best methods for collecting this data. Some types of information may require quantitative data collection methods, such as detecting any measurable differences in knowledge or behaviour of learners in the Mathematics class. Soliciting learners' reactions to a selection of programme messages, on the other hand, may be best done through qualitative methods. According to Vithal and Jansen, (1997) it is very important to recognise the multiplicity of the sources of data collection. The data collected from the questionnaires and the interview would help to provide the answers required to address the scope of the research topic. An effective research study requires a combination of research approaches in order to generate the data needed for decision-making. Cohen *et al*. (2005) note that each approach has positive attributes, and that combining different methods enable the researcher to gain the best of both research worlds. This combination of approaches was necessary because of the wide range of data needed to develop the research study.

3.3.1 The Quantitative Method

According to Cohen *et al*. (2005), quantitative research is defined as social research that employs empirical methods and empirical statements. They add that an empirical statement is defined as a descriptive statement about what "is" the case in the "real world" rather than what "ought" to be the case. Moreover, Creswell (2009) provides a concise definition of quantitative research as a type of research that is used to explain a particular phenomenon by collecting numerical data that are analysed using mathematically based methods. The strengths of the quantitative methods in my research were to produce quantifiable and reliable data that are indicative of the learners' views of Mathematics as a subject. Quantitative measures are often most appropriate for conducting needs assessments or for evaluations comparing outcomes with baseline data. Researchers use quantitative research methods to test hypothetical generalisations and also to emphasise the measurement and analysis of causal relationships between variables (Denzin and Lincoln, 2005).

While it is important to use the most suitable data analysis tools, it is even more important to use the appropriate research design and data collection instruments. The questionnaires used in this research study will reveal the attitudes, experiences, and self-efficacy beliefs that learners hold about their Mathematics performance and CA levels. My aim in using the PRCA-24 questionnaire is to establish learners levels of CA in Mathematics. It will also guide educators to plan learning activities which will help in reducing learners' CA in Mathematics. In quantitative research, it was imperative to determine MA and CA in learners' attitudes towards Mathematics. Quantitative data collection methods use a limited range of predetermined responses with which to measure the experiences and perceptions of the participants. The quantitative approach uses questionnaires (Creswell, 2009) to establish the levels of MA and CA exhibited by learners who study Mathematics. The data from this type of research can be represented graphically. This type of research facilitates the analysis the of data. Integrating quantitative and qualitative research methods lends depth and clarity to this research study.

3.3.2 The Qualitative Method

Qualitative research is concerned with exploring social and human problems in a natural setting, with the intention of understanding what people feel the way they do

the experiences that have caused them to have these feelings (Cohen *et al.,* 2005). Creswell (2009) states that the qualitative approach in the form of a group interview will provide rich detailed data from learners' personal experiences. Qualitative methods include interviews with a focus group. This will allow participants to inform the interviewer of unforeseen barriers or opportunities to adopting the behaviour needed to increase their chances of success.

The focus group for this study consisted of three participants. These three participants volunteered to be interviewed. Originally I had five participants who volunteered and then two of them withdrew from the interview. Learners would not feel intimidated because they were amongst their own peers and they could respond freely. Open-ended questions allowed me to delve into the personal experiences of the respondents that would reveal and verify emerging themes concerning their attitudes and experiences in the Mathematics class. The interview helped to understand and learners' feelings and meanings of situations through the lens of the learners. The advantage of using qualitative methods is that they generate rich, detailed data that leave the participants' perspectives in tact and provide a context for specific types of behaviour. The quantitative and qualitative process research can be conducted simultaneously to collect and react to data. Although a qualitative study would encapsulate the experiences of learners, it would not be useful in generalising about the entire grade 9 learners. Cohen *et al.* (2005) argue that a case study researcher typically observes the characteristics of an individual unit and that the purpose of such observation is to probe deeply and to analyse intensively the multifarious phenomena in order to establish generalisations about the wider population to which that unit belongs. In order to gather rich and detailed descriptions of learners' experiences, more than one method of data collection was used. This allowed me to listen carefully to the nuances of the learners when they spoke about their experiences in the focus group, but also to assess the opinions of a large number of learners who responded to the questionnaire. This allowed for one set of instrument to verify or refute the other.

3.3.3 Interpretivist Paradigm

This research is a case study of secondary school learners' experiences of MA and CA in Mathematics. This case study is an in-depth study of one particular grade at a

school. This case study is a naturalistic research that is used in the interpretivist paradigm (Denzin *et al*., 2005). The relationship between philosophy and research practice, which is generally a way of looking at the world, is known as a paradigm (Cohen *et al*., 2005). Data gathered within the interpretivist research paradigm is primarily descriptive, although it may be quantitative in terms of using coded questionnaires. Ontology refers to the nature of social reality (Cohen *et al*., 2005). The ontological aspect of this research deals with the kind of knowledge learners would have about the reality of Mathematics. Learners come into the Mathematics classroom with innate ideas and *a priori* knowledge. It was necessary to interpret and investigate the reality of such ideas in conjunction with MA and CA that learners exhibit. Research set in the interpretivist paradigm can address questions about how and why something is happening. It can also address questions about what is happening in a wider context and what the nature of reality of the learners' MA and CA is.

Denzin *et al*. (2005), argues that all behaviour is based on interpretation and therefore, the perceptions and experiences of those who are served must be grasped, interpreted and understood if solid, effective applied programmes are to be created. Epistemology refers to the nature of knowing and construction of knowledge (Cohen *et al*., 2005). The epistemological aspect of the research is the basic assumptions acquired by learners about what was known about the reality of their views of Mathematics. The overarching perspective concerning appropriate research practice, based on ontological and epistemological assumptions, directed the research study. Therefore it was essential to base my research study in the interpretivist paradigm. Denzin *et al*. (2005) argues that the interpretivist paradigm can also address questions about what is happening in a wider context and what is likely to happen in the future. Research set in the interpretivist research paradigm can address questions about how and why something is happening. Denzin *et al*. (2005) is of the opinion that the 'truth' has to be a conclusion in the mind of a researcher's power of argument. The interpretivist paradigm would provide suggestive interpretations of a particular group of learners at a particular time. This study therefore requires an interpretivist approach to get an understanding of learners' behaviour, and an empathic understanding of learners' actions towards Mathematics. The importance of the researcher's perspective and the interpretative nature of this particular research is a reality of the

learners' experiences in Mathematics. The meaning existed in my interpretation of the situation at Riverview High School .

3.4 Research Instrument

Three instruments were used to obtain the data.

3.4.1 Instrument 1- The Fennema- Sherman Mathematics Attitude Scale - MAS

The first instrument was the Mathematics Attitude Scales (MAS), which has 50 questions and is based on The Fennema- Sherman Mathematics Attitude Scale (Fennema & Sherman, 1976). The Fennema-Sherman Mathematics Attitude Scales was developed in 1976, and has become one of the most popular instruments used in research journals over the past three decades. The Fennema-Sherman Mathematics Attitude Scales consist of of nine subscales. For the sake of my research study, I selected the following seven subscales: (a) personal confidence about Mathematics: self confidence/self-efficacy, (b) enjoyment of Mathematics, (c) attributing factors, (d) perceptions that Mathematics is a male domain, (e) perceived usefulness of Mathematics , (f) perceptions of teacher attitude and (g) general. The number of statements per scale varied. There were 38 statements in the entire MAS questionnaire. Positive and negative statements were included in the scale, although these were not equivalent in number. The instrument uses Likert scales. The Likert Scale caters for a range of responses that exhibit varying degrees or intensities of feelings, thereby making it a flexible tool to use; yet it generates statistics that can be easily analysed. A five-point scale was used and the responses ranged from "disagree strongly", to "disagree", "neither agree nor disagree", "agree" and "agree strongly". Learners were asked to place a 'cross' in the appropriate column. An example was provided for the learners to use as a guide in responding to the statements in the questionnaire. Sample questions from the MAS are presented in Appendix A.

3.4.2 Instrument 2- The Personal Report of CA- PRCA-24

The second instrument was used to measure levels of CA in Mathematics. The Personal Report of Communication Apprehension (PRCA-24) is a questionnaire, which consists of 24 questions. The PRCA-24 is an international questionnaire that was adapted by McCroskey (1982). I selected the PRCA-24 because the items clearly reflect both anxiety and the behavioural components of assertiveness. McCroskey

(1982) states that the validity of the PRCA-24 has been established by correlating with nonverbal components of assertive behaviour, trait and interpersonal anxiety. The data collected will help to explain the possible relationships that exist between these variables and the impact of CA on learning Mathematics. The PRCA-24 uses Likert scales with a range of "strongly agree" to "strongly disagree". The total score is calculated as in MAS. The PRCA-24 questions' "...reliability...is very high, usually above 90" and there is "...overwhelming evidence for the predictive validity of the measure" (McCroskey, 1982, p. 92). A high score means that a learner has more anxiety related to CA. High scores range from 80-120, while low scores are below 50. A low score means that learners experience less CA. The score should range between 24 and 120. If a score is below 24 or above 120, this indicates a mistake in computing the score. Scores above 85 indicate a high level of CA, between 55 and 85 indicates a moderate level of CA and scores between 24 and 55 indicate a low level of CA. "It is clear that CA is associated with both negative attitudes and lower achievement" (McCroskey, 1982, p. 32). The focus is not on association between PRCA-24 scores with learners' specific responses to a single communication encounter. The PRCA-24 scores are based on multiple responses across a broad range of situations in the Mathematics class. Sample questions from the PRCA-24 are presented in Appendix B.

3.4.3 Instrument 3- The Focus Group Interview

The third instrument was the interview. The interview consisted of a combination of unstructured questions, which consisted of a focus group discussion, observations, semi-structured questions and structured (closed questions). These questions will provide a means of investigating the research area. The main purpose of the focus group research was to draw upon respondents' attitudes, feelings, beliefs, experiences and reactions in a way that would not be feasible using other methods; for example observation, one-on-one interviews, or questionnaire surveys. Group interviews bring together learners of differing ability and perceptions and minimise the intimidation factor that could arise in individual interviews. The success of a group interview is dependent on many factors. The interviewer and interviewees need to work together. The learners should be made to feel relaxed and the interviewer must be trustworthy so that the learners will be encouraged to respond truthfully. Responses from this interview would also need to be analysed (Cohen *et al*., 2005). The interview would

establish information about learners' experiences in Mathematics and ascertain the degree to which specific affective factors affect their learning in Mathematics. The aim of the interview was to allow the learners an opportunity to express their perceptions of Mathematics, for the interviewer to probe their responses, and for them to suggest a way forward. The interview sought to verify the emergence of MA and CA in learners. This would help to understand the *status quo* and meanings of situations in the Mathematics class through the lens of the learners. A copy of the interview questions is presented in Appendix C.

3.5 Data Analysis

Data from the MAS and PRCA-24 questionnaires were collected and compiled using a computer spreadsheet program on Microsoft Excel. Learners were assigned numbers that protected their identity but preserved their gender. In addition to recording each learner's score on the MAS and PRCA-24, the 2011 second term percentage mark in the Mathematics examination and assessment was entered on the spreadsheet. Mathematical calculations were used to analyse the data from the MAS and PRCA-24 instruments for this study. 36 responses out the 38 questions from the MAS questionnaire have been tabulated under each subscale according to the factors that were tested and have been represented. Two questions showed similarities when the factor analysis was done. The minimum score for the MAS questionnaire was 36xl=36 and the maximum was 36x5=180. Factor analysis is a method of data reduction. It does this by seeking underlying variables that are reflected. Factor analysis is a pattern of results such that each variable loads highly onto specific factors. A computer programme was used to determine the number of factors and determine which number of factors yields the most interpretable results as reflected in the excel spreadsheet. The following was the scoring formula used for PRCA-24. Group discussion: 18 + (scores for items 2, 4, & 6) - (scores for items 1,3, & 5) Meetings: 18 + (scores for items 8, 9, & 12) - (scores for items 7, 10, & 11) Interpersonal: 18 + (scores for items 14, 16, & 17) - (scores for items 13, 15, & 18) Public Speaking: 18 + (scores for items 19, 21, &23) - (scores for items 20, 22, &24) The subgroups for both questionnaires were rearranged according to the factor analysis. The Personal Report of CA (PRCA-24) overall CA score was arrived at by adding together the subgroup scores for each of the participants. The score should range between 24 and 120. A score between 84 and 120 indicates a high level of CA.

This would assist in establishing the underlying factors that are influential in determining the levels of CA and MA in individual learners. In addition, the data were examined to determine the levels of MA and CA in learners in conjunction with their MAS and PRCA-24 scores. Data on males and females were analysed separately to determine if a gender difference existed.

The recorded group interview with the learners was transcribed accurately. Key factors that emerged from the interview were linked directly to how the learners accounted for their levels of MA and CA in the Mathematics class. Data gathered from this research study would enable the researcher to understand reasons for the three learners attitude , self efficacy beliefs and CA pertaining to Mathematics.

3.6 Ethical Clearance

Seeking consent is a necessary process as it protects all role players and the researcher from any future problems. It also provides proof of the authenticity of data collected and the processes that were used (Cohen *et al*., 2005). All human subject protection regulations were implemented to ensure the privacy of the participants and the confidentiality of information was made clear and followed throughout the study. The assurance of confidentiality and anonymity dictates that this dissertation should at no point suggest or reveal information that can identify the respondents (Cohen *et al*., 2005).

3.6.1 University Approval

The University of KwaZulu-Natal requires the research proposal to be reviewed by a research committee for any research done with human subjects. The research proposal for this study was reviewed and approved by the Research Ethics Committee of the Faculty of Education. The protocol reference number is HSS/0707/011M. A copy of the Certificate of Ethical Clearance is presented in Appendix G.

3.6.2 School Approval

The proposal for the study was submitted to the Department of Education and Riverview High School principal. The principal reviewed the consent letter and permission was granted. A copy of the correspondence is presented in Appendix F.

3.6.3 Parents' and Learners' Consent

According to Cohen *et al*. (2005) the researcher should first get consent from the adult under whose authority the learner is during the context of the research and secondly from the learners themselves. A letter was sent to the parents of learners in three classes of Grade 9 at Riverview High School requesting written consent for their children's participation in the study. The study and its intentions were explained. Another letter was given to learners, requesting that they participate in the research on a voluntary basis. The parents and learners were asked to sign and return the consent forms to me. A copy of the explanatory letter and consent form are presented in Appendix E and Appendix D.

3.7 Participants

This study used a convenience sampling method to select the respondents. A convenient sample consists of using the most readily available or most convenient group of subjects for the sample (Cohen *et al.*, 2005). This convenience sampling method was chosen because it provided easy access to the respondents. It was simple, practical, economical and quick. The respondents were attending Riverview High School where the researcher teaches. Riverview High is an ex-House of Delegates School, where the population comprises of learners from a variety of ethnic and socio-economic backgrounds. At the time of the study, Riverview High had a population of 800 learners. The study sample was learners from three grade 9 classes. The participants consisted of 97 Mathematics learners. I decided on selecting the entire grade 9 learners so as to have a wide range of responses that makes my research trustworthy. Each of the classes exceeded the recommended maximum class size of 32 learners. The number of respondents were as follows: 29 , 32 and 36 learners. All participants were between the ages of 14 and 16 years. There were more female participants (62) than male participants (35). Three grade 9 learners formed a focus group for the interview. There were 6 learners who originally volunteered to form part of the focus group whilst the others seemed sceptical to be part of the interview. The power differential between the learner and researcher might make the learners feel obligated to participate in the research, even though they might not want to (Cohen *et al.*, 2005). Although I tried to make the the interview informal and allowed learners to be comfortable, 3 learners withdrew and 3 remained in the focus group for the interview. Learners were informed that their withdrawal or participation in the study

was completely voluntary and would not influence their marks in Mathematics.

3.8 Triangulation

Triangulation in this research was essential due to the need to use multiple methods of data collection in order to avoid bias. According to Cohen *et al*. (2005), in social sciences triangulation attempts to map out, or explain more fully, the richness and complexity of human behaviour by studying it from more than one standpoint. In qualitative research, triangulation aims to enhance the credibility and validity of the results. The combination of different methods, methodological perspectives or theoretical viewpoints strengthens this research study. This may mean using several kinds of methods or data, including using both quantitative and qualitative approaches to research. In the research process on which this dissertation is based, triangulation was achieved through multiple data collecting sources, procedures and strategies.

3.9 Limitations of the Study

It was not possible to follow the time frames that had been drawn up due to the fact that schools are dynamic institutions and time was lost on unforeseen disruptions such as inclement weather and teacher absenteeism. The data collection instrument, particularly the questions for the focus group interview are not without its disadvantages, because it is time consuming to design and refine (Cohen et al., 2005). A questionnaire also has its limitations in terms of the scope of the questions that can be asked and the range of the responses that can be anticipated (Bell, 1993). Due to strict time constraints at school, there was minimal time to complete data collection. The focus of the study was open to subjectivity. Mathematics is interpreted by different people in different ways and produces constructs of varying levels of confidence. As such, an interpretivist approach was most suitable for my research study. The authority of this study is open to question since the interpretivist method is subject to the perceptions of the researcher, and as such could be criticised as lacking rigor. The questionnaire itself could potentially be a source of anxiety in participants and the data was therefore likely to be affected. However, as far as possible, MA, CA and subject knowledge are considered and questions are raised regarding how they can be measured. Data collection was limited to one interview with 3 learners in the focus group in order to gain a picture of Mathematics from the learners' perspective.

Such a small-scale study is restricted in terms of reliability, and the limitations inherent in a single interview are recognised.

3.10 Summary

A description of the participants, the MAS and CA instruments and their administration and the manner in which data were compiled and analysed were presented in this chapter. These methods were the most appropriate to obtain the data that was needed to steer this research study and to establish the existence of barriers in the form of MA and CA in the Mathematics class. Ethical considerations and the limitations of the study were also outlined. The next chapter will present the results of the study.

CHAPTER 4

RESULTS

The chapter provides a summary of the data that was gathered during the research process. It contains results from the MA Scale (MAS) and the Personal Report of CA (PRCA-24) questionnaire from each participant. Data from the questionnaires and the focus group interview are presented. The purpose of the research study was to generate and capture themes on learners' attitudes towards Mathematics and the reasons they attribute to their levels of MA and CA in Mathematics. The quantitative aspect of the study, the MAS questionnaire for MA and the PRCA-24 questionnaire for CA, were administered subsequent to the qualitative research, the interview, with the intention of determining whether the findings from the qualitative research were representative of all grade nine Mathematics learners. Although the intention of the study is not to elaborate on gender differences in relation to MA and CA, I present some information concerning gender and its importance in this study. The research study was intended to elicit learner perceptions and ideologies for strategies that can be used to improve their learning in Mathematics. The data revealed emerging themes that provided responses to the main research questions. These themes enabled me to understand the challenges that learners face in the Mathematics class.

The findings provide a basis for the recommendations that will be made for the improvement of teaching and learning Mathematics. This chapter focuses on the data obtained in order to provide answers to the research questions. It describes the events that indicate how the analysis supports the interpretations that have been drawn. Evidence from the questionnaires and the focus group interview are used to make interpretations and analysis.

4.1 Identifying Subscores

I first verified the reliability and validity of the questionnaire. The Cronbach alpha coefficient was calculated and an overall reliability score of 0.997 was obtained. The Cronbach Alpha test shows a reading of 0.997, meaning that the data is reliable so it can be used. The accepted standard is > than 0.7 and as a result of the Cronbach Alpha test there is consistency in the instrument. The data analysis of the findings in

the MAS questionnaire were originally reported under the following key headings: (a) personal confidence about Mathematics: self confidence/self-efficacy, (b) enjoyment of Mathematics, (c) perceptions that Mathematics is a male domain, (d) attributing factors, (e) perceived usefulness of Mathematics, (f) perception of teacher attitude and (g) general attitude to Mathematics. After the factor analysis was done the seven subscales were reduced to four namely: subscale one: personal competence and confidence: summarised by the composite statement *I feel competent and confident and enjoy the maths class*, subscale two (b*) my teacher affirms me*, subscale three (c) *maths will be useful in my adult life* and subscale four (d) *maths is more for boys than girls*. I present some information concerning the attitudes learners have regarding Mathematics, levels of CA and some gender concerns with rellevance to its importance in this study. The sub-scores on the PRCA-24 questionnaire were computed. The four communication contexts–group discussions are, (a) *participatory roles*, (b) *interpersonal conversations,* (c) *group discussion* and (d) fear *of speaking*. An overall CA score was then calculated.

The data from the questionnaires have been summarised with learner responses of "Agree", "Strongly Agree", "Disagree" and "Strongly Disagree". The sub-scores for each group were calculated. The groups were rearranged according to the factor analysis. The Personal Report of CA overall CA score was calculated for each of the participants. The score should range between 24 and 120. A score between 84 and 120 indicates a high level of CA. Scores between 71 and 85 indicate more than average CA. Scores from 50 to 71 indicate an average level of CA. Scores from 24 to 50 indicate a low level of CA.

4.2 MAS Scores in learners

Figure 4.1 indicates a box and whisker plot of the MA Scale scores for this research study. The total score for the MAS questionnaire was 180 for the total sample (where the minimum score was 36 x l = 36 and the maximum was 36 x 5 = 180). Learners MAS scores were varying.

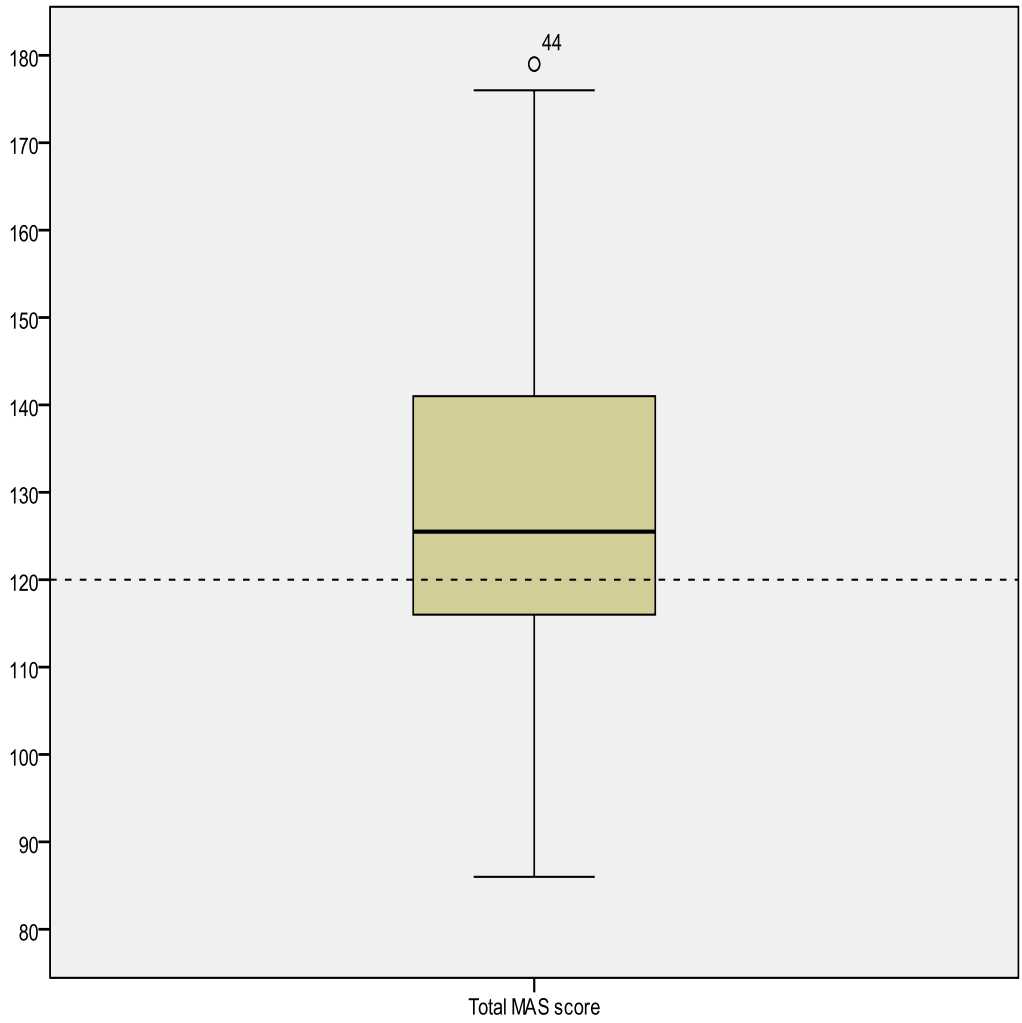

Figure 4.1 **MAS scores for learners**

If the sample scores are separated into Quartiles, Quartile l is 115, Quartile 2 is 126, and Quartile 3 is 141.5. One quarter of the students scored higher than 141.5. This means that 25% of learners experienced some levels of MA. One quarter of the students scored lower than 115. The lowest MAS score was 86 and the highest was 179. The learner whose MAS score was 86 had a mark of 41% and the learner whose MAS score was 179 had a mark of 80% in Mathematics. Two learners had a MAS score of 174 and their marks were 98% and 78%. The total MAS scores are inversely related to the learners' MA (Fennema & Sherman, 1976). A learner whose MAS score was 88, obtained a mark of 36% and another learner's MAS score was 116 had a mark of 26% in Mathematics for the second term. Quartile 2 is the median, which indicates that 50% of the learners scored less than 126. It is evident that learners had varying scores in the MAS questionnaire.

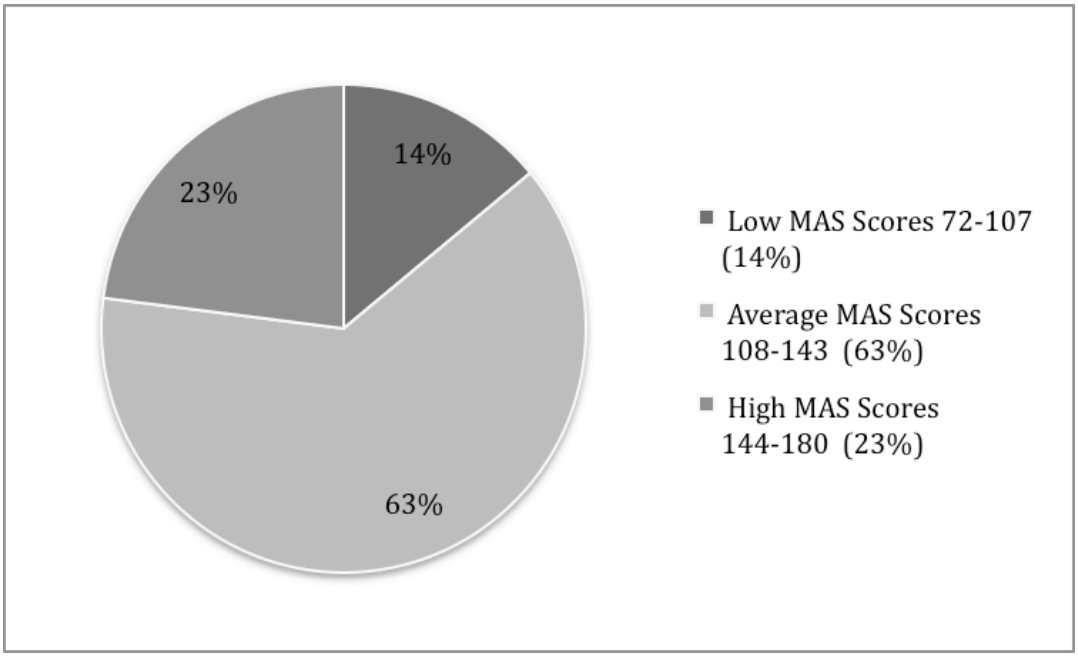

Figure 4.2 **Distribution of MAS scores in grade 9 learners**

Sixty three percent of the learners MAS scored from 108 to 143. 14%of the learners had a MAS score (between 72 and 107). The MAS scores in figure 4.2 indicates that these learners experience varying levels of MA. Twenty-three percent of the learners scored from 144 to 180. According to Fennema & Sherman, (1976) a high score means that learners experience low levels of MA. Learners' MAS scores ranged from 86 to 179 out of a total of 180 and these learners experience varying levels of MA which may impact on their performance in Mathematics.

4.3 Subscale 1: I feel competent and confident and enjoy the Mathematics class

Figure 4.3 indicates the learners' responses to the questions that fall in the first subscale of the MAS questionnaire. The aggregate scores were calculated for each learner. 11% of the learners strongly disagreed and 22.5% disagreed that they felt competent and confident in Mathematics. A total of 33.5% had responed that they strongly disagreed and disagreed for Subscale 1 that pertains to questions regarding learners' feelings of competency, confidence and enjoyment in the Mathematics class. As noted by Hembree, (1990) the first years of secondary school have been identified as a key period in the development of MA. It was evident that 33.5% of learners have experienced some level of MA in subscale 1.

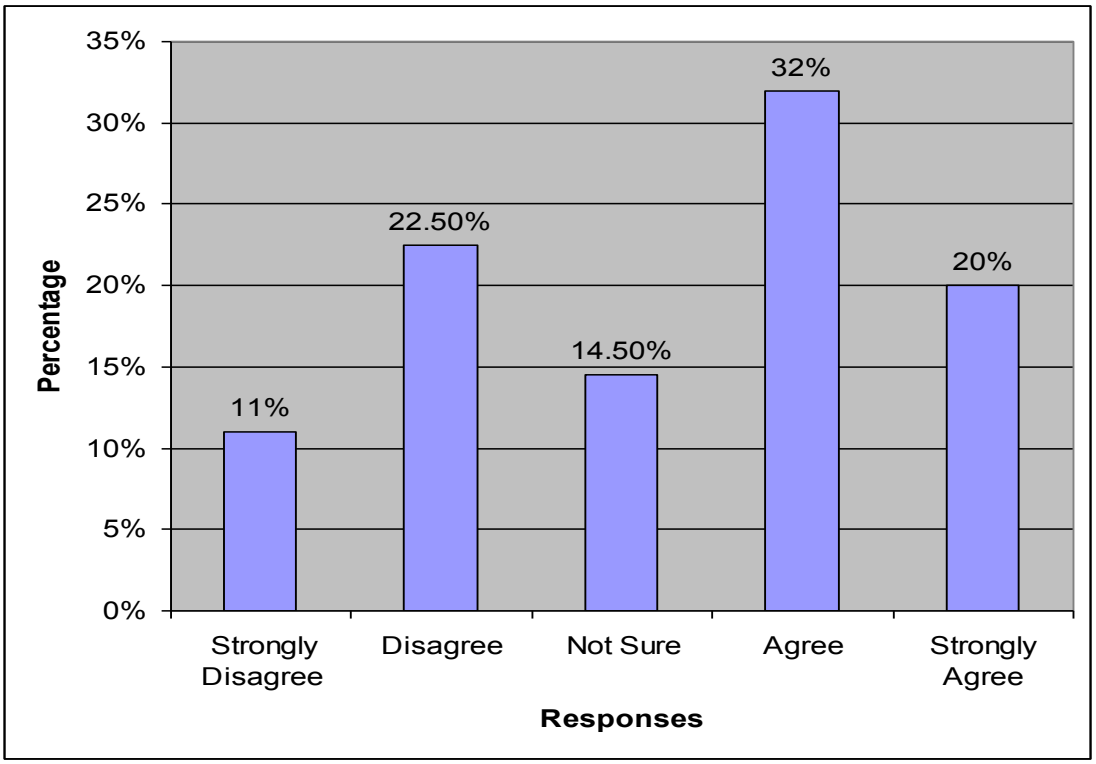

Figure 4.3 **MAS score distribution for Subscale 1: I feel competent and confident and enjoy the Mathematics class**

Table 4.1 indicates four selected examples from the 17 questions that appeared in Subscale 1 of the MAS questionnaire regarding self-efficacy. 45% of the grade 9 learners surveyed are not confident when doing Mathematics and only 29% of learners feel confident. 39% of the learners feel that they are just not good in Mathematics and they also find Mathematics too difficult. 44% get scared when they see a page full of Mathematics problems. This implies that many learners perceive themselves negatively in Mathematics.

Table 4.1 **Learner responses to selected items from Subscale 1: Personal competence and confidence**

Item	**Statement**	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
A04	I am confident of myself when I do maths	9	20	26	34	11
A07	I'm just not good in maths	13	26	18	23	21
A03	I find maths too difficult for me	6	30	14	33	16
A09	I often get scared when I see a page full of maths problems	26	18	6	32	19

* The numbers in each column reflects the percentage of learners' responses.

Figure 4.3 shows that 11% and 22.5% of the 97 learners have very low and low scores in columns 1 and 2 respectively in Group 1 of the MAS questionnaire. It is apparent that these learners lack confidence in their capability in doing Mathematics. Learners who experience this type of helplessness also have low self-efficacy beliefs and they believe that they do not have the ability to learn Mathematics. An average of 16% of learners responded that they were "unsure". It could be conjectured that 16% of the learners may also have low self-efficacy beliefs because they could not give a definitive response. High MA may contribute to the poorer performance in Mathematics, which will continue into the higher grades.

4.4 What are learners' perceptions and attitudes towards Mathematics?

Two out of the 3 learners who were interviewed indicated that they experienced problems in Mathematics. The interview revealed that the learners displayed predominantly negative attitudes and views towards Mathematics. Some responses are … *it gives you like a low self esteem* … . The learners said that they regarded themselves as being unsuccessful in the subject …. *I also try so hard and study so hard ... it scares me because my marks end up being bad ... it is very scarey to think that I could fail*. Feroza responded that … *it's just hard to understand no matter how much you try … it's hard to understand.* The underlying factor that emerged from the interview was that the learners have various negative perceptions and experiences in Mathematics. These aspects will be discussed below.

4.4.1 Learners perceive Mathematics to be difficult

Learners were asked to describe their experiences with Mathematics during the focus group interview. The 3 participants stated that Mathematics was difficult. The interviewees also attributed their poor performances in Mathematics to their perception that Mathematics was difficult. Ashton also commented that Mathematics was *hard … and a bit boring*. Jabulu confirmed that Mathematics is *hard and difficult.* Learners already have the preconceived idea that they are bound to encounter problems in Mathematics because they perceive Mathematics to be difficult. The learners said that they regarded themselves as being unsuccessful in the subject …. *it is very scarey to think that I could fail*. Jabulu's mark in Mathematics was 15%, whilst Feroza's mark was 54% and Ashton's mark was 49%. Although 2 out of the 3 participants had obtained a pass mark in Mathematics, all of them found Mathematics

to be difficult. …. *I also try so hard and study so hard… it scares me because my marks end up being bad.*. This is an indication that Ashton and Feroza worked very hard in Mathematics and they felt that they are not performing well.

4.4.2 Learners fear of Mathematics

Another negative attribute that learners have is their fear of Mathematics. Feroza said, *... it's tough, I fear school a lot because of Mathematics* .... Jabulu responded, *... I fear Mathematics because it is so hard to understand.* Ashton was also in agreement *... I fear Mathematics because there is a lot of work ... and I cannot manage to complete it.* The fear that the learners encounter causes anxiety when they learn Mathematics. Due to their fear of Mathematics, they tend to perform poorly in the subject. Jabulu responded *... I have been trying hard and I did not succeed.* Feroza said, *... I try my best ... no matter how much I try my best ... I just don't succeed.* Learners fear and lack understanding in Mathematics. Understanding Mathematics is problematic due to the learners' fear of the subject. Jabulu responded *... I find it hard to understand* and Ashton also confirmed that *... I don't understand Maths ...*whilst Feroza reiterated that *... it's hard to understand Maths.* All three participants expressed their fear for Mathematics during the interview. Such comments from the focus group interview indicated that learners had negative perceptions of Mathematics.

4.4.3 Negative experiences

It was evident from the focus group discussion that learners were afraid of participating in class discussions during Mathematics. When asked whether they felt comfortable to answer questions during Mathematics lessons, Feroza answered , *no ... it's scary because I don't have the correct answers most of the time.* Ashton also agreed that, *... I feel uncomfortable to answer questions because I don't know the correct answers.* When learners were probed further as to why they exhibited such discomfort in answering questions; Ashton responded that *... once when the teacher asked me a question and I got it wrong ... everyone started laughing at me.* Feroza explained *... people laugh and mock you ... it also gives you a low self esteem.* Responses from the interview indicated that peers played an important role in learner's beliefs about self-efficacy in Mathematics. It was evident that learners were affected by their peers' comments and attitudes, which were also responsible for their

perceptions about Mathematics. As was pointed out in chapter 2, self-esteem and CA have an inverse relationship with social-communicative anxiety and self-esteem. Various statements regarding learner perceptions of peers were included in the questionnaire.

Table 4.2 **Learner responses to selected items to their peers' responses from Subscale 1: Personal competence and confidence**

Item	Statement	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
D01	I am afraid to ask questions in class because my peers will think I am stupid	15	26	6	30	23
D02	The 'clever' learners in my class make me feel stupid	6	14	10	30	40

* The numbers in each column reflects the percentage of learners' responses.

Table 4.2 shows that 41% of participants were afraid to ask questions. They agreed that their peers were not supportive in the Mathematics class. Twenty percent of the learners claimed that their peers make them feel stupid in the Mathematics class. 30.5% of the learner responses indicated that the high achieving learners were not sympathetic to them. 30.5% of the learners felt discouraged by their peers' poor attitude towards them. It was also apparent from the MAS data that learners were intimidated by their peers' comments and that this was one of the reasons for their negative experiences in and perception of Mathematics. Learners also perceived their Mathematics teachers in different ways.

Table 4.3 **Learner responses to selected items from Subscale 2: My teacher affirms me**

Item	Statement	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
B05	My teacher makes me feel silly when I ask questions in maths class	9.5	9.5	13	35	33
B04	I feel that my maths teacher ignores me when I try to ask questions in class.	8.5	5.5	9	38	39
B06	My teacher only worries about teaching the clever learners in class.	8	6	11.5	32	42.5
B02	I wish my maths teacher would pay more attention to my maths learning in class	14	19	14	34	19

* The numbers in each column reflects the percentage of learners' responses.

It is evident from the responses, that some learners attributed their lack of confidence in Mathematics to their interaction with the Mathematics teacher. When teachers display a lack of confidence in learners' performance, learners will also feel that they are incapable of doing well in Mathematics. Learners also expressed their . . . *fear*. . . . during the interview. Ashton and Feroza indicated that they were afraid to ask questions during Mathematics lessons because of their anticipation of how the teacher might respond. According to Ashton, he was afraid to contribute to class discussions in Mathematics because ... *sometimes the teacher shouts ... if I get the wrong answer, the teacher says ... you are wasting my time ... maybe I did not pay attention.* Feroza agreed that ... *sometimes the teacher shouts at you or calls you names.* Being ridiculed by a teacher or peers ultimately contributes to their dislike of Mathematics. Teachers of Mathematics play a significant role in building learners' confidence and improving their self-efficacy beliefs. As noted in chapter 2, the classroom environment and the teaching practices adopted by the teacher may encourage learners to feel confident and they will thus enjoy Mathematics.

4.4.4 Learners experience of enjoyment in Mathematics

The learners' suggested in their responses that whilst they experienced extreme stress due to the difficulty of the subject and external pressure from their teachers and peers, there were times when they experienced positive perceptions and experiences in Mathematics. During the focus group interview, learners were asked whether they enjoyed Mathematics at any time and to relate their experiences in Mathematics, Feroza said, ... *sections like FOIL method in polynomials and geometry were the two sections in Maths I enjoyed because I actually understood that work*. Ashton's face gleamed and he laughed as he responded ... *me too* (that he enjoyed Mathematics at some point)... *geometry part* . Jabulu also expressed his happiness in his home language ... *Yebo (Yes!)* . . .when asked about his experience of enjoyment in Mathematics ... *I enjoyed the section on exchange rate because I did well in the test.* This suggests that learners' performance is better when they understand the mathematical aspects of a problem. Understanding Mathematics boosts the learners' enthusiasm and they tend to enjoy Mathematics. The focus group interview and the data generated by the questionnaire suggest that the teacher's disposition in the Mathematics lesson is important. The amount of confidence and self-esteem learners have link directly to the attitude of the teacher towards the learners. 2 of the learners

said that as they reached grade 8 and the other said that as they reached grade 7; their enjoyment in Mathematics diminished and so too did their performance level.

4.4.5 Importance of Mathematics

It emerged from the interview that all 3 of the learners concur that learning Mathematics is important. Although the learners displayed a negative attitude to Mathematics, they were still of the view that Mathematics was essential in their lives. Ashton explained that learning Mathematics is not a sheer waste of time ... *because you need to study Maths to get a good job ... whilst* Jabulu responded that ... *learning Maths can help you in many different ways.*

Table 4.4 **Learner responses to selected items from Subscale 3: Mathematics will be useful in my adult life**

Item	Statement	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
E06	I would like to avoid studying mathematics after matric	7	22	15	24	32
G03	I would prefer never to study maths ever again	9	12	14	36	29
E05	I don't know why I have to learn maths	5	4	14	34	43
E03	Maths will not be important to me in my life's work	7	5	14	24	50

* The numbers in each column reflects the percentage of learners' responses.

Table 4.4 indicates that 7% and 22% of the learners strongly agreed and agreed respectively with the statement that they would like to avoid studying Mathematics after matric. 56% disagreed with the same statement. 21% of the learners agreed that they would prefer never to study Mathematics ever again. 74% of learners believe that Mathematics will be important to them in their future. This importance of Mathematics in acquiring a good job was also expressed during the interview.

4.5 Subscale 3: Mathematics will be useful in my adult life

An overwhelming high percentage (77%) of the grade 9 learners, agree that Mathematics is useful in their adult life. The 77% indicated in Figure 4.4, consists of 48% of the learners who strongly agree and 29% of those who agree that Mathematics will be useful.

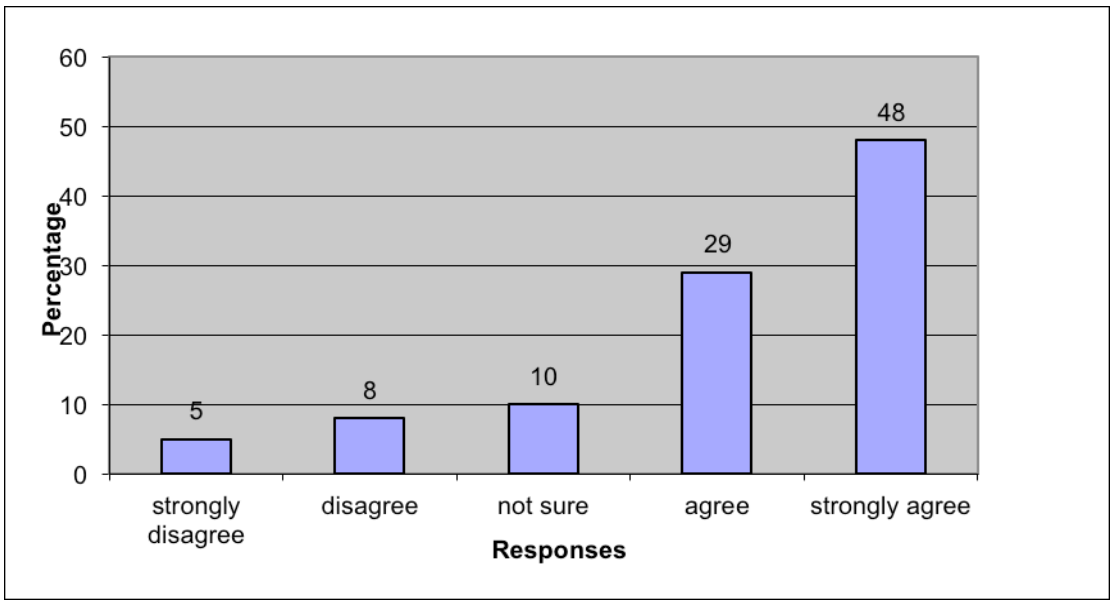

Figure 4.4 **Aggregate score distribution for Subscale 3: Mathematics will be useful in my adult life**

5% of the learners strongly disagreed and 8% disagreed that Mathematics would be of any use to them in their adult life. Figure 4.4 indicates that 10% of the learners were not sure whether Mathematics would be useful in their adult life or not. Although an overwhelming majority of learners acknowledged the importance of Mathematics, 33,5% revealed in Subscale 1 that they did not feel positive about their capability in Mathematics.

4.6 Subscale 4: Mathematics is more for boys than girls

Sixty-two of the participants were girls and thirty five were boys. The girls consisted of 64% of the grade 9 learners and the boys 36%.

Table 4.5 **Learner responses to selected items from Subscale 4: Mathematics is more for boys than girls**

Item	Statement	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
C01	Males are naturally better at maths than females	13	8	14	22	43
C04	Maths is more useful for boys than for girls	4	2	12	28	54
C03	I find maths too difficult for me	24	19	31	13	13

* The numbers in each column reflects the percentage of learners' responses.

21% of learners subscribe to the notion that males are naturally better at Mathematics than females, whilst there were significantly more learners (65%) who disagreed with this statement. Table 4.5 indicates that this 21% of learners agreed with the statement that, "males are naturally better at maths than females" It is imperative that Mathematics educators change this mindset. 82% of the learners disagree that Mathematics is more useful for boys than for girls. 43% of the learners find Mathematics too difficult.

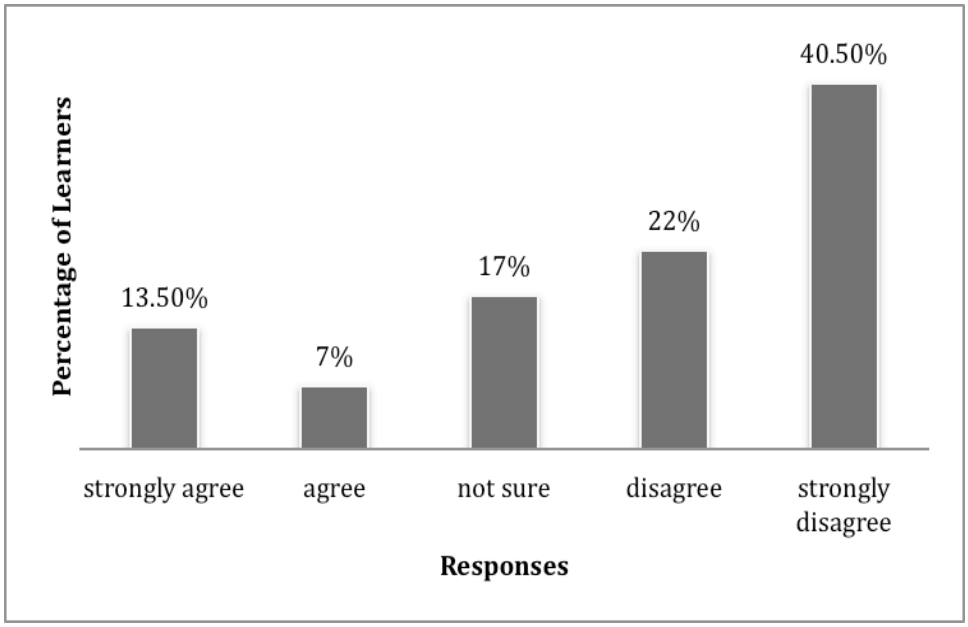

Figure 4.5 **MAS score distribution for Subscale 4:Mathematics is more for boys than girls**

An interesting scenario emerged in subscale 4. Figure 4.5 indicates that 20.5% of the grade 9 learners agreed that Mathematics is more for boys than girls and 17% were unsure. 62.5% disagreed that Mathematics is more for boys than girls. There seemed to be a shift in the mindset of the learners. What is of concern is the remaining 37.5% of the learners who have indicated as follows: 17% of those who are unsure, 13.5% who strongly agreed and 7% of those who agreed that Mathematics is more for boys than girls. As pointed out in chapter 2, "male-advantaging" stereotypes include beliefs that males are naturally more skilled in Mathematics. Educators need to eliminate this type of gender stereotyping to obviate the debilitating levels of MA and CA in learners.

4.7 MAS Scores in male and female learners

Table 4.6 **MAS scores for males and females**

Statistic measure	Males	Females
Mean	127	130
Median	125	129
Range	88	91
Mode	122	125
Minimum MAS score	86	88

* The numbers in each column reflects the percentage of learners' responses.

Table 4.6 indicates the MAS scores for male and female participants. The median and mode are slightly higher for female participants than for male participants. The highest MAS score was also a female participant. Two female learners had the highest scores of 179 and 176. The overall MAS scores indicated that the participants experienced many different levels of MA. The minimum score of 86 was a male participant who experienced high levels of MA. This male learner received 34% in the Mathematics examination. A female participant had the maximum score of 179 out of a possible 180. This learner scored 80% in the Mathematics examination. Another female participant who scored 174 in MAS got 98% for Mathematics. The mean scores of 127 for the males and 130 for the female participants indicate that the participants are experiencing a moderate amount of MA. As noted in the literature review, some level of MA enhances performance in Mathematics.

4.8 CA Scores for all Learners

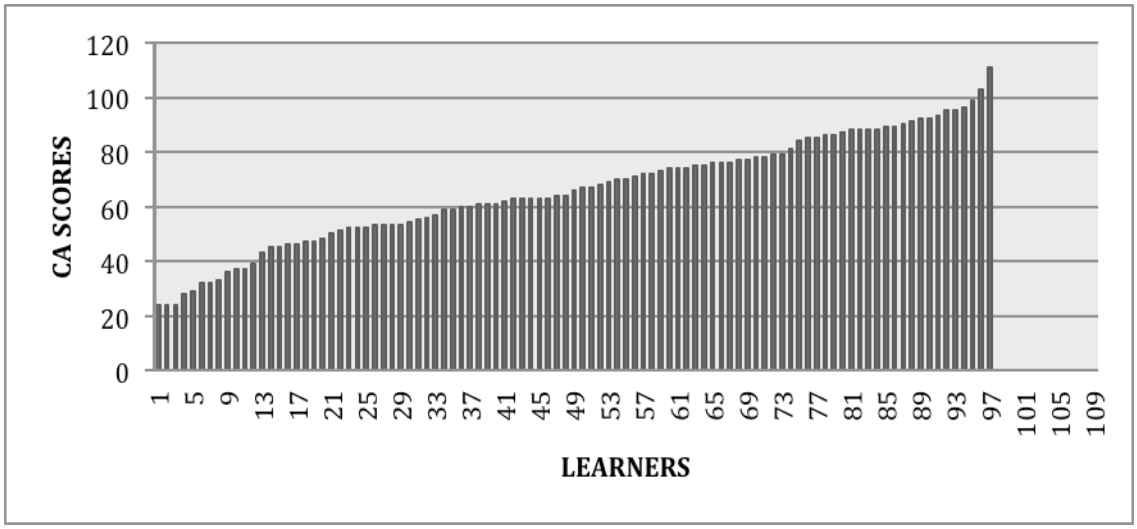

Figure 4.6 **CA scores of grade 9 Learners**

Figure 4.6 shows a bar graph of the CA scores obtained for this research study. If the sample scores are separated into Quartiles, Quartile l is 52, Quartile 2 is 66 and Quartile 3 is 80. This indicates that one-quarter of the students scored higher than 80, and one-quarter of the students scored lower than 52. The cause for concern is the one-quarter of learners whose CA scores are above 80, which means they experience a more than average CA. 22 out of 97 learners (22.7%) have high levels of CA.

Table 4.7 **CA score for Male and Female Learners**

Statistic measure	**Males**	**Females**
Mean	64.86	67.26
Median	61	68.5
Range	71	87
Mode	52 and 63	53
Minimum CA score	24	24
Maximum CA score	95	111

* The numbers in each column reflects the percentage of learners' responses.

Female learners had a higher mark for the 2011 second term examination and they also had a higher CA score. Female participants had a greater range of CA scores than their male counterparts. The female participants also had a greater mean and median value for the CA score; it is evident that there is some gender disparity in Mathematics. It was highlighted in chapter 2 that females are more likely to attribute the reason for their good performance in Mathematics to effort rather than ability. Having a high CA score means that learners may have high levels of CA. These results are supported by Chafetz (2006), who notes that norms and stereotypes that portray males and females differently will tend to reinforce these differences. As noted in chapter 2 the possible explanation is that females are more likely to compare themselves with others in the Mathematics class. This exerts pressure on female learners to portray perfection according to social norms (Chafetz, 2006).

Table 4.8 indicates that 23% of the learners who completed the PRCA-24 questionnaire had scores ranging from 84 to 112. This is the range that includes learners who had high levels of CA.

Table 4.8 **Learner s' CA Scores**

CA Score	Description of score	No. of learners	% of learners
85 +	High CA	22	23
72 – 84	More CA than average	19	19.5
51 – 71	Average CA	35	36
24 – 50	Very low CA	21	21.5

* The numbers in each column reflects the percentage of learners' responses.

McCroskey (1982) emphasises that high levels of CA may impact on learning. The learners with 'high' CA usually experience fear and anxiety in communicating (McCroskey, 1982). 23% of the learners who had high CA scores would usually find the Mathematics classroom a threatening environment. Such learners are likely to avoid communication in many situations. This type of participatory avoidance can be detrimental during Mathematics lessons. A common example is the learner who does not participate in Mathematics class discussion. 19.5 percent of the learners have scores ranging from 72 to 84 which indicates more than average levels of CA.

4.9 CA Scores and Achievement

Figure 4.7 shows that 36% of the learners have scores that are average levels of CA. McCroskey's (1982) research indicates that learners with average scores experience CA on a partial level. 68.5% of the grade 9 learners have levels of CA, which inevitably makes them anxious or tense during Mathematics.

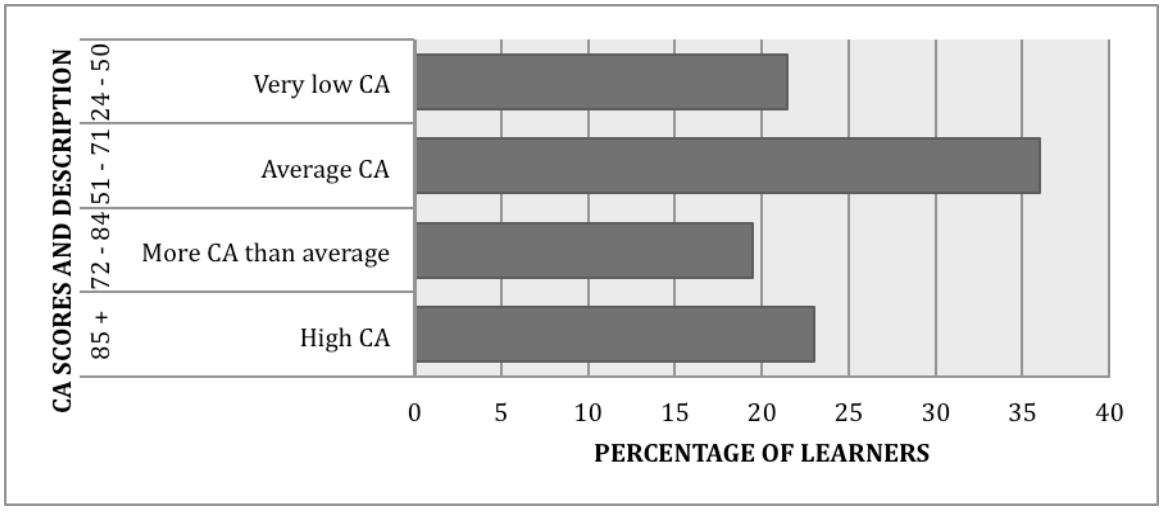

Figure 4.7 **Percentage of learners' CA scores**

Only 21.5% of learners had scores between 24 and 50. These learners experience the least CA. They are apt to talk more and would actively seek opportunities in Mathematics because they are able to interact freely with others. What is of great concern is that close to half of the grade 9 learners experienced an above average level of CA. 42.5% of the learners experienced an above average level of CA. According to McCroskey (1982) high and average CA learners achieve less and like school less than low communication apprehensive learners. Such learners are likely to avoid communication in any situation during Mathematics (McCroskey, 1982).

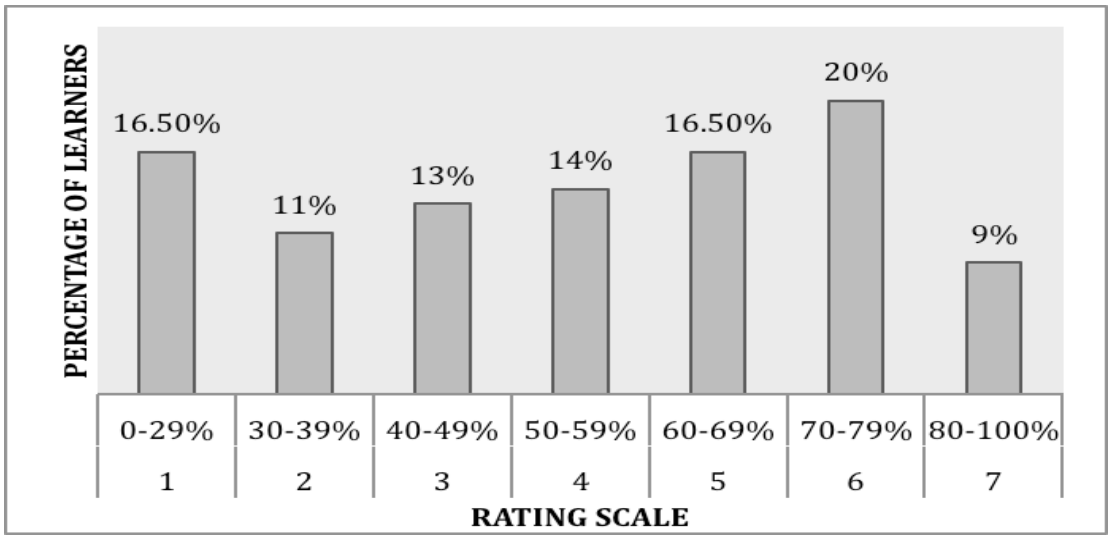

Figure 4.8 **Rating scale of learners' Term 2 Mathematics percentage**

It is evident from figure 4.8 that 40.5% of the learners' attained less than 50% in the second term Mathematics examination. 27.5% learners failed Mathematics by obtaining less than 40%. Figure 4.8 indicates a varying range of marks attained by the Grade 9 learners.

4.10 CA scores for Group 1: Participatory Roles

Table 4.9 shows that 38% of the learners become confused when giving answers during Mathematics lessons. 41% of the learners agreed that they feel tense and rigid while answering Mathematical questions. 42% of the learners get nervous and they forget facts that they really know. Although 50% agreed that they do not become nervous when giving Mathematics explanations.

Table 4.9 **Learner responses to selected items from Group 1 of PRCA-24**

Item	Statement	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
22	My thoughts become confused and jumbled when I am giving answers in maths	20	18	14	36	12
20	Certain parts of my body feel very tense and rigid while answering questions	16	25	12	25	19
18	I'm afraid to speak up in conversations.	8	18	8	41	25
24	While giving maths explanations, I am so nervous, I forget facts I really know	14	28	8	32	18

*The numbers in each column reflects the percentage of learners' responses.

It is of concern that 42% of the Grade learners are apprehensive and uncomfortable. Learners who are extroverts tend to be more gregarious than introverts. The analysis of the PRCA-24 questionnaire with respect to the MA questionnaire on learner self-efficacy beliefs showed that many learners believed that they did not have the ability to learn Mathematics. This was also in keeping with the findings of the focus group interview, which revealed that learners experienced low self-efficacy beliefs in Mathematics.

4.11 CA scores for Group 2: Interpersonal Discussion

Table 4.10 **Learner responses to selected items from Group 2 of PRCA-24**

Item	Statement	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
12	Communicating in maths lessons usually makes me uncomfortable	16	30	10	26	18
19	I have no fear of giving answers in the maths class	16	31	10	26	11
23	I face the prospect of giving maths answers with confidence	15	22	26	23	11
21	I feel relaxed while giving answers during maths lessons	7	24	14	25	20
9	I am very calm and relaxed when I am called upon to express an opinion in class	16	21	14	29	20

*The numbers in each column reflects the percentage of learners' responses.

Table 4.10 shows that 46% of the grade 9 learners were apprehensive about interpersonal communication during Mathematics lessons. 37% percent of the learners disagreed that they had no fear in giving answers in the Mathematics class. It is of great concern that 45% of the grade 9 learners are afraid of answering in a Mathematics class. 34% of the learners disagreed that they are confident at the prospect of answering questions while only 37% are confident and 26% were not sure. The learners who indicated that they are unsure are also apprehensive because they were indecisive. 45% of the learners disagreed that they felt relaxed while giving answers during Mathematics lessons, whilst 49% disagreed that they are usually calm and relaxed when they are called upon to express an opinion in class. 14% were not sure. Once again it is of great concern that nearly half of the grade 9 learners do not feel relaxed in a Mathematics class. It is of paramount importance that learners communicate in order to learn. This was also in keeping with the findings of the focus group interview, which revealed that three of the learners experienced low self-efficacy beliefs in Mathematics and did not want to communicate in the maths class.

4.12 CA scores for Group 3: Group Discussion

Table 4.11 **Learner responses to selected items from Group 3 of PRCA-24**

Item	Statement	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
1	I dislike participating in group discussions.	11	14	9	40	25
2	Generally, I am comfortable while participating in a group discussion	23	44	11	15	6
4	I like to get involved in group discussions.	24	37	16	16	6
8	I am very calm and relaxed while participating in group discussions	23	38	18	13	8

*The numbers in each column reflects the percentage of learners' responses.

Table 4.11 indicates an interesting dimension with regard to the PRCA-24 questionnaire. 65% of the learners disagreed with the statement; "I dislike participating in group discussions", which simply means that 65% prefer group discussions in Mathematics. 67% agreed that they are comfortable while participating in a group discussion; 61% agreed that they like to get involved in group discussions; and 61% agreed that they are calm and relaxed while participating in group discussions. The implication is that that learners enjoy group discussions in

Mathematics. The result from group 3 of the PRCA-24 questionnaire concurs with McCroskey's (1982) finding that the traditional interaction-oriented instructional system whereby the teacher teaches and learners listen, presents a severe handicap to learners. An obvious answer to the problem is to allow learners as much interaction with their peers as with the teacher. This will help to increase learners' self-efficacy beliefs and increase their confidence. The results in group 3 link directly to the findings of Osman, *et al*. (2010), who also found that learners feel comfortable when working in groups, rather than being called on to speak in class, or being involved in personal interaction.

4.13 CA scores for Group 4: Fear of Speaking

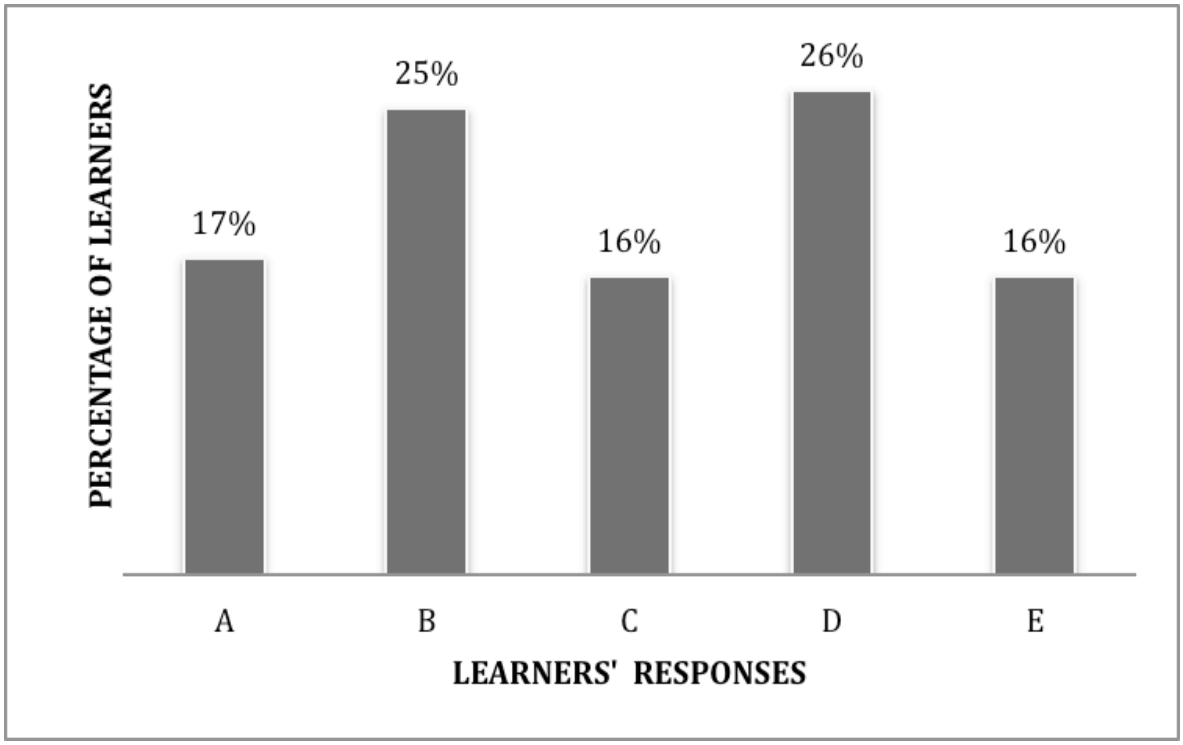

Figure 4.9 **Learners' CA responses for Group 4 of PRCA -24**

Figure 4.9 illustrates the learners' responses to statements that describe their fears about speaking during Mathematics lessons. 16% of the learners exhibited very high levels of fear; and 26% had high levels of CA. It is evident that 42% were afraid of speaking during Mathematics discussions. Figure 4.8 reflects 40.5% of the learners who obtained below 50% in the examination. This fear of participation was also

confirmed in the focus group interview. This avoidance can be detrimental, because communicating would help to clarify any confusion in the Mathematic. These type of learners shy away from participation during class discussions. Only 25% and 17% of the learners who disagreed and strongly disagreed that they had any fear of speaking.

4.14 SUMMARY

This chapter discussed the results of the research study. It explored some of the perceptions learners have about (a) their experiences and attitudes towards Mathematics, (b) the factors that contribute to their levels of CA, and (c) the reasons they attribute to their performance in Mathematics. The results indicate that learners had different experiences in and attitudes towards Mathematics. Factors such as the attitude of their Mathematics teachers and peers, and their levels of confidence impacted on their ability to do well in Mathematics. The chapter also explored factors that impacted on learners' levels of CA in Mathematics. These findings indicate that some learners have negative attitudes towards Mathematics. Chapter 5 discusses the findings of the research in order to draw conclusions from this study.

CHAPTER FIVE

CONCLUSION

This chapter discusses the findings of the study and offers tentative recommendations. The limitations of the study and suggestions for further research are also presented.

The aim of this research was to investigate learners' perceptions and attitudes that led to MA and CA in Mathematics. This would promote an understanding of the challenges and the barriers that learners face in the Mathematics classroom. This research study was guided by the following research questions: (a) what are secondary school learners' attitudes towards Mathematics? (b) What are secondary school Mathematics learners' levels of CA? (c) How do secondary school learners account for their levels of MA and CA?

A quantitative methodology was implemented using the MA Scale (MAS) instrument, which consisted of 38 questions of which 36 were used after the factor analysis for the calculation of MAS scores.The instrument used for measuring levels of CA in Mathematics, the Personal Report of CA (PRCA-24) a questionnaire, which consisted of 24 questions. The qualitative methodology, which was the focus group interview with three selected learners, triangulated with many of the responses from the questionnaires. These three types of instruments were the most appropriate in order to obtain data for achieving the aims of this research study. The two questionnaires used in the quantitative methodology were administered to 97 Grade 9 learners.

5.1 Perceptions and attitudes of Learners

The responses from the MAS and PRCA-24 questionnaires and the focus group interview revealed that learners had encountered a variety of experiences in the Mathematics class. These experiences shaped learners' perceptions of and attitude to Mathematics. It is important to note that the 3 learners who were interviewed had negative experiences that contributed to their negative perceptions of Mathematics. Learners' beliefs, attitudes and emotions represent increasing levels of affective involvement and decreasing levels of cognitive involvement that decrease levels of

responses (McLeod, 1992). Negative support from teachers and peers discourages learners from participating in Mathematics class discussions, and this prevents them from asking questions. Learners' self confidence deteriorated when their peers made them feel as if they were incapable The three learners who were interviewed indicated that they were disappointed about their performance in the Mathematics class. Teachers also played a very important role in shaping learners' attitudes towards Mathematics. Learners in this study generally have positive attitudes to Mathematics especially in the domain of usefulness of Mathematics

5.2 Attitudes and Mathematics Performance

The research findings suggest that there are factors which contributed to learners' attitudes in Mathematics. Some of the factors that emerged from the study were: (a) perceptions of Mathematics being a difficult subject (b) learners' negative attitude towards Mathematics (c) fear of the subject, (d) learners' self-efficacy beliefs in Mathematics, (e) peer behaviour, and (f) teacher behaviour. As discussed in Chapter 2, the affective domain refers to a wide range of beliefs, feelings and moods that are present in the Mathematics class which may affect learners' performance (McLeod, 1992). Learners who experience strong emotional feelings of stress and fear have low self-efficacy in Mathematics. Both the questionnaires and the focus group interview revealed that some learners had low self-efficacy beliefs in Mathematics. Although learners revealed that, while they lacked self-efficacy beliefs, they still acknowledged that Mathematics is very important. The importance of Mathematics was also emphasised in the focus group interview.

5.3 Maths Anxiety (MA)

There were factors that contributed to their MA. These are some of the factors: learners' perceptions of Mathematics, teachers' behaviour, peers' behaviour, attitude and learners' self-efficacy beliefs in Mathematics that led to some learners experiencing MA. A few examples of learners MAS scores and Mathematics marks from the data are discussed in Chapter 4. Learners had a range of MAS scores. Hembree, (1990) is of the opinion that high achievement is linked to a reduction in MA. It can be hypothesised that there is a relationship between MA and Mathematics academic performance among secondary school learners. These findings concur with

Hembree (1990) and Ma (1999) who found that MA impacts on performance in Mathematics.

The results also revealed that there is a very slight gender differences in the scores for MA. These findings concur with the conclusions of Correll (2001) and Chafetz (2006) on the role of gender. They also show that gender has a some impact on MA.

5.4 Communication Apprehension (CA)

The research study suggests that CA may be attributed to withdrawal behaviour of learners. Learners need to communicate in order to learn. Learners experience varying levels of CA in the maths class. The inhibitions learners experience also increases their CA level and reduces their response. Some learners experience fear and do not like to participate in discussions and some feel uncomfortable to communicate during Mathematics lessons. Learners who feel self-conscious in certain situations in the Mathematics class feel uncomfortable and Tobias (1995) emphasises that they will lose their self-confidence. While significant findings were not produced, this study is still important to future researchers examining CA as a barrier in learning, because CA can affect many aspects of ones' life.

5.5 Strategies for the improvement of learning Mathematics

Since I am familiar with some of the factors that influence learning in Mathematics, I am in a position to recommend strategies to enhance successful teaching and learning. It is imperative that Mathematics teachers understand that learners in Mathematics may have some level of MA and CA. This will offer insight into learners' performance. All role players should search for strategies to help learners to overcome MA and CA, which are barriers to learning Mathematics. Various teaching methods should be implemented. Teachers may need to alter their approach to accommodate learners who may be experiencing MA and CA. Teachers could avoid calling on learners known to have high levels of CA and forcing them to participate in discussions. The teacher could structure the Mathematics lessons so that learners overcome MA and the CA and they do not feel intimidated. The use of collaborative learning activities in the Mathematics classroom can lead to learners generating more ideas and being less stressed about expressing themselves in the classroom. More exposure to collaborative learning activities and group discussions will help learners

overcome MA and CA. The results of this study provide evidence that MA and CA may impact on Mathematics education. Therefore, teachers should be thinking about how to reduce learners' anxiety by finding innovative ways to teach Mathematics. Teachers need to be aware of the effects of MA and CA on learners'. They should make an effort to lessen anxiety. Teachers need to develop teaching strategies that help highly anxious learners. The following techniques should be considered: (a) Create an environment in which learners do not feel threatened and that allows them to relax. (b) Use cooperative grouping. It helps learners to understand that others have the same problems as they do. (c) Teach at a slow pace. This can help learners better comprehend what is being taught. (d) Provide extra tuition sessions so that some learners are not left behind academically.

Educators and parents need to foster positive attitudes in young girls and women in order to enhance their interest and achievement in mathematics. These efforts could have a positive effect in reducing MA and CA.

5.6 Limitations

This study was limited to one school and one teacher. With a larger sample and more grades there would be a greater variety of learners, competency levels, environments, and teaching styles. This would result in a global view of the extent of MA and CA on performance in Mathematics.

5.7 Implications for further Research

The Department of Education reported that the Mathematics results were lowest when compared to all the other subjects in the 2010 and 2011 National Senior Certificate examination. In 2010, 138 285, (52.6%) out of a total of 263 034 learners who wrote the Mathematics examination failed. In 2011, 120 629 (53.7%) out of a total of 224 635 learners who did Mathematics failed. The TIMSS survey (Reddy, 2006) found that South Africa came last out of 41 countries with regards to Mathematics performance. This indicates that something has definitely gone wrong in the teaching and learning of Mathematics at schools.

5.8 Suggestions

Teachers need to be aware that learners may experience MA and CA. They should

understand the impact of MA and CA on these learners in Mathematics. Teachers should develop teaching strategies that help highly anxious and apprehensive learners. The curriculum standards at secondary school level may have to be reviewed and reorganised. There should be both professional and in-service-training programmes for teachers that incorporate such instruction on MA and CA. With all these efforts it can be a positive force in reducing MA and CA.

5.9 Conclusion

The findings of this research study suggest that there are factors that contribute to the existence of MA and CA in learners. The Department of Education should initiate programmes that can be instrumental in reducing the number of failures in Mathematics each year. Research in Mathematics education at schools will reveal what goes on in the classroom. Mathematics educators should be acknowledged and their expertise should be harnessed to improve Mathematics education at schools. This study of MA and CA is a suitable foundation for further research along a similar design over a longer period of time. For example, a study could focus on learners as they progress through the grades in secondary school. This will provide interesting insights into the origins of MA and CA that are barriers to learning Mathematics. The results of this study provide evidence that MA and CA have an important impact in Mathematics education that cannot be ignored. Therefore, educators should be thinking on how to reduce learners' MA and CA by finding suitable and innovative ways to teach Mathematics.

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APPENDICES

APPENDIX A

There are no right or wrong answers. Many of the statements are similar to other statements. Do not be concerned about this. Work quickly and just record your first impression.

Below is the scale that you will use to rate your responses to the questions.

A Strongly Agree
B Agree
C Not sure
D Disagree
E Strongly disagree

Please place only one cross in the appropriate column.

A Personal confidence about maths: Self Confidence/Self-efficacy

Nos.	Statements	A	B	C	D	E
1	I am good at maths					
2	I do not enjoy maths					
3	I find maths too difficult for me					
4	I am confident of myself when I do maths					
5	Doing maths makes me nervous and upset					
6	I'm not the type to do well in maths					
7	I'm just not good in maths					
8	Maths is my worst subject					
9	I often get scared when I see a page full of maths problems					
10	I am able to solve maths problems without much difficulty					

B Perceptions of teacher attitude

Nos.	Statements	A	B	C	D	E
1	My maths teacher makes me feel I have the ability to go on in maths.					
2	I wish my math teacher would pay more attention to my maths learning in class.					
3	My teacher thinks that I could do well in maths.					
4	I feel that my maths teacher ignores me when I try to ask questions in class.					
5	My teacher makes me feel silly when I ask questions in maths class.					
6	My teacher only worries about teaching the clever learners in class.					

C Perceptions that maths is a male domain

Nos.	Statements	A	B	C	D	E
1	Males are naturally better at maths than females.					
2	Studying maths is just as good for women as for men					
3	Naturally most of the greatest mathematicians in the world are male.					
4	Maths is more useful for boys than for girls.					
5	A female is just as good as a male in solving important maths problems.					

D Attributing Factors

Nos.	Statements	A	B	C	D	E
1	I am afraid to ask questions in class because my peers will think I am stupid.					
2	The 'clever' learners in my class make me feel stupid.					
3	I never do well in maths no matter how hard I try.					
4	Learning maths is too pressurising and stressful.					

E Perceived usefulness of maths

Nos.	Statements	A	B	C	D	E
1	Knowing maths will help me get a good job					
2	Maths is important in everyday life					
3	Maths will not be important to me in my life's work					
4	I will use maths in many ways as an adult					
5	I don't know why I have to learn maths					
6	I would like to avoid studying maths after matric					
7	Doing well in maths is not important for my future					
8	Mathematics is one of the most important subjects for people to study					

F Enjoyment

Nos.	Statements	A	B	C	D	E
1	I have usually enjoyed studying mathematics in school.					
2	Mathematics is dull and boring					
3	I am happier in a math class than in any other class					

G General

Nos.	Statements	A	B	C	D	E
1	I would like to further my studies in maths.					
2	I do not mind studying maths after matric, if it is necessary for my studies.					
3	I would prefer never to study maths ever again.					

APPENDIX B
Personal Report of Communication Apprehension (PRCA-24)

Nos.	Statement	A	B	C	D	E
1	I dislike participating in group discussions.					
2	Generally, I am comfortable while participating in a group discussion.					
3	I am tense and nervous while participating in group discussions.					
4	I like to get involved in group discussions.					
5	Engaging in a group discussion with new people makes me tense and nervous.					
6	I am calm and relaxed while participating in group discussions.					
7	Generally, I am nervous when I have to participate in a discussion					
8	Usually I am calm and relaxed while participating in class discussions					
9	I am very calm and relaxed when I am called upon to express an opinion in class					
10	I am afraid to express myself at class discussions					
11	Communicating in maths lessons usually makes me uncomfortable.					
12	I am very relaxed when answering questions during maths lessons.					
13	While talking with a new acquaintance, I feel very nervous.					
14	I have no fear of speaking up in conversations.					
15	Ordinarily I am very tense and nervous in conversations.					
16	Ordinarily I am very calm and relaxed in conversations.					
17	While conversing with a new acquaintance, I feel very relaxed.					
18	I'm afraid to speak up in conversations.					
19	I have no fear of giving answers in the maths class					
20	Certain parts of my body feel very tense and rigid while answering questions					
21	I feel relaxed while giving answers during maths lessons					
22	My thoughts become confused and jumbled when I am giving answers in maths					
23	I face the prospect of giving maths answers with confidence.					
24	While giving maths explanations, I am so nervous, I forget facts I really know.					

APPENDIX C

Group Interview Questions

The purpose of the interview is to gather information about learners' experiences in the maths class and to ascertain the degree to which specific affective factors affect their learning in mathematics. The learners' identities will remain confidential. Learners are required to give your honest views without having to feel intimidated. They will be interviewed in a focus group.

Gender: _____ Grade: _____ Age: _____

1. How would you best describe your experience of school maths?

_____

_____

2. Which two words best describes your feelings about maths?

_____ _____

3. Why do you feel this way?

_____

4. Did you enjoy maths at any time, tell me about the time when you enjoyed maths? Why did you enjoy maths?

_____

_____

5. Do you think that you are successful in maths? Explain why you think so.

_____

_____

6. What do you think has contributed to your success/ failure in maths?

_____

_____

7. What do you think will improve your learning of maths in the class?

_____

_____

8. Do you like or hate or fear maths? _____

Explain why you feel this way. _____

_____

9. Why do you think you fear maths?

_____

_____

10 When did you develop this fear for maths?

_____

What has caused this/

_____

11. Do you feel comfortable to answer questions during maths lessons?

_____

Give reasons for the above

_____

12 Are you afraid to contribute to class discussions? _____

Explain why you feel this way.

_____

_____

13 Would you ask your teacher for help or would you tell the teacher in the presence of your classmates that you do not understand an aspect in maths?

_____

Explain why you feel this way. _____

_____

14. Name one worst experience in maths.

_____

_____

Explain

_____

15 Some people say that learning maths is a sheer waste of time. What do you think?

_____

Explain

_____

_____

THANK YOU !

INTERVIEW TRANSCRIPTS

Teacher: Firstly I would like to thank you for coming to this interview… and the first question is...how would you best describe your experience of school maths?

Ashton : It's average, it its , average..eh..just making to pass by two terms ..last term, not that … last term.

Jabulu: I have not been successful in maths.

Feroza: It's tough .... I fear school a lot because of maths.. it's hard to understand.

Teacher: Which two words best describes your feelings about maths?

Ashton: Hard.. and a..eh..a bit boring.

*Jabulu:*Hard and difficult.

Feroza: Difficult..and …yeh

Teacher: Why do you think you feel this way?

Jabulu: Eh .. because I have been trying hard and I did not success.

Ashton: Because it is a lot of ..eh… work and examples to do.

Feroza: It's just hard to understand no matter how much you try

***Teacher:* Is it…..**..

Feroza: It's hard to understand.

Teacher: Did you enjoy maths at any time, tell me about the time when you enjoyed maths? Why did you enjoy maths?

*Feroza:*Yes,..eh..eh...sections like …eh.. FOIL geometry and stuff like that I enjoyed the two sections in maths. because I understood it and I actually understood that work.

Ashton; Me too…hee...hee, the..the .. Geometry part.

Teacher: Okay!

Jabulu: Yebo! I enjoyed the exchange rate because I did good in the test.

Teacher: Do you think that you are successful in maths? Explain why you think so.

Ashton: Eh.. no… eh.because I'm only getting 40 and around 60 %. Eh….and the work is a bit confusing, that's why I think I got that mark.

Jabulu: No, but I tried to do my best.

Feroza: No, eh..mm..no I try my best. otherwise no matter how much I try my best..I just don't succeed.

Teacher: Okay, What do you think has contributed to your success/ failure in maths?

Jabulu: Nothing because I find it hard to understand.

Teacher: Why do you think you find it hard to understand?

Jabulu: mm..

Feroza: Maybe..it's the way the teacher…er….explains the work or.. I just don't *know.*

Ashton: Er.. I don't understand it. Eh… Because ..because.. I.. didn't get a good mark and maybe because the teacher does not teach the work properly …or … or..I eh..just don't pay attention to the teacher sometime.

Teacher: What do you think will improve your learning of maths in the class?

Jabulu: Paying attention in class.

Feroza: I have no idea ..mm..a different approach to teaching eh.. a different way of explaining the work..and ..mm..a lot of attention.

Ashton: Do more examples and practise it.. and maybe go for extra lessons.

Teacher: Do you like or hate or fear maths?

Explain why you feel this way.

Feroza: Fear maths. Because No matter how much you try and understand maths… no matter how hard you try to get it and even when… when you think you know something it ends up being wrong.

Jabulu: I fear maths because it is so hard to understand.

Ashton: I fear maths because there is a lot of work. …and….eh..and I cannot manage to complete it.

Teacher: Why do you think you fear maths?

Ashton: I think I fear maths because I don't understand the work…the teacher teaches us in class.

Jabulu: I don't understand and I don't ask my teacher.

Teacher: Why do you think you don't understand?

Jabulu: I don't understand certain sections…I don't understand and I don't ask the teachers….eh.

Feroza: It's hard to understand maths…even though you try…you pay attention in class…. you don't understand it…even though sometimes you don't understand and stuff like that …what people will say..

Teacher: People like whom are you referring to?

Feroza: Say for instance the teacher…say you don't understand….you get a shouting from the teacher…you don't understand because you don't pay attention …n something like that. I also try so hard and study so hard it scares me because my marks end up being bad. It is very scarey to think that I could fail.

Teacher: When did you develop this fear for maths?

Feroza: Last year..eh….

Teacher: Did anything in particular happen last year?

Feroza: yeh.. like new surroundings.. I really could not concentrate.. that's why it was very hard to understand. I was not so bad before last year..also the fact that understanding.

Ashton: A year ago.

Teacher: What led to this fear of mathematics?

Jabulu: … the work got difficult…

Teacher: What about the work in grade 9?

Jabulu: Also grade 9, the work got harder.

Teacher: And what contributed to this fear in Grade 7?

Ashton: In grade 7.The change of teachers caused it and eh….eh..the work…the work got more ….hard..harder.

Teacher: Okay..when you talk about the change of teachers, what do you mean a change of teacher?

Ashton: The way two different teachers explain the work and the teaching styles were different.

Teacher: Do you feel comfortable to answer questions during maths lessons?

Feroza: No.

Ashton: No.

Teacher: Why not Feroza?

Feroza: because….people laugh at you and mock you … and like when you get something wrong…and..like…ja... it is …like.. embarrassing ..It is scarey…

Jabulu: No… but I am comfortable with it at times.

Teacher: Who makes you feel comfortable?

Jabulu: Everyone in the class… and the teacher.

Teacher: The teacher…

Ashton: No ... I feel uncomfortable…uncomfortable … hee ... hee ... because I don't know the right answers.

Teacher: But when you do know the right answers…

Ashton: Then I answer the questions.

Teacher: Are you afraid to contribute to class discussions?

Feroza: Yes… because sometimes the teacher ..like..shouts at you..

Teacher: Sometimes…

Feroza: sometimes…

Teacher: And what about the other times? Why are you afraid?

Feroza: because you don't know what you are going to say is right or wrong.

Ashton: Yes ,but not all the time.. well.. I feel afraid when the teacher shouts … when I get the answers wrong. But other than that ..I.. contribute to the class discussions.

Teacher: Does the teacher shout at you all the time when you get an answer wrong?

Ashton: No… hee..hee..

Feroza: No… hee…hee…

Jabulu: Me… I ....find my friends laughing at me.

Teacher: But why are you afraid to answer?

Jabulu: I feel as though you would shout at me…and all my friends will laugh at me.

Teacher: Okay. When they laugh at you do you feel embarrassed in any way?

Feroza: Yes.

Teacher: What about you Ashton?

Ashton: No.

Teacher: Would you ask the teacher in the presence of other classmates that you do not understand an aspect in maths? Would you ask your teacher for assistance (meaning that you need help) or would you tell the teacher that you don't understand in the presence of others?

Feroza: No.

Teacher: Why is it you would not ask the teacher?

Feroza: ….It gives you like a low self esteem… and..ja…

Ashton: Yes, because the teacher can help me if I don't understand the work.

Teacher: So you would ask the teacher Ashton!

Ashton: Yes …I would ask the teacher.

Teacher: And what about you Jabulu?

Jabulu: I would'nt…. ask the teacher for help… but … I don't do that.

Teacher: But why you don't do that…why don't you ask the teacher for help?

Jabulu: I feel shy…very shy…

Feroza: Scared…

Teacher: But why?

Feroza: Because I don't know what the teacher will say to me.

Teacher: Are you afraid only of the teacher or are you afraid of any other things or any other persons?

Feroza: Yeh… if the teacher explains it to me and I still don't get it…. its like… I just explained it to you.

Teacher: Mmm… Ok! Name one worst experience in maths.

Jabulu: When I failed my test.

Teacher: Would you want to explain why you failed?

Jabulu: Too many mistakes… and I lose marks.

Teacher: Okay … your worst experience Ashton!

Ashton: When the teacher asked me a question and I got it wrong… and I did'nt know what to do after that… everyone started laughing at me.

Teacher: Your worst experience Feroza.

Feroza: Failing … because it really brings you down … because you studied so hard… and you think you understand…you end up getting things wrong.

Teacher: mmm….Some people say that learning maths is a sheer waste of time. What do you think?

Feroza: No it is not a waste of time…it is very hard to understand and stuff like that…. But it does help you in the long run …you need maths in anything you do.

Ashton: I think that it is not true…because ... eh ... eh…you need …maths to study and to get a good job. So it is not a waste of time.

Jabulu: I think so … you need maths can help you in many different ways …maths can help you in ... the… future.

Teacher: In the future or the present?

Feroza: Both.

Jabulu: Both.

Teacher: Is there anything else you want to say? Don't be afraid…anything you would want to say about maths…it is your opinion… just about anything… about maths

Feroza: It is just very..very difficult and hurtful when you get stuff wrong. Maths is just … hard to understand.

Teacher: Anybody else…

Jabulu: No.

Ashton: No.

Teacher: Thank you very much for participating in the interview and making your valuable input.

APPENDIX D

Dear learner

My name is Mrs.S.Moodley and I am a second year Master of Education (MED) student registered at the University of KwaZulu-Natal and I am a teacher at your school.

As my research project, I am conducting a research on **Maths anxiety and communication apprehension as barriers to learning mathematics.** Mathematics plays an increasing role in all spheres of life. Interest in mathematics at school level and in tertiary education has decreased in most countries and the research that I intend to conduct could give some indication of whether you think mathematics is important.

My research project is being supervised Dr. Sally Hobden who can be contacted on 031 2603435 at the Faculty of Education, University of KwaZulu-Natal (School of Science, Mathematics and Technology Education). If you need further information about the project, please contact my supervisor.

I would like your consent to participate in my research project. I have selected three classes from this school. 1 would like you to complete a questionnaire relating to various aspects of mathematics education. The questionnaire should take about 45 minutes to complete.

The project will be conducted during school time, and I have asked the school principal for permission to conduct the research. There will be no additional cost to you or the school.

Your name and the name of the school will not appear in my dissertation, or in any papers or presentations that I make after the study. If you decide not to participate, you will not be disadvantaged in any way. You may withdraw from the study at any stage and for any reason. Once the project has been completed, the questionnaires will be destroyed.

If you agree to participate in my research, please complete the attached consent form and return it to me. I thank you for taking the time to read this letter.

Yours sincerely

.....
S.Moodley

(Please complete the declaration and give it to me).

I hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I may withdraw from the project at any time

No.	Signatures of learners	Date
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Thank You

……
S.Moodley

APPENDIX E

Dear parent

My name is Mrs.S.Moodley and I am a second year Master of Education (MED) student registered at the University of KwaZulu-Natal and I am a teacher at the school that your child attends.

I am presently engaged in a Mathematics research study based on **Maths anxiety and communication apprehension as barriers to learning mathematics.** Mathematics plays an increasing role in all spheres of life. While mathematics education is a key element of schooling and high quality mathematics is seen as important training for citizenship as well as preparation for work, research has shown that mathematics in many countries are facing serious problems. Interest in mathematics at school level and in tertiary education has decreased and the research that I intend to conduct could give some indication of whether our learners think that mathematics is important.

My research project is being supervised by Dr. Sally Hobden who can be contacted on 031 2603435 at the Faculty of Education, Edgewood Campus (School of Science, Mathematics and Technology Education). If you need further information about the project, please contact my supervisor.

I would like your consent to include your child in my research project. 1 would like the children in my study to answer a questionnaire relating to what they are learning in mathematics, what they would like to learn about, their opinions on mathematics and their understanding of the challenges in mathematics. 1 will be asking the children in my class to complete the questionnaire, as well as children from another grade.

The project will be conducted during school time. I have asked the university, Department of Education and the school principal for permission to conduct the research. The questionnaire will take approximately 45 minutes to complete. There will be no additional cost to you or the school.

Your child's name and the name of the school will not appear in my dissertation or in any papers or presentations that I make after the study. If you decide not to allow your child to participate, she/he will not be disadvantaged in any way. Your child may withdraw from the study at any stage and for any reason.

If you agree to your child participating in my research, please complete the attached consent form and return; it to the school. I thank you for taking the time to read this letter.

Yours sincerely

……

S.Moodley

(Please complete the declaration below, and send it back to school)

I …….. (full names of parent) hereby confirm that I understand the contents of this document and the nature of the research and I consent to my child, …….. to participate in the research project.

I understand that my child is at liberty to withdraw from the project at any time.

…… .....

Signature of parent Date

APPENDIX F

The Principal

Attention: …….

I am currently a second year Master of Education (MED student at the University of KwaZulu-Natal, Edgewood and I am presently engaged in a research study on **Maths anxiety and communication apprehension as barriers to learning mathematics.** Mathematics plays an increasing role in all spheres of life. While mathematics education is a key element of schooling and high quality mathematics education is seen as important training for citizenship as well as for preparation for work, research has shown that mathematics in many countries are facing serious problems. Interest in mathematics at school level and in tertiary education has decreased in most countries and the research that I intend to conduct could give some indication of whether our learners think mathematics is important.

In this regard I am asking your permission to conduct research in two classes at your school. Please note: this is not an evaluation of learners or teachers' performance. I am simply interested in learners' views on mathematics. Learners will be asked to complete a questionnaire during school hours relating to what they are learning in mathematics, what they would like to learn about, their opinions on mathematics and their understanding of the challenges they face in mathematics. The questionnaire will take approximately 45 minutes to complete. There will be no additional cost to the school. I will be asking the learners in the grade 9 classes to complete the questionnaire.

The identities of all who participate in this study will be protected in accordance with the code of ethics as stipulated by the University of KwaZulu-Natal. I undertake to uphold the autonomy of all participants and they will be free to withdraw from the research at any time without negative or undesirable consequences to themselves. However, the parents of participants will be asked to complete a consent form. The names of the learners and the name of the school will not appear in my report, or in any papers or presentations that I make after the study.

My supervisor is Dr. Sally Hobden who can be contacted on 031 2603435 at the Faculty of Education, Edgewood Campus (School of Science, Mathematics and Technology Education).

You may contact my supervisor, should you have any queries or questions you would like answered.

Yours faithfully

……
S.Moodley

APPENDIX G

UNIVERSITY OF
KWAZULU-NATAL
INYUVESI
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mohunp@ukzn.ac.za

8 August 2011

Mrs S Moodley (208525105)
School of Science, Mathematics & Technology Education
Faculty of Education
Edgewood Campus

Dear Mrs Moodley

PROTOCOL REFERENCE NUMBER: HSS/0707/011M
PROJECT TITLE: Maths anxiety and communication apprehension as barriers to learning mathematics

In response to your application dated 5 August 2011, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL.**

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

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

Yours faithfully

.....
Professor Steven Collings (Chair)
HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE

cc. Supervisor: Dr S Hobden
cc: Ms T Mnisi, Faculty Research office, Faculty of Education, Edgewood Campus

APPENDIX G

PROFESSIONAL EDITING SERVICES
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16 November 2011

This is to confirm that I have edited the dissertation Maths anxiety and communication apprehension as barriers to learning mathematics by Savathrie Moodley, student number 208525105.

Yours sincerely,

(Ms) Deanne Collins (MA)