An Investigation into Learner Perceptions of Mathematics: A Means to Understanding the Challenges of Learning Mathematics

by

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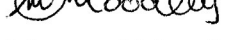
PREFACE

The work described in this thesis was carried out in the School of Science, Mathematics and Technology Education, University of KwaZulu-Natal, from July 2004 to November 2007 under the supervision of Mrs Sally Hobden (Supervisor), Edgewood Campus.

Ethical clearance was granted by the University of KwaZulu-Natal. The ethical clearance approval number is HSS/06179A.

DECLARATION

This study represents original work by the author and has not otherwise been submitted in any form for any degree or diploma to any tertiary institution. Where use has been made of the work of others, it is duly acknowledged in the text.



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ABSTRACT

The purpose of this study was to investigate the experiences and perceptions that learners have in the maths class with the aim of determining learners' attitude to maths. It also intended to identify and understand the challenges that maths learners face in the maths class. The findings from this investigation would be used in the development of strategies to (a) improve the attitude of learners in the maths class, (b) develop healthier self-efficacy beliefs in learners and (c) create a positive learning environment for maths learners.

To this end, a poster activity and group interview were used as the data collection instruments for the qualitative part of the research. The poster activity entailed the development of a poster by learners in which they recorded information on their experiences and perceptions of maths. This highlighted emerging themes that were further explored in the group interview and used in the development of the questionnaire. A group interview was conducted with a select group of learners with the intention of confirming the themes that had emerged from the poster activity. The quantitative phase of the study included a questionnaire, the design of which was based on the findings from the poster activity and was administered to all grade eleven learners of maths in order to determine whether the findings from the poster activity were representative of all the grade eleven maths learners. These data collection instruments generated data that was used to answer the main research questions.

Analysis and interpretation of the findings lead to the following conclusions being reached: (a) Learner attitude to maths is in part a product of the accumulated experiences and perceptions of learners in the maths class, (b) The teacher, peers and learners' self-efficacy beliefs affect maths learning and (c) The learning environment is an important factor in maths learning. The final part of the write-up includes the implications that this research has for the practising maths teacher with suggestions for further research in the area of affect.

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- Sally Hobden, my supervisor, for her guidance and support throughout this study
- My parents for their unconditional love and support
- Lushan, Parushan, Thejevan and Kashreya for being my inspiration

Dedicated To

Kashreya, Thejevan, Parushan
and
Lushan

STYLISTIC CONVENTIONS USED IN THE TEXT

Throughout the study, pseudonyms have been used to protect the privacy of the participants and the participating school in the research.

Citation conventions

This study contains the written comments from the poster activity and direct quotes of the participants as transcribed from the group interview. I have decided to present the direct quotes of the learners in the group interview verbatim from the transcript and within italics. The poster comments have been included within quotations marks to distinguish them from the direct quotes. No changes have been made to the direct quotes from the group interview or the comments from the poster activity. Where the source of the comments and quotes are made explicit in the text in which it has been presented, I have made mention of only the pseudonyms of the participants.

The subject mathematics, in keeping with common practice in South Africa, has been referred to as maths.

CHAPTER ONE

MOTIVATION AND BACKGROUND

1.1 GOALS OF MATHS IN EDUCATION

The Department of Education, South Africa, has acknowledged the need for mathematical competence amongst people in and out of the workforce by committing itself to the introduction of mathematical literacy at schools. Yet the question of whether this will create a nation of mathematically literate people has yet to be answered. The National Department of Education has stated that the goals of maths education, aims to develop in the learners (a) the necessary confidence and competence to deal with any mathematical situation without being hindered by a fear of mathematics, (b) an appreciation for the beauty and elegance of mathematics and (c) a love for mathematics (Department of Education, 2002).

1.2 BACKGROUND

In today's global society, information technology has become the means of global communication. The current trend in technology, the globalisation of the economy, the spread of telecommunication and the increasing demand for highly skilled and computer literate people, has fuelled the need for people who are mathematically proficient. It is becoming apparent that with global trends in information technology, mathematical competence is fast becoming a core element in the preparation of the individual for constructive participation in the workplace. In a world that is fast emerging as a technological arena, information technology has become the norm in every sphere of human endeavour. Simple everyday tasks that range from banking and shopping to the more sophisticated jobs of designing cars and dating items using carbon dating, are done through the use of technology. In an effort to be quicker, better, smaller and cheaper,

human endeavour has produced technology that can outdo some of our human capability. It has thus become equally necessary for individuals in and out of the workforce to possess some degree of mathematical competence if they are to function effectively in society. The dynamic field of information technology has put a considerable amount of pressure on schools to produce learners who are mathematically literate. If we as a country are to participate in a global economy, we need to equip our learners with the mathematical knowledge that will enable them to participate constructively in this highly technological world.

The poor performance of the South African grade 12 maths learners in the Senior Certificate Examination indicates that school-leavers are not adequately equipped with the maths knowledge needed to be active participants in a highly technological society. Performance in maths has become a matter of concern to all stakeholders in South Africa. Mathematics is one of the most important subjects in the school curriculum to the extent that it has now been made a compulsory subject up to grade 12. Learners have always studied mathematics because they know that it is an important subject in the study of any field of science (Middleton & Spanias, 1999). It also serves as a filter for entry into various career paths. A review of the TIMSS study (Hammouri, 2004) reveals that the number of maths learners who took maths on the higher grade between 1995 and 1997, dropped to about a half of the number taking maths on the higher grade between 2000 and 2004. The concern then also lies with the small number of higher grade maths learners who are eligible for the study of science-based professions (Reddy, 2006). I believe that this steady decline in the number of learners who qualify to study maths and maths related courses, subsequent to grade 12 might impact negatively on a world that is advancing technologically at an exponential rate.

1.3 ATTITUDES

The emerging scenario is that poor attitude to and lack of belief in one's ability to do mathematics is fast creating a nation of mathematically illiterate people, who lack the necessary academic and technological expertise to maintain and advance technology (Middleton & Spanias, 1999). Statistics indicate that despite the state's emphasis on maths, science and technology, performance in maths is at an all-time low. For example,

statistics taken from TIMSS 2003 (Reddy, 2006) have revealed that South Africa, in keeping with the study done in 1999, had the lowest score in maths out of the six participating African countries. The mean score in maths determined in TIMSS 2003 is 264 (SE 5.5) and is below the international mean of 467 (SE 0.5). The range of scores also indicated that South African learners had very low as well as very high scores indicating the widest distribution of scores in the study. For example, the schools neighbouring Westlake High, the site for this study, are phasing out Computer Studies and Physical Science as subjects at the senior secondary phase because many of their learners do not want to study maths or maths-related subjects anymore. In my opinion, at Westlake High, the state of mathematics in education is at an all time low. So too is the morale of the teacher and the learner. Mathematics, the teacher and the learner form an educational triangle, that more often than not culminates in frustrated teachers, de-motivated and tearful learners and a subject that is viewed upon as being insurmountable.

The driving force behind the research topic has been my desire to make learning maths an enjoyable and successful experience for all maths learners. When I became an educator of maths, my vision was to inculcate a passion for maths in the learners that I taught. I went into teaching with the preconceived notion that everyone enjoyed doing maths as much as I did. I believed that this was enough to motivate learners to try their best in maths. I was wrong! To find a learner, who appreciated the beauty of maths, was difficult, and one who actually enjoyed it and strove to do well in it even more so. This was immediately a source of concern to me. In order to tackle this issue, I looked at different approaches to teaching maths that would increase learners' enjoyment of it.

1.4 PROBLEM STATEMENT

From my experience in the maths classes and discussions with my colleagues, I found that despite poor results in maths, learners seemed to lack the desire to improve their maths results. This became even more evident when attempts were made to get learners to pay attention in the maths class. This was a constant challenge that seemed to get even more challenging over time. Every maths period became a battle of wills as the maths educator tried to get through the obstacle of disinterested learners who refused to engage in the maths lesson. Consequently, my concern lies in determining what would

make learners want to learn maths and what can be done to help change the status quo of mathematics at schools. In order to accomplish this, I felt that it was necessary to identify the challenges that learners face in the maths class. The questions that needed to be asked were (a) What experiences do learners have in the maths class and what are their perceptions of the maths class? (b) To what do learners attribute their performance in maths? (c) What strategies do learners suggest that will make them want to learn maths? In order to find answers to these questions, it was imperative that the attitudes of learners to maths be determined. The need to identify the challenges that learners associate with maths learning, led to the first research question, which sought to investigate and highlight the experiences in and perceptions of learners in maths. It was hoped that this would enable teachers to understand the challenges that learners faced in the maths class and hence find ways to help learners overcome these barriers to learning maths.

Being a maths educator at this school for many years afforded me the opportunity to informally observe the behaviour of learners in the maths class. In order to determine why some learners were eager to learn maths and yet others showed no interest in it, it became necessary to ask the maths learners to explain their attitude towards learning maths. The following comments, which arose out of a conversation that I had with two learners, Sash and Reena early in 1993, piqued my interest. Sash performed poorly in maths, did not pay attention to the lesson in the maths class and made very little or no attempt to do his work. I asked him why he did not put more effort into learning maths the way he did with his soccer. His response was wh*en I look at my books, my mind just starts to wander and I can't learn. When I sit in the classroom, I listen to my teacher but I can't hear…. I love to play soccer because I play well. I am involved in the game. I contribute to the success of my team and very often we win* (Interview, 1993). Reena, was a diligent learner who paid attention, was eager to participate in the lesson and who achieved extremely well in maths. Her response to my question: What makes you work as much as you do in maths?, was *I like the feeling of success. I know what it is like to perform poorly and doing well makes me feel at the top of it all. I like to feel that way and so I work hard to stay there.* (Interview, 1993). More than a decade later, at my school, maths suffers an even worse reputation than before. What Sash and Reena said, I believe, went to the heart of the problem, which was that learner perceptions and experiences with maths, affected their attitudes to it.

My school was not overjoyed by the reality that despite having the correct resources and suitably qualified maths educators, who were passionate about teaching maths, the results in maths were still paltry. It was evident, from my discussions with the Principal and maths educators that not much credibility was given to the role of affect in the teaching and learning of maths. The preferred view of management at my school seemed to be that of the 'black box' (see Figure 1.1) in which learners were put into a 'box' with qualified educators, resources and a classroom and the expectation that this was enough to produce good results in maths. Evidently this was not the case. It seemed to have been overlooked that learners are social beings who function within a social context and are affected by the dynamics within it. These dynamics include the learner's association with their educators, peers, parents and their beliefs about their own ability to learn maths.

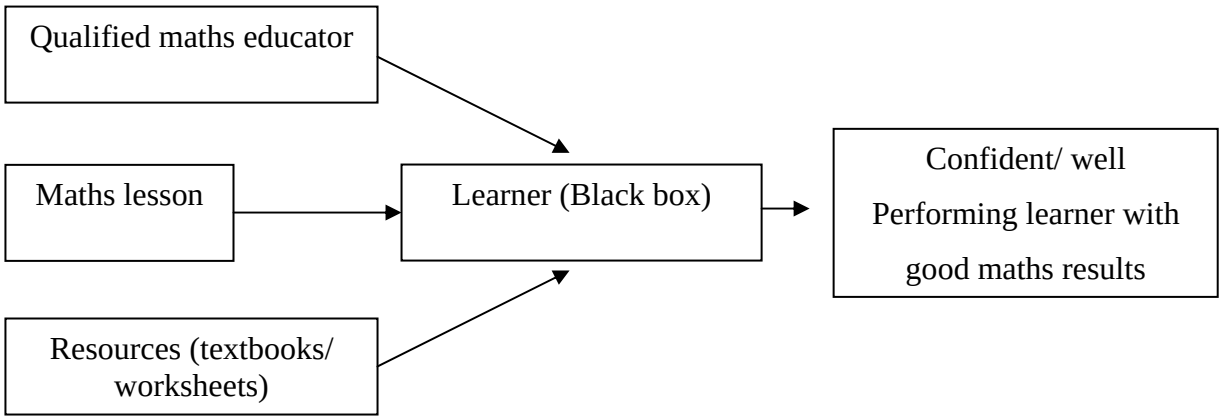

Figure 1.1 Representation of the ideal situation in the maths class

The school Principal has subsequently declared maths to be a 'subject in crisis' and decided to focus on improving the maths results by identifying the causes of the poor maths performance and finding strategies aimed at improving maths learning at the school. The suggestions that emerged include purchasing textbooks, arranging extra maths lessons after school hours and during school holidays. Educators of maths have been supplementing the daily notes and examples with exercises, worksheets and assignments that they have developed for the learner. Furthermore, the current prescribed hours for maths and the duration of a school day have been found to be adequate and educationally sound, taking into consideration learners' level of development. It has yet to be shown that extending the school day to accommodate more maths, will accomplish the desired results. Though these were seen to be important factors, I felt that these suggestions did not address the real issues underlying the challenges that learners faced in the maths class.

Some of my preliminary reading on affect revealed that the range of emotions that learners developed as a result of their experiences in maths had a direct bearing on their performance in maths. Furthermore, studies in the area of affect, showed that the self-efficacy beliefs of learners in the maths class, peers and educators were important contributors to learners' disposition toward maths. To determine the factors that affected learning in the maths class, I realised that the attention needed to be focussed on the learners because only they could shed light on their poor maths performance. This led to the second research question, which sought to determine the affective factors that influence learning in the maths class.

1.4.1 Observation

The backdrop to this study is my observation of a few maths lessons prior to the commencement of this study. I decided that to get a 'feel' of the environment in the maths class and to further understand what went on in the class, it was necessary to informally observe the learners during their maths period. This experience, as described in my notes, formed the motivation for this study. With my colleague's permission I observed a few maths lessons in a grade eleven class. Within ten minutes of the first observation lesson, my presence in the class ceased to be a novelty and 'normality' returned to the class. This was good because I had wanted to remain as 'invisible' as possible in order to get an idea of what really goes on in the maths class without my presence impacting on learner behaviour. The maths educator, Mr Tyler, started the lesson by reviewing the homework that had been set for the previous maths lesson. Some of the learners were busy copying down all the correct answers as Mr Tyler was writing them down and explaining them to the learners. Evidently, they had not even attempted the exercise but wanted a book full of correct answers. Sadly, it must be pointed out, that if having the correct answers were the solution to learning maths, then maths would not be the concern that it currently is. In my opinion, it was this very belief that led to poor maths performance. Mr Tyler explained that paying attention and understanding the work was more important than having the correct answers as learners still needed to be able to solve the problems on their own eventually. Mr Tyler then continued with the lesson for the day, explaining the importance of understanding the concepts being taught and its place in the scheme of maths seeing as it would form a basis for the work that was

to follow in that week. He emphasised that maths learning is accumulative in nature hence every maths lesson is an important link in the chain of learning.

I found that some of the learners had at first started to pay attention and then slowly their attention had started to dwindle and they began to look out of the window, fiddle with their pens or interfere with the person next to them. No attempts were being made by these learners to try to work out problems that were given on the board. They took down copious notes but did not attempt any of the activities. It seemed as though their maths lesson was about having a book full of notes and correct answers without a thought for what they meant. I interpreted this as being either boredom, that is, if the learners knew the work that was being taught and did not want to hear it again, or that they just could not grasp what the teacher was saying and were in fact 'lost'. I suspected it was more likely to be the latter of the two scenarios since this was firstly a new lesson and secondly there did not seem to be any understanding on the part of these learners of what was being taught.

This attitude to maths was displayed over the next few lessons as well. Just a handful of learners listened intently to the lesson that was going on and attempted the problems which were put onto the board. During a class test, I observed many of them read through the questions, write down question numbers, then without any working, put down answers, which I later discovered had no relevance to the question or even the section at hand. For many, this test was about finishing as quickly as possible so that they could concentrate on other things. It appeared as though learners had written down some answer in order to avoid the embarrassment of having too many blanks on their answer sheets. Despite this, many questions were left unanswered and yet learners professed to have 'finished' the test. The faithful 'lot' of learners who engaged in the lessons actively, completed their test and worked to the last minute checking their work thoroughly. The test results revealed and gave credence to what I had suspected, that those who paid attention and attempted the problems performed significantly better than those who did not. Why some of them would persevere and yet others would not even make an attempt was a question that I wanted answers to.

This led to the next research question, which sought to determine strategies that learners thought would improve their learning of maths. In so doing it became necessary to find out what preventative measures could be taken to avoid the challenges that learners faced. I was convinced that answering these research questions would enable me

to determine the answers to this study. Observation of learners during maths lessons brought to light the fact that any research on learners had to focus on their perceptions of and experiences with maths.

1.4.2 Rationale for the study

As an educator of maths, one of my visions is to inculcate in learners a passion for maths. I certainly did not want this to be an idealistic goal. For teaching and learning to be successful in the maths class, this goal has to be actual and achievable. To achieve this goal, the first step would be to understand the barriers that learners face in the maths class. To accomplish this it became necessary to investigate the perceptions that learners had of maths. The research topic was formulated as a means of achieving this end and is an investigation into the experiences and perceptions that learners have in the maths class with the purpose of understanding the challenges of learning maths. If the experiences and perceptions of maths learners could be revealed, it would provide a window into the world of maths as seen through the eyes of the learners. Once the challenges that maths learners faced became evident, strategies could be developed to help overcome these barriers to learning maths.

Through the last century there have been many shifts on the thinking behind poor mathematical performance. These shifts have been driven by research, which has been motivated by concern over consistently low maths performance. Schools and teacher training colleges have been through trends in teaching and learning mathematics, which at different points in time emphasised different teaching and learning styles-'drill and practise', 'memorisation' and 'discovery learning', to name but a few. Yet another line of thinking professes that 'teaching for understanding' is the key to improving mathematical learning. The learning process is dependant on many significant factors, those that affect learning intrinsically and those that use extrinsic motivation. The mathematical performance of learners is due in part to the interplay of both of these types of factors. For example, primary school children generally seem to enjoy working with numbers and manipulating them, yet as they approach high school, their love and enjoyment of mathematics tends to wane. As a maths educator, my challenge includes attempting to understand what causes learners to feel this way about mathematics and strategies that will make them want to learn maths.

The future of mathematics as a subject of study looks bleak. The aim of developing in learners a love of mathematics seems to be seldom achieved. The learning of mathematics has always been a stressful activity for many mathematics learners. After a century of investigating, experiencing, theorising and practising, we still ask the question: How do we improve the learning of mathematics for all learners? Educators are charged with the task of ensuring that learners are adequately equipped with mathematics knowledge, skills, attitude and values that are necessary for them to function effectively in and out of the workplace in a highly technological society (Kilpatrick, Swafford & Findell, 2001).

This research sought to investigate, among others, the role of affect on learner performance. It was my intention to find out what made mathematics such a challenge for the majority of our learners. What did learners see as being the challenges to their learning of mathematics and what did they think could be done to overcome these barriers? This study aimed to provide rich, diverse data on affective issues that maths learners experienced and alternatives for improving student learning. The dissertation has been divided into chapters that describe the sequence of the research. Chapter Two presents a critical review of the literature that has informed and guided this research. It provides a framework for the (a) affective factors that influence maths learning, (b) attribution theories in the area of affect and maths including self-efficacy beliefs of maths learners and how they can be developed and (c) development of a positive learner environment to benefit maths learning. Chapter Three is a discussion of the research design and the methodologies that were used to accomplish the aims of the research. Chapter Four discusses the findings of the research based on the data that was collected from the research methodologies. Chapter Five presents the findings from Chapter Four. Limitations and ambiguities that arose from the study were included in this chapter. This chapter also concludes this dissertation with recommendations for further study in the area of affect.

CHAPTER TWO

LITERATURE REVIEW

This chapter details the theoretical framework surrounding research on affect and its relation to maths education. My concern in this study lies with determining (a) the experiences and perceptions that learners have in the maths class, (b) the reasons that learners attribute to their performance and (c) what learners think will make them want to learn maths. Poor maths performance, the drop in the number of learners who wish to study maths at tertiary level and the advances in technology that require a mathematically literate workforce have generated much interest in affect and its impact on learning maths. This has been confirmed by the National Council of Teachers of Mathematics, who has reaffirmed its concern with affective issues by recommending the assessment of student confidence, student interest and perseverance with respect to mathematics achievement (Mcleod, 1992). This has resulted in research being done on the interplay between mathematics and cognitive and affective factors. This research is of value to educational practitioners because it seeks to highlight affective issues that influence learning in the maths class.

2.1 FOCUS OF THE STUDY

The purpose of this review is to highlight the theoretical viewpoints guiding research in the area of affect and its effect on learner attitude to maths. As such the review will be discussed under the following key areas: (a) defining and discussing *affect* and *attitude* to maths and their relation to learning, (b) *attribution theories* and more specifically the *self-efficacy beliefs* of learners and their effect on learners attitude to maths, (c) the learning environment and its influence on learner perceptions and attitude and (d) strategies that will improve the learning of maths. I will first clarify the role of mathematics in education, followed by an explanation of the key concepts affect,

attitude, self-efficacy and confidence, by reviewing the theoretical definitions as expounded by various researchers. Secondly, I will discuss some of the different theoretical perspectives on affect and the role that they play in influencing learner attitude to maths, drawing upon the research and findings of national as well as international studies in this area of research. The findings of these studies will be presented in this review to highlight the concepts of this study and to offer an unbiased critique of the various points of view. Thirdly, I look at self-efficacy beliefs and their influence in developing learner disposition to mathematics. In the discussion on strategies for the improvement of maths learning, I found that the role of the teacher, peers, classroom environment and learner self-efficacy beliefs overlap in many ways. I have therefore decided to discuss them separately for the sake of emphasis and this discussion informs the way the data analysis is done later on. Establishing the definitions of the terms used in this study ensures that the researcher, the participants and the readers are clear about the meanings that have been attached to the concepts in this dissertation.

Role of Mathematics

Mathematics is a key subject in the study of the natural sciences and yet it also extends itself beyond this to a variety of learning sciences. It has often been referred to as the “queen of sciences and yet the servant of all“ (Department of Education, 2002, p. 47). Through the course of time, mathematics developed out of a need to count and to keep a record of numbers. According to Joseph (2000) there has always been a society that has used some form of counting. Since time immemorial, mathematics has been an activity worth studying. The study of maths enhances human capability and ensures the development of technology, business, education and government. Society as we know it has made huge advances in all spheres of life. The advent of the computer has brought with it advances in information technology which has tapped into all aspects of human functioning. Ensuring the maintenance and further development of this technology requires highly skilled people who are mathematically literate.

The South African National Curriculum Statement has attempted to define mathematics as a “distinctly human activity” which with “rigorous logical thinking” and creative reasoning about the world in which we live, “ enables us to understand the world and make use of that understanding in our daily lives” (Department of Education, 2002, p. 9). There are many reasons for the study of mathematics at school. Within the South

African context, mathematics at school is taught with the purposes of (a) empowering learners with functioning competency in mathematics so that they are able to solve real-world problems and make sense of their 'world', (b) enabling learners to develop an appreciation and a deeper understanding of mathematics and (c) ensuring the continual study of mathematics at tertiary level in an attempt to advance the study of mathematics and to ensure vocational opportunities in the field of mathematical sciences (Department of Education, 2002).

Mathematics develops the power of deductive reasoning that enables one to reason logically and to participate actively in society. Advances in mathematics and its related fields will be made as learners progress through school and into society. Schools are charged with the task of anticipating the needs and changes in technology and in preparing learners to meet the challenges of a dynamic society (Department of Education, 2002). "Mathematics is …a human endeavour. Through the continuing inventiveness of the human mind, new mathematics is created and recreated through social interaction over the centuries of human existence" (Department of Education, 2002, p. 47). The developments in science and technology are ongoing processes that have been fuelled through the dual interaction of mathematics and the creativity of the human mind (Kilpatrick et al., 2001).

2.2 KEY CONCEPTS

In this section I will introduce and discuss some key concepts used in this study.

2.2.1 Affect

In the context of maths education, the *affect* refers to *the range of emotions (*feelings, beliefs and moods) that learners develop toward a subject as a result of their experiences with it in the classroom (Mcleod, 1992). For the purposes of this study, I too refer to affect as the range of emotions that learners develop toward maths as a result of their experiences with it.

2.2.2 Attitude

Renga and Dalla (1993) describe attitude as " the tendency to behave favourably (positively) or unfavourably (negatively) to given circumstances" (p. 23). Mcleod & Ortega (1993) refer to attitude as " affective responses that involve positive and negative feelings that are relatively stable" (p. 29) and they have identified two ways in which attitude is formed. The first, they claim, is when learners experience many negative experiences in an aspect of mathematics and the accumulation of these negative experiences culminates in the learners developing a negative attitude to these aspects in maths. A learner, who experiences consistent failure in geometric proofs for example, may develop a negative attitude to geometry. From my own experience with teaching, learners often say that they hate geometry and would rather study algebra. The second is the transfer of this negative attitude to other aspects of maths, which eventually creates a negative attitude to maths in general (Mcleod & Ortega, 1993). Neale (1969) proposes that attitude to maths is a product of "liking or disliking mathematics, a tendency to engage in or avoid mathematical activities, a belief that one is good or bad at mathematics, and a belief that mathematics is useful or useless" (p. 632). Similarly Aiken (1970) describes attitude as the tendency of an individual to act positively or negatively to a situation. According to Middleton and Spanias (1999) attitudes are more or less stable feelings that develop over a period of time when learners experience repeated instances of success or failure. In this study, attitude refers to feelings that are more or less stable and that indicate a positive or negative disposition to maths.

2.2.3 Self-efficacy

Bandura (1986a) introduced a theory of social learning which propagates the notion that the perceptions that people develop about their capability affects the goals that they pursue and the degree of control that they have over their environment. Self-efficacy beliefs refer to a person's belief about their own capability to perform certain actions or tasks effectively to a designated level of performance. According to Bandura (1986a) individuals engage in personal ability judgements based on their own unique system of appraisal, the task at hand and the situation at that point in time. Self-efficacy, with respect to maths schooling, refers to learner beliefs in their capability to do maths and to perform at a designated level of performance.

2.2.4 Confidence

The National Council of Mathematics Teachers, has emphasised affective issues, setting two of its major goals as (a) helping learners to understand the value of maths and (b) developing confidence of learners in maths (Renga & Dalla, 1993). According to Renga and Dalla, learners base their confidence in themselves on the way that teachers perceive them and try to fit their various experiences and the feedback that they get to suit this perception. Feedback that is not in keeping with this perception is rejected. Teachers can improve the situation by helping learners develop confidence in their maths ability. According to Renga and Dalla (1993) self-confidence in mathematics leads to the development of mathematical understanding.

2.3 ATTITUDE

2.3.1 Constructivism

Constructivism is a theory of how people learn. Constructivist classrooms emphasise the role of learners as active participants in their own learning. The teacher is seen as a facilitator rather than someone who delivers the knowledge (Kanai & Norman, 1997). The role of the teacher is to develop learning experiences that encourage learners to construct knowledge for themselves. It emphasises the need for the teacher to structure and control the learning process so that learners are able to achieve the objective that has been set out by the teacher. In constructivism the emphasis is on getting learners to be motivated by their own desire to learn, to build up their skills, ability, knowledge and understanding. The constructivist understanding of learning implies that if maths learners are to be active in their own learning, teachers must ensure that consideration is given to learners' emotional state in creating an environment that is conducive to learning. The cognitive approach to learning focuses on the learner's developmental level of learning. Motivation and the affective processes highlight the emotional factors. In my research I focus on investigating the affective factors that learners believe are influencing their learning and hence performance in maths. Mcleod & Ortega (1993) claim that when learners are active participants in their maths learning, it has a positive effect on their feelings and attitudes.

2.3.2 Correlation Between Attitude and Performance in Maths

The studies of Middleton and Spanias have shown a positive correlation between attitude, positive experiences, beliefs and achievement in mathematics. Creating a positive learner attitude to maths, they say, should be included as a primary goal in the mathematics class, as this facilitates maths learning (Middleton & Spanias, 1999). A positive attitude is viewed by many authors, for example Middleton and Spanias, Mcleod and Ortega and Renga and Dalla, as an important goal of instruction because positive attitude in learners facilitates learning. Positive attitude can be achieved when learners have mathematical experiences that they enjoy and can succeed in. It is therefore important that learners enjoy and develop a love for maths (Renga & Dalla, 1993). Learners who believe that maths is important, are more likely to feel positive about it and tend to value maths more than those who do not (Middleton & Spanias, 1999).

2.3.3 Factors that Affect Attitude

A positive attitude to maths has been linked to achievement, learning and enjoyment in maths. The following reviews focuses on studies that investigated factors that affect learner attitude to maths.

Teacher

The teacher plays a role in creating an environment that encourages equity amongst learners, self-confidence, persistence, and coping strategies in the face of failure (Middleton & Spanias, 1999). A study done by Bolaji (2001) found that the personality of the maths teacher, the role that they played in the lesson (involvement with learners) and the comments that they make to learners, play a huge role in forming positive learner attitude to maths. In keeping with the studies of Fennema (1976), he found that teachers who were enthusiastic, well-organised, achievement oriented, approachable and who motivated learners intrinsically, had learners with more positive attitudes to maths. The study focused on a group of Junior Secondary learners in Zaria and showed that teacher-related issues were instrumental in developing learner attitude toward maths. Bolaji (2001) contends that the behaviour that teachers display and the activities that they facilitate are central in forming learner attitudes. Studies indicate that the decrease in the

number of learners with positive attitude is in part attributed to lack of teacher support and classroom environment (Middleton & Spanias, 1999).

Attribution Theories

" Attribution theories deal with how the outcomes of an activity are evaluated in relation to the individual's perception of their own contribution (i.e. effort or ability) and the contribution of the task demands" (Middleton & Spanias, 1999, p. 69). Atkinson (cited in Middleton & Spanias, 1999) focuses on factors that students perceive as contributing to their success or failure in maths and discusses these in terms of attribution theories. He shows in his study that attribution theories identify causal factors such as difficulty and luck, known as unstable factors, and ability and effort, known as stable factors that learners use to explain their performance in maths. Furthermore, Atkinson suggests that success is not a universal motivator and that the learner's explanation of his success does not necessarily lead to a motivated learner. For example, if the learner believes that his success was because of the simplicity of the task as opposed to the effort that he made then he is less likely to be motivated by it. Similarly, if a learner attributes his failure to lack of ability rather than to lack of effort then he is less likely to be motivated to make an effort in the future. This is an attribution trait leading to failure.

Gender

Of significant interest to the maths educator is the difference in the attitudes of male and female learners in the maths class. Boys tend to show a more positive attitude to maths than girls do even when the performance of the latter outshines that of the former (Middleton & Spanias, 1999). Leder (1992) found that teachers are generally more helpful to boys, encourage them more and generally create the impression that boys are more maths oriented than girls. Studies by Fennema (2000) corroborate these findings and highlight the attributions that male and female learners make about their performance as further evidence of gender disparity in maths. For example, female learners tend to believe that they need to put in greater effort than their male counterparts if they are to succeed in maths. They tend to attribute their success to effort and lack of success to lack of ability. Male learners are more likely to attribute their success in maths to ability and their failure to lack of effort (Fennema & Sherman, 1976). Male and

female learners also respond differently to different aspects of teacher behaviour and teacher involvement and this affects their attitude to maths (Bolaji, 2001).

No study of learners is complete without acknowledging that despite efforts to achieve gender equity in all spheres of life, gender differences still do exist, albeit less than before. Society does tend to expect that boys, more than girls, should be able to do maths and that it is okay for girls to shy away from maths, but not for boys to do so. This stereotyping of boys places them under more pressure to succeed at maths and is even more pressurising when they do not. Girls on the other hand are less pressured to do maths and to do well in it since this is seen as being socially acceptable. They may also be looked upon strangely if they do excel in maths (Fennema, 2000).

Learner Beliefs

The beliefs that learners hold about maths play a deciding role in whether they attempt to learn maths. If learners believe that a maths problem should be solved quickly then they are disillusioned when it takes longer than is anticipated. Learners then become less willing to complete or to attempt the activity. Learners hold a belief in their own ability to do maths (Renga & Dalla, 1993). Learners who believe that they are capable of doing the task, may attempt the task with a positive attitude. If they believe otherwise, they may be reluctant to attempt or to persist in completing the task in the belief that they will not be successful (Blay, 1995). Learners are also more easily disillusioned in the face of failure. Learners, who believe that they are capable in maths, tend to value maths more than those who do not (Middleton & Spanias, 1999). Mcleod (1992) claims that learner beliefs about themselves, significantly affects their affective responses to a maths situation. They assert that this belief in maths relates to achievement in maths and is consistently so. The views of the teacher, peers and society in general affect the way that male and female learners see themselves as learners of mathematics. Boys believe that they should perform better at maths than girls and surprisingly girls tend to believe this as well. This thinking is reinforced by the beliefs of the teacher and the behaviour of the teacher in the class.

In society in general, there is a perception that if parents were not good at maths, then their children will not be either. Parents are often instrumental in reinforcing the beliefs that their children hold about maths. " Many, even parents believe that math ability is genetic… Parents tell their kids that they don't expect them to succeed in math because

they, themselves, were unsuccessful." (Mcleod & Ortega, 1993, p. 26). Parents who themselves were not good at maths or are afraid of maths pass this on to their children. Learners watch their parent's behaviour and reaction to maths and use this to justify their own performance in maths. Mcleod (1992) mentions that parents find poor grades in maths more acceptable than poor grades in other subjects. This is in keeping with the beliefs of the American public that the learning of mathematics is related to ability rather than effort. This is in contrast to the findings of studies on Japanese and Chinese parents who encourage their children to work hard at mathematics. They emphasise that with effort they can excel at maths (Renga & Dalla, 1993; Mcleod & Ortega, 1993).

2.4 SELF-EFFICACY BELIEFS IN MATHS

Research has shown that people who perceive themselves as being highly efficacious, think differently from their counterparts. The interplay between thought and affect is put into action and is a strong predictor in determining how learners produce their future in mathematics. The self-efficacy beliefs of learners refer to the belief that learners have in their ability to accomplish a task successfully.

2.4.1 Self-efficacy

Cognitive theory is a theory of learning that focuses on the thinking processes underlying any learning activity (Bandura, 1994). Cognition is emphasised because of its role " in people's capabilities to construct reality, self-regulate, encode information and perform behaviours " (Pajares, 2002, p. 1). In the 1970's, Bandura, saw a gap in this theory of social learning and identified self-efficacy as a key element that fits this gap. Maths self-efficacy refers to the belief that learners have in their capability to do maths. According to Bandura's social cognitive theory, individuals tend to participate in tasks that they feel confident and competent in and avoid tasks that they believe they are not so competent or confident in (Pajares & Schunk, 2001). Social cognitive theory, as expounded by Bandura, says that "behavioural and environmental information create the self-belief that, in turn, inform and alter subsequent behaviour and environment" (Pajares & Schunk, 2001, p. 13). Social cognitive theory focuses on the interplay between personal factors, behaviour and the environment. This theory sees people as interpreting their own behaviour, which influences their environment and their own personal factors.

This in turn influences their behaviour. These three components form a "triadic reciprocality" (Bandura, 1986). Bandura's theory of self-efficacy, lends itself to the study of affect in maths.

Self-efficacy is context specific. A learner may have high self-efficacy in some aspects of maths, but not in others. Bandura (1986) says that learners act on what they believe they can do and what they expect the 'outcomes' to be. There are many variables that affect learner achievement in maths for example affective, motivational and cognitive variables. According to Singh (cited in Hammouri, 2004) the dynamic interaction between these factors is the catalyst in the formation of learner perceptions and attitude in maths and understanding these factors is critical to understanding the challenges facing maths learners. One of the factors identified by Singh is self-efficacy. According to Bandura (cited in Pajares, 2002) self-efficacy forms the basis for human motivation, perseverance and behaviour. Human action and perseverance is determined by failure or success in a task or action. Learners in the maths class may react quite differently to the results that each receives in an assessment. Two learners, who have achieved similar results after putting in equal effort, might be affected in different ways. For example a learner who is normally a high achiever well might be disillusioned by his marks if it is lower than his usual performance. This disillusionment might discourage the learner from persevering in another similar assessment, whereas a learner who does not normally achieve well, will no doubt be highly excited and encouraged to persevere if his achievement is higher than normal (Pajares, 2002).

Self-efficacy beliefs influence learners expectations of outcomes. Learners who are confident in their ability to do maths, will have a high expectation in the success that they will achieve in a given task or test. But learners whose self-efficacy indicates low confidence in maths have a low expectation in their ability to perform the task with success. According to attribution theories discussed earlier, the reasons that learners attribute to their performance in maths influence the effort that is put into future tasks and the degree of perseverance in that task. Self-efficacy beliefs therefore influence the way that learners envision performing in a task and the expected outcomes. Pajares (2002) points out that the link between self-efficacy beliefs and behaviour is not always consistent. A learner, who is highly self-efficacious in maths, may not always act in accordance with these beliefs. Some learners might look at the requirements of the task and decide that it is not worth the effort. According to Bandura (1986a), highly

efficacious maths learners display qualities of (a) eagerness and commitment in tackling a maths task and (b) perseverance and resilience in completing the task. They also regard failure as a minor setback and attribute failure to factors that they believe are within their control.

2.4.2 Impact of Self-efficacy on Maths Learning

According to Bandura (1986a), self-efficacy plays an important role in determining the amount of effort that a learner will put into an activity, the learners perseverance and the extent of his resilience in the face of adversity. This is illustrated in Figure 2.1. The higher a learner's self-efficacy beliefs, the more will be the amount of effort, resilience and persistence that a learner is likely to show toward an activity (Bandura, 1986a).

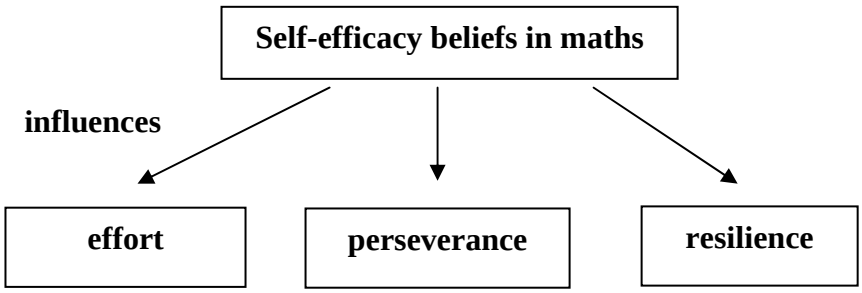

Figure 2.1 Representation of the influences of self-efficacy on learners

Highly efficacious learners generally attribute failure to lack of effort. Learners with low self-efficacy see things as being more difficult or insurmountable than they actually are (Bandura, 1986). Self-efficacy beliefs also influence the amount of anxiety and stress that learners experience when they engage in an activity. According to Pajares and Schunk (2001) high self-efficacy beliefs in learners, tend to encourage feelings of calmness and confidence in the way they approach a task. Highly efficacious maths learners view tasks as challenges to be overcome. They display perseverance and resilience during the task. Success or attainment of the desired level of performance encourages better performance, which in turn fuels greater confidence and higher self-efficacy. Learners with low self-efficacy beliefs tend to be less confident and therefore more anxious and stressed when attempting a task. They would rather avoid the task seeing it as a threat than confront it. Consequently, they do not exert as much effort into an activity and this more often than not, leads to failure. Failure in learners with low self-

efficacy lowers the learner's confidence and morale (Pajares & Schunk, 2001). In this case low self-efficacy tends to perpetuate itself.

2.4.3 Self-efficacy as a Predictor of Performance

Self-efficacy beliefs of learners, whether high or low, according to Pajares (2002) are vulnerable to experiences or consequences that have a huge impact on them. High self-efficacy beliefs in learners are most often the product of repeated experiences of success over time. High self-efficacy is more sustainable and predictable over time. The " focus on a student's sense of self as a principal component of academic motivation is grounded on the … assumption that the beliefs that students create, develop, and hold to be true about themselves are vital forces in their success or failure at school" (Pajares & Schunk, 2001).

Studies done by Multon, Brown and Lent and Collins (cited in Pajares & Schunk, 2001) show that self-efficacy beliefs have a positive influence on academic achievement and that highly efficacious maths learners completed more maths problems correctly and were more persistent in answering problems that they had earlier missed out. Highly efficacious maths learners, when faced with difficult problems in maths, are more likely to engage in different strategies or to develop new ones in an effort to find the solution (Miltiadou, 1999). Generally, self-efficacy determines the amount of effort that a learner expends on a task. In that regard, Bandura (1986) acknowledges that high self-efficacy is a "double-edged sword" in that a learner who is highly efficacious in maths, may not see the need to invest much effort, if at all, in preparation for a task. Maths learners with low self-efficacy beliefs in maths are inclined to tackle easier tasks that are more likely to yield success. If the learner has a low self-efficacy belief in maths, it is most likely that the performance will be poor (Fennema & Sherman, 1978; Fennema, 1984; Bandura, 1977). Low self-efficacy beliefs have been found to impact on other areas of affect, for example maths anxiety, which in turn affects achievement. The improvement of learners' self-efficacy beliefs is directly related to improvement in academic performance (Miltiadou, 1999). Self-efficacy is a major concern in the studies of academic achievement and attribution theories. Seeing as self-efficacy is such an important factor in achievement in maths, it has been suggested that self-efficacy not be overlooked in the hope that it will develop on its own, if at all, but that it be developed in the learner (Blay, 1995).

2.4.4 Gender and Self-efficacy Beliefs

The need to entrench gender equity amongst all is highlighted in the National Curriculum Statement which stresses that "the teacher needs to be sensitive to the manner in which gendered attitudes towards mathematics play themselves out in the classroom…" and that "stereotyping needs to be guarded against in this respect where mathematics is seen to be a male preserve leading to arrogance and domination by the boys in the class " (Department of Education, 2002, p. 48).

The findings made by Bolaji (2001) in his study of factors that influence students' attitude towards maths learning, are as follows (a) male and female learners react differently to aspects of teacher behaviour and teacher involvement and (b) this was shown to affect learners' attitude to maths. Leder (1992) found that learners perceive teachers to be more helpful and encouraging to boys and that teachers generally created the impression that boys were more maths oriented than girls. Pajares and Schunk (2001) cite the works of several researchers whose findings show that gender differences in maths self-efficacy beliefs are still prevalent. Girls are still more likely to underestimate their capability in maths even though their maths performance indicates the contrary. Yet the statistics quoted by the same researchers indicate that the gap between academic achievement between girls and boys is diminishing. Girls are also more likely to attribute the reason for their good maths performance to effort rather than ability. Studies done by Kanai and Norman (1997) indicate that as learners progress to high school, boys have more confidence in their maths abilities than girls even when the girls perform better than the boys.

2.4.5 How are self-efficacy beliefs created in learners?

Pajares (2002) outlines four primary sources that he considers to be major contributors to the formation of self-efficacy beliefs. These are (a) mastery experience (b) vicarious experience (c) emotional states and (d) verbal persuasions. He contends that it is the "integration, interpretation and recollection" of information derived from experiences with these sources that influences the development of ones self-efficacy beliefs.

Mastery Experience

" Failures that are overcome by determined effort, can instill robust percepts of self-efficacy through experience that one can eventually master even the most difficult obstacles" (Bandura, 1986, p. 399). He emphasises that mastery experience is the most influential source of self-efficacy beliefs in the learner. The learner's past successes or failures are the most reliable way of assessing the self-efficacy of a learner. He contends that exposing or engaging maths learners in authentic mastery experiences results in successful maths experiences and that, in turn, enhances learners' self-efficacy in that aspect of maths. The opposite is also true. Experiences of failure will lower self-efficacy beliefs in that task. Learners engage in tasks and interpret the outcomes of their tasks. Successful experiences raise self-efficacy beliefs and unsuccessful experiences lower and justify low self-efficacy. After several successful experiences, self-efficacy beliefs are quite strong. Occasional setbacks in terms of failure to successfully complete a task are not likely to dent a learner's self-efficacy beliefs. Learners who are highly efficacious are more likely to attribute lack of effort, poor strategies or situational factors as causes of their performance. Once achieved, enhanced self-efficacy in one aspect of maths may be generalised across other aspects of maths similar to the one in which the self-efficacy of the learner was enhanced (Bandura, 1986).

Studies show that successful experiences tend to boost learners' confidence just as unsuccessful experiences have a negative impact on them. Successful experiences in the maths class helps to build positive attitude to maths (Renga & Dalla, 1993) and a positive attitude to maths facilitates the learning of maths. Learners, who constantly aspire to levels of achievement that are not within their immediate reach, regard it as failure when they do not achieve the results that they desire. For successful experiences to be within the grasp of learners, both teachers and learners must be engaged in goal setting according to levels and time frames against which learners can measure their achievement in maths. Learners are able to explore their own competencies without being demoralised by the comparisons made with their peers (Bandura, 1994). Doing this requires constant monitoring and evaluation during and at the end of each level (Mellick, 1999). Gauging their progress, as they are actively involved in their task enables them to see their progress, which in turn builds their self-efficacy and motivates them to persevere in the attainment of these goals. These goals must be specific, short-term and attainable yet challenging enough so that learners can achieve them successfully without

feeling deflated at the easiness of the task. Research indicates that the task of the teacher is to prepare learners to be successful by exposing them to different strategies, for example, goal setting, that can contribute to their success. When learners feel that they have the correct strategies for working out the problem successfully, they are going to feel greater efficacy in their ability to perform the task successfully and when they verbalise their strategy, it exposes the important features of the task helping the learner to complete the task and attain mastery (Schunk, 1995). Learners can be assured that successful experiences in maths are within their reach, if opportunities for success in maths tasks are created.

Vicarious Experience

A " vicarious experience" is one in which learners are able to learn and develop through observing the experiences and successes of others who share similar attributes as the learner himself. Learners self-efficacy beliefs can be boosted by watching others perform (model) mathematical tasks. If the learner observes someone (who has similar attributes as himself/herself), succeed in an activity it contributes to him/her creating the belief that he/she is also capable of accomplishing the task with the same degree of success (Pajares, 2002). If a learner assumes a high degree of similarity with a peer, then the peer's successful experiences are absorbed by the learner, and the learners is then persuaded that this success is possible for him/her as well. Emphasising that success is as a result of effort would reinforce the learner's self-efficacy belief in maths. This is especially applicable when the learner identifies with the peer.

The opposite is also true. When a learner, who identifies strongly with a model, observes that model fail despite high effort it can diminish the learner's self-efficacy beliefs in that maths task. It could result in doubts of the learner's own ability to be successful in maths. The educator, however, can minimise the impact of failure by stressing that the outcome was because of a lack of effort (Bandura, 1986b, Bandura, 1994). Encouraging learners to adopt competent, comparable models, similar in ability to the himself/herself, provides a greater chance that learning vicariously will be successful. Learners who are uncertain of their own capability in maths are more susceptible to being influenced vicariously than those who are set in their beliefs about their capability in maths. Though learning through observing others might not be as direct and strong as learning through one's own experience, vicarious experience does have a significant

effect on performance. The source that is considered to be the most common contributor to the development of self-efficacy beliefs is verbal persuasion (Pajares, 2002).

Verbal Persuasion

Verbal persuasion refers to use of persuasion to convince a person that they are capable of performing a task. In the context of this dissertation, verbal persuasion is seen as a strategy that is used to verbally persuade a learner that he/she is capable of successfully completing a task. Using verbal persuasion to build learners' self-efficacy beliefs in maths entails using realistic judgements about learner's performance in maths. It can increase learners' beliefs in their capability to perform a task with the required level of success. Verbal persuasion is a motivating factor in developing self-efficacy. It encourages learners to exert the effort required on a mathematical task. Verbal persuasion must be realistic if it is to be effective. It has proved to be influential in developing the maths self-efficacy beliefs of the learner when used appropriately (Bandura, 1994). Convincing learners that they are capable of the maths task at hand, enables them to overcome their doubt about their capability to take up the challenge successfully. Persuasion should seek to empower and motivate learners through developing their self-efficacy beliefs as opposed to being detrimental to the development of self-efficacy (Bandura,1986; Pajares, 2002).

However, attempting to convince a learner that a task of extreme difficulty can be done, when the learner is of the belief that the task cannot be accomplished, will not result in the desired behaviour. Persuading learners that they have the competency required to tackle a problem of extreme difficulty, only serves to diminish their already low self-efficacy in the face of failure. It then makes it more difficult to enhance the learners' self-efficacy on subsequent attempts (Bandura, 1986). An added disadvantage is that if the teacher was responsible for trying to persuade the learner, then the teacher loses all credibility in the eyes of the learner. This type of enhanced self-efficacy is volatile in the face of subsequent failure (Miltiadou, 1999). Verbal persuasion can be used to develop self-efficacy beliefs, but the effects are not always positive or lasting and is considered to be the weakest source of self-efficacy development. The last source of self-efficacy development is the physiological state of a person prior to an activity being performed.

Physiological States

The physiological state refers to the period just prior to a task being performed when the learner experiences anxiety, increased heart rate and symptoms of anxiety in anticipation of the task to follow. Learners who anticipate failure in a maths task, and experience strong emotional feelings of stress and fear, have low self-efficacy beliefs in maths. This is further justified by the very performance that the learner feared. However, those learners who expect to be successful in the task have a positive emotional disposition and enhanced self-efficacy beliefs. The teacher should seek to improve the learners' emotional welfare. Learners, who are convinced that they will fail at a task, most probably will because they themselves are convinced of it (Pajares, 2002). Hackett (1985) found that self-efficacy beliefs were a strong predictor of maths anxiety, even more so than of maths achievement. This links the perceptions that one has of their own capability to do maths with the onset of maths anxiety. The fact that attitudes are more or less stable feelings, shows that in order for learners' attitudes to change from being positive to becoming negative, the learner must have been through repeated situations of stress and anxiety. It is therefore not easy to change these attitudes.

2.5 STRATEGIES FOR THE IMPROVEMENT OF MATHS LEARNING

The research in this section focussed on affective issues and strategies that would improve maths learning. Emphasis was placed on the role of the teacher, peers, classroom environment and learner self-efficacy beliefs and their role in the development of meaningful learning experiences.

2.5.1 Experiences of learners in the maths class

Bolaji (2001,p.16) writes that "Since intrinsic motivation plays a crucial role in the success of a student, it is important for teachers to know how to and raise this motivation in learners". To develop and sustain intrinsic motivation, pupils need to be reminded of their own personal success in maths and this is an important function of the teacher (Bolaji, 2001). A study done by Middleton ad Spanias (1999) shows that the effort that learners put into their work is influenced by their expectation of successful outcomes. Hence learners' expectation that they will be successful in maths tasks influences their

motivation. Success and expectations of success in maths reinforces the achievement motivation of learners. High success rates imply that learners will put in even more effort into learning maths but low success rates often have a negative impact on effort and attitude (Renga & Dalla, 1993). Rawnsley and Fisher (1998) found that lower attitudinal scores were prevalent in environments where teachers admonished the learners, were strict and dissatisfied and allowed learners too much responsibility. If learners have enjoyable experiences in the maths class, it will make them want to perform well in it, it will boost the learners' confidence in maths and this success is likely to be positive reinforcement for effort (Hawkey, 1986). Peklaj and Vodopivec (2000) found that there was a positive correlation between feelings of success in maths and achievement. This clearly highlights the fact that success, motivation and achievement be considered, by maths educators, as significant factors in developing a positive attitude.

2.5.2 Role of the teacher in developing the classroom environment

The maths educator, being entrusted with the responsibility of accomplishing the aims and objectives of maths as set out in the National Curriculum Statement (Department of Education, 2002), is responsible for creating an environment that is conducive to the teaching and learning of maths. It must be realised that whilst some learners love maths and excel in it, a large number of learners are anxious about it and fear it. Understanding and compassionate behaviour toward maths learners can help to create a safe and unthreatening environment that is conducive to learning maths (Edge & Freedman, 1997). Rawnsley and Fisher (1998) emphasise that the learning environment created by the teacher can make learning maths enjoyable and learners feel valued if it is an encouraging one. On the whole, it is evident that discouraging environments lack good teacher-learner relationships and a good work ethos and therefore impact negatively on maths learning.

2.5.3 Attribution theories

As outlined on p. 15, attribution theories describe causal factors such as luck and difficulty, ability and effort, also known as stable and unstable factors respectively, as attributions that learners use to explain their performance in maths. Learners' attributions of their performance in maths affects their attitude to maths. Attribution theories deal with how the individual perceives his/her own contribution to the performance and how this is used to evaluate the outcomes of an activity in terms of the effort and ability put

into the task and the level of difficulty of the same (Middleton & Spanias, 1999). Teacher perceptions of learners affect learners' attributions of their own ability. If consistently high-performing learners perform poorly the teacher may attribute it to lack of effort when the actual cause may be that the cognitive level required of the learner is too high. By giving learners the impression that they did not try hard enough, the teachers fail to see the true attribute of the performance of the learner and are therefore unable to act in the best interest of the learner (Renga & Dalla, 1993). Attribution theories are regarded as being significant in helping learners make appropriate judgements of their performance (Hawkey, 1986).

2.5.4 Strategies For Developing a Positive Learner Environment

Pajares and Schunk (2001) suggest ways in which positive change in children's self-efficacy beliefs can be effected. I believe that the strategies that I have encountered in my reading can be extended to the classroom environment where the self-efficacy beliefs of learners in maths can be improved by improving the learning environment. Environments that provide a multitude of interesting activities that pique the interest of learners and offer challenging tasks that are within the grasp of children motivate them to engage in the activities. Books, puzzles and computers, amongst other resources, can be used as stimuli to encourage learner thinking. An environment that is warm, supportive and that supports responsive behaviour encourages learners' intellectual development.

Rawnsley and Fisher, (1998, p. 1), refer to the classroom environment in terms of the "psychological and social form" that it takes. The learning environment of each class is unique to that class. A positive learning environment is one in which the learner feels encouraged, valued and enjoys his/her work. However, from my experience in the class, it is well known that learner behaviour in the class is determined by the perceptions that they have of the class environment. The study by Rawnsley and Fisher focused on finding links between particular learning environments in the class and the development of learner attitudes to maths. Interviews and a questionnaire on teacher interaction were implemented with 490 grade nine learners from 23 schools in Adelaide, South Australia. The findings showed that learners develop a more positive attitude toward maths when the teacher was perceived to be supportive, equitable, friendly and helpful. It also showed that positive attitude was encouraged when teachers emphasised understanding of work, involved learners in investigations and displayed minimal admonishment of

learners. Learning environments can be encouraging or discouraging to learners based to a large extent on the perceptions that they hold about their teacher. Furthermore, learners tend to base their behaviour on the perceptions that they have of their teacher. Hence learner attitude to maths is very much a product of their perceptions of the learning environment. Rawnsley and Fisher found that learners, whose teachers exhibited leadership qualities, were helpful, friendly and understanding showed a healthy attitude to maths. This is in contrast to learners whose teachers displayed strict, admonishing behaviour and showed dissatisfaction with them.

Using success to develop a positive learning environment

Success must be thought of in terms of overcoming obstacles, especially when beliefs of learners say to them they cannot do the task. Overcoming these thoughts and teaching learners to believe that they can do maths when they believe otherwise must be viewed as success (Holt cited in Larcombe, 1985). One of the aims of maths as set out in the National Curriculum Statement (Department of Education, 2002) stipulates that " if students are to achieve mathematics proficiency, they must 'believe' that mathematics is understandable, not arbitrary; that with diligent effort, it can be learnt and used; and that they are capable of figuring it out ". Experiences of success in the maths class strengthen the learners' belief in their own ability to do maths (Bandura, 1994). Repeated experiences of this type serve to strengthen one's self-efficacy beliefs in maths. It must be noted however, if the learner encounters too many successful experiences due to ease of the tasks, a false sense of self-efficacy is created, and this could lead to learners' expectations that maths tasks should always be completed quickly. Hence when learners are given challenging tasks, and these take more time to complete than the time they are used to expending on a maths activity, the learners becomes disillusioned. Creating situations for success in an attempt to build self-efficacy in maths must include tasks of a sufficiently challenging degree, so that any success in maths can create a sustained feeling of efficacy. Failure is then seen as a minor setback from which learners can recover (Bandura, 1994). It is important that educators set tasks that are challenging, stimulating and can be accomplished within reasonable time frames.

Planning of Assessments

According to Pajares (2002) the aims of a task and the levels of performance indicating that a task has been successfully completed need to be properly outlined to the learner so that they can focus their effort on accomplishing the different levels of the task and accumulating marks whilst tackling the task. The assessment of the task must then be judged on the basis of these criteria. Learners must be aware of the performance criteria by which the task is going to be assessed and the levels that indicate successful completion. If this is not clear, he adds, then ambiguities can arise and learners may not understand the nature of the task. Learners can easily misjudge the level of difficulty of the task and this can lead to task failure. Learners who overestimate the task and think it is too difficult for them may display low self-efficacy and may be deterred from thinking that they can accomplish this task successfully. Those who underestimate the task may be over confident and may not exert as much effort in it as they should. According to Pajares, teachers should aim for tasks that are only slightly higher than the learner's actual capability, so that it gives them something to aspire to, yet something that is achievable. The nature of the task influences the learner's sense of self-efficacy of the task and how they approach the task. Ambiguities in the task affects the amount of effort that learners are prepared to exert on a task. It also impacts on whether learners will persevere in attempting the task and the extent of their resilience in carrying it to completion (Pajares, 2002). Successful experiences must be made personal to the learner and should not be seen in competition with others. Learners must therefore be encouraged to compare their current performance with their previous performance and not that of their peers (Larcombe, 1986).

Using Group Work as a Strategy in Teaching Maths

In a study done by Burton (2001) learners indicated that group work was an activity that they enjoyed. They mentioned that playing maths games was a form of group work that they enjoyed as well since it allowed them to be involved in their own learning. From my own experience in the class, group work tends to be successful in building self-efficacy beliefs among learners. Group work, with learners from different performance levels, is a strategy that can be used to creates the opportunity for learners to work together and learn from each other. It also provides the opportunity for learners within a

group to share in the glory of success, yet minimise the trauma of failure by allowing all the members of that group to absorb the impact of that failure.
Learners in this study tended to lean toward a constructivist class that emphasises active learner involvement claiming that this kind of activity was more relaxed and more conducive to learning and to remembering what was taught.

2.6 SUMMARY

Much of the research in the area of affect points to the fact that affect is a strong factor in determining learner attitude to maths. It is essential that any study concerned with the performance of learners in maths, considers the perceptions, experiences and attitude of learners in the maths class if it is to be authentic. This study focuses on investigating learners' perceptions of and experiences in the maths class in order to understand the challenges of learning maths. Furthermore I look at learner self-efficacy beliefs in maths and how they affect learner attitude toward maths. Knowing the affective factors that influence learning in the maths class enables me to recommend strategies for developing a successful learning environment in the maths class.

CHAPTER THREE

RESEARCH METHODOLOGY

The aim of this chapter is to explain the research process that led to the collection of data that was used to provide answers to the main research questions. This chapter presents a discussion of the research context, research design, rationale behind the research methodologies and data collection instruments, the data collection process, ethical considerations, sampling strategies and the techniques that were used in the analysis and interpretation of the data.

3.1 RESEARCH CONTEXT

The site of the research was Westlake High, which is an established high school in Chatsworth. It is situated in a lower socio-economic area and caters for learners predominantly in the areas of Chatsworth, Umlazi (both classified as previously disadvantaged) and some learners from the more affluent Mobeni Heights area. Many learners come from single parent homes and homes where one or both parents are unemployed. There are 1200 learners enrolled at the school. Class sizes are generally high, sometimes up to 55 learners in a Biology class and 48 learners in the senior maths classes. Parents do not play an active role in the financial running of the school hence the employment of more educators to reduce class sizes is presently not financially feasible. Westlake High is one of several high schools within close proximity of each other, yet the learner intake is much higher than that of the other high schools in the area. Westlake High has received commendations in their region for excellent performance in all subjects at Senior Certificate level with the exception of maths.

3.2 RESEARCH METHODOLOGIES

Having established the broad research topic, it was necessary to translate this into a set of concrete research questions that would provide the answers needed to address the scope of the research topic. Data gathered from these questions would enable the main research question to be answered. The research questions had to be developed in order to determine the research methods and data collection instruments that would be most appropriate in gathering the data that was needed. These questions provided a focussed means of investigating the research area (Cohen et al., 2000, Gaskell, 2000). Identifying the broad questions that arose out of the main research topic clarified the type of data that was to be captured in order to answer these questions. The following questions were drawn up to obtain preliminary data (a) What experiences and perceptions do learners bring into the maths class? (b) To what do learners attribute their success or failure in maths? and (c) What do learners think will improve their learning of maths in the class?

Reviewing the different research methodologies provided me with the opportunity to plan the best ways to obtain the data that was needed to answer the research questions. Qualitative and quantitative methods are systematic processes that fall within the realm of research. Qualitative research is concerned with exploring social and human problems in a natural setting, with the intention of understanding what people feel and the experiences that have caused them to have these feelings. Asking open-ended questions allowed me to delve into the personal experiences of the respondents to reveal and verify emerging themes concerning (a) the perceptions and experiences that learners have in the maths class, (b) the attributions and more specifically self-efficacy beliefs that they hold about their maths performance and (c) strategies for the improvement of maths learning (Patton, 2002; Bell, 1993; Cohen, Manion & Morrison, 2000). These methods included asking in depth questions about learners' feelings and looked at the meanings of situations as seen through the eyes of the learner. Using this research methodology enabled me to explore learner self-efficacy beliefs in maths and to determine learner perceptions of factors that they perceived to be necessary in creating an environment conducive to learning maths.

Quantitative data collection methods make use of a limited range of predetermined responses in which the experiences and perceptions of people can be measured. The data from this type of research can be represented statistically and graphically. This type of research facilitates the analysis and the comparison of data. The poster activity and the

group interview would enable me to obtain data that was used to provide answers to the research questions. The poster activity would facilitate the collection of data on the emerging themes concerning the research area. These themes would be used in conjunction with other established surveys on attitude to develop the questions for questionnaire. The outcomes of the poster activity would also be used in the development of the questions for the group interview. After much deliberation on the merits of the various data collection instruments, it was decided that it would be necessary to use more than one source for the purposes of data collection in order to facilitate the collection of data that would further the aims of the study. My study therefore had both a qualitative and a quantitative component. This was achieved by the use of triangulation, which is a term that refers to the use of a data gathered from a variety of sources in order to achieve a study that is well-balanced (Bell, 1995). This research drew on elements proposed by the qualitative approach, using a poster activity and a group interview to determine answers to the three research questions. It also required the use of the quantitative approach, using a questionnaire to establish the extent to which the findings from the poster activity were representative of the grade eleven maths learners at this school. The first research question was aimed at finding the affective factors underlying the poor maths results at school. Research question two aimed at finding learner attributions of their success or failure in mathematics, and the role of self-efficacy beliefs in the development of these attributions. The third research question was aimed at determining learner perceptions of strategies that would improve the learning of maths.

In the qualitative part of the study, the first activity carried out was the poster activity. This was conducted with learners in order to identify the factors that learners felt were affecting their learning. To further investigate those factors that arose out of the poster activity, I decided that a group interview with the learners would allow me to accomplish this. Because the poster activity was administered with a select group of learners, it was necessary to determine the extent to which the responses that were extracted from this group of learners could be generalised across the maths learners in grade eleven. Quantitative research would yield statistics that would either support or challenge the qualitative results. In order to determine whether the findings from the qualitative part of the study were representative of all the maths learners in grade eleven, I decided that a small-scale survey was the most appropriate instrument to conduct this

part of the study. Table 3.1 indicates the data collection instruments that were used in the collection of data.

Table 3.1

Research Questions and Type of Data Collected

	Data Collection Instrument			
Research Questions	**Observation**	**Poster Activity**	**Questionnaire**	**Group Interview**
1. What perceptions and experiences do learners have in the maths class?	√	√	√	√
2. Learners Attributions and self-efficacy beliefs in maths		√	√	√
3. Strategies for the improvement of maths learning		√		√

Time Frames for data collection

The following time frames were decided upon and followed accordingly. The poster activity was carried out in the second term at school. It was decided to pilot the questionnaire in term two so that sufficient time could be allocated to refining the questionnaire prior to its final administration. To ensure that learners would give their full attention to the answering of the questionnaire and that the validity of the responses would not be compromised, it was decided that the final refined questionnaire would be administered during the third term at school. These time frames were chosen because the second term at school is a busy period, with grade eleven maths learners preparing for the Provincial examination that was to be written in June. Due to the strict time constraints of the school programme, the group interview that had been scheduled for the third term was conducted in the first term of the following year. In the sections that follow, each method of data collection is discussed in detail.

3.3 POSTER ACTIVITY

I discussed the collection of data with my supervisor who suggested that I initially engage the learners in a poster activity. The questions used in the poster activity were open-ended and were used to elicit responses from the maths learners on (a) What are your feelings about maths? (b) What do you perceive to be responsible for your "success" or "failure" in maths? (c) What do you think will improve your learning of maths? A copy of the poster activity questions and responses is found in Appendix A. The poster activity provided learners with the opportunity to respond but did not allow the researcher the opportunity to clarify or ask in-depth questions. This was due to the fact that the learners were assured that they could remain anonymous and, as such, did not attach their names to the responses, ensuring that the responses could not be traced back to a particular learner. It was decided that if any clarifications were necessary they would be addressed in the group interview. I administered the poster activity personally to ensure that the process was carried out effectively and that the validity, reliability and authenticity of data were not compromised.

3.3.1 Sampling

The participants in the poster activity were thirty-two grade eleven learners at Westlake High School, who take both Computer Studies and Maths as exam subjects. The average age of the respondents was 16. The class was made up of learners who exhibited a diverse range of maths marks. This was positive because it ensured that the responses of learners would not be skewed in terms of their maths performance. Learners in the class had their maths in splits which means that they were taught by different maths teachers. This was also important to the study since I did not want the findings to be attributed to a specific maths teacher. This study would be meaningful if the participants are reflected in terms of gender and achievement.

It was imperative that time frames be set from the outset of the study. In order to get authentic results the entire activity had to be completed within the allocated teaching period, and the outcomes of the chosen poster activity could be achieved within the time period. Allowing this activity to be spread over more than one period would give learners the opportunity to discuss the questions and to perhaps write down responses that were not entirely their own. This could taint the data and sway the conclusions reached (Cohen et al., 2000). Fortunately, the timetable runs on one-hour periods and with proper time

management, this time frame proved to be sufficient to adequately complete the poster activity. If the data collected was to be authentic, I could not impose my personal beliefs concerning affect on this study. To avoid any bias, the source of the information had to be the learners. A few days prior to the implementation of the poster activity, a brief explanation of the study was given to the learners who were then given letters of consent to sign. They were told that their responses were critical to the validity and success of the study and that it was therefore imperative that they be totally honest in their responses. Learners were assured of absolute confidentiality with respect to their identity. They were assured that even though their responses would be used in the poster activity, it would not be possible to link a response with an individual.

3.3.2 Data Collection

The poster activity was the first data collection method used to answer the research questions. The poster activity facilitated the collection of data on a single A4 sheet. This activity required learners to write down their responses on pieces of paper. Learners had to, within groups, categorise and paste each response onto A4 sized posters labelled Important, Very Important and Most Important. Some of the responses were overlapping each other on the poster and it was therefore necessary to rearrange these to facilitate them being scanned into the computer. The poster activity highlighted several emerging themes that each group used in the development of their poster. These were analysed and also used in developing the questions for the group interview.

The process of the poster activity was explained to the learners. Each learner was given 4 pieces of paper on which they were asked to write down their responses. They were then each given a few small pieces of paper on which they were required to write down their responses to the following questions that I had then written on the board (a) What do you feel about maths?, (b) Why do you feel this way? and (c) What do you think will improve your learning of maths? This activity was an individual one and learners were asked to write down their responses anonymously on the pieces of paper that had been given to them. They were told that they could write as many as four comments on each question and that they need not write their names. It was hoped that this would encourage them to respond truthfully and without fear of reprisal. Once they had written down their comments for question 1, they were told to put their responses into a box that had been provided for that purpose and they then repeated the process for

questions 2 and 3. When learners had completed this part of the poster activity, they were then asked to rearrange themselves in groups of about eight. Asking them to group themselves was done because I wanted learners to be part of a group that they felt comfortable with so that they would feel at ease to respond truthfully. Each group was given three sheets of A4 paper, a pair of scissors and glue. They were asked to use each A4 sheet as a poster and to title each one as (a) Important, (b) Very Important and (c) Most Important, respectively. These categories were selected as such to assure learners that every response was regarded as important. The responses that had been collected in the box earlier during the poster activity were then divided equally and indiscriminately amongst the four groups of learners. The task of each group was to categorise the responses that had been distributed to them according to what they perceived to be Important, Very Important and Most Important responses to the questions from the board. They were then asked to paste their selections for each category onto the appropriate poster (see Figure 3.1).

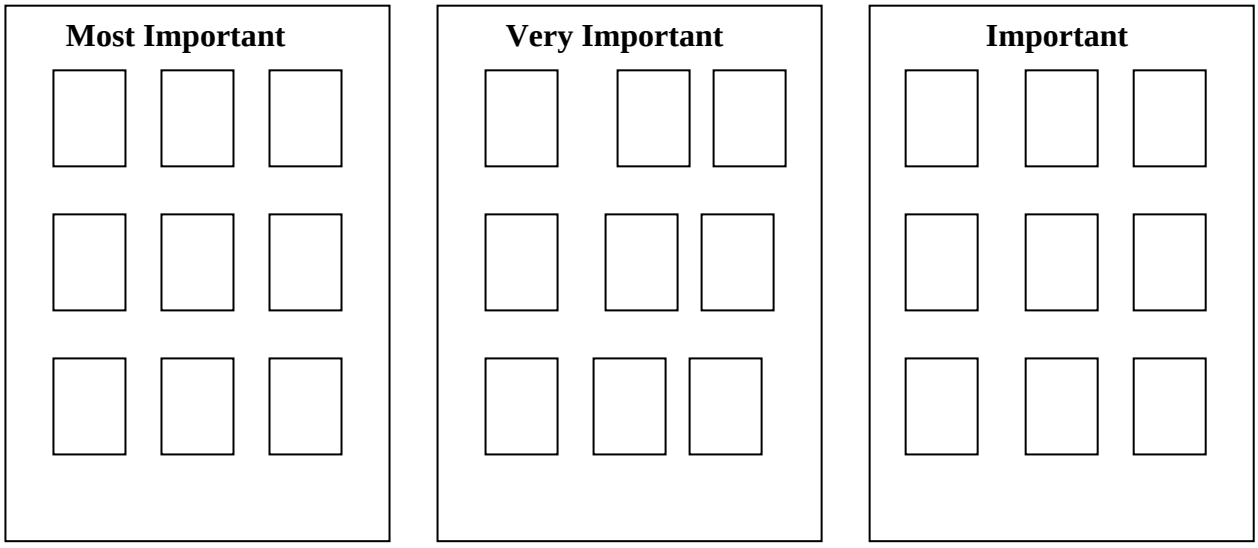

Figure 3.1 Diagrammatic Representation of the Poster

I requested that they remove any duplicates since it would serve no purpose to include the same type of response more than once on the same poster. These duplicates were then filed together with the rest of the data collected.

Initially, as I observed them, I noticed that the learners were a bit reluctant to openly discuss their thoughts. I reiterated that their participation was voluntary and that it was also confidential, pointing out that responses could not be traced back to the learner since names were not attached to the responses. Monitoring of the poster activity took place to

ensure that the rights and viewpoints of all respondents were respected without them being made to feel inadequate about their feelings. At the end of this session, each group presented their three posters. The posters were put up on the board for the class to verify. The last part of the activity entailed collecting the posters from each group. These were filed for further analysis and interpretation.

Hence the poster activity as a data collection method was a means of engaging the learners in an activity that generated the information needed for the design of the questionnaire and the questions for the group interview. It also allowed individual responses to be considered and yet allowed groups the opportunity to select responses that they felt were most important. Since the diversity of responses could not be predetermined, the poster activity acted as a filter to select the responses that indicated learners' perceptions of maths and some of the factors that affected their learning in maths.

3.3.3 Analysis

Although the poster activity was initially intended to generate themes that would be used in the design of the questionnaire, it was found to be a rich and diverse source of information. After referring to the initial aims of the research, I focussed the data analysis on the problem statement. As such, it was subsequently decided that in addition to the initial intention, the data from the poster activity would be analysed together with the transcript of the group interview to answer the research questions. Once the poster activity had been completed, I began the process of sifting through the data by reading through the comments on the posters in order to identify the themes. The process of analysis was a " continual revision, modification and amendment until all new units " could " be placed into an appropriate category…" (Rudeskam & Newton, 1992, p. 114). As the different themes arose out of this data they were recorded in a table using a word processor. As more themes emerged they were added to the table. I subsequently began the process of finding supporting evidence from the poster that had similar meanings and grouped these together. Once this was done, the process of tabulating the data into particular categories followed. Responses that encapsulated the meaning of specific categories were included in that category. Once this was done, the items on the table were categorised according to the meanings that they held and items that fell within a particular factor, those identified in Chapter Two, were grouped together. For example

responses to the question concerning attributions of feelings about maths include ‘teacher behaviour towards learners’. This was a common thread throughout most learner responses as a factor that influenced learner perceptions to maths. As such all comments regarding teacher behaviour towards learners were grouped together into positive and negative comments under the sub-heading teacher factors. The comments on each poster were then recorded into the categories that had been identified.

3.4 QUESTIONNAIRE

It was necessary to determine whether the range of responses elicited from the poster activity were common to all learners. The findings would be more significant to practitioners if they could be generalised across the maths learners in grade eleven. After consideration of the various types of data collection instruments and given the factors that arose out of the poster exercise, it was decided that a survey would be the most suitable research tool to capture the type of data that was needed.

3.4.1 Value of a Questionnaire

Attitudinal surveys (in the form of a questionnaire) consist of a series of statements to learners who are required to answer within preset responses and are a good way to collect valuable data on learner perceptions and attitudes. The questionnaire facilitates the collection and analysis of numerical data that is structured and can be easily generalised and administered by someone besides the researcher (Cohen et al., 2000, Gaskell, 2000). In particular, the questionnaire would allow specific data to be collected from a large number of respondents within a short time frame. If the questionnaire was going to determine what it was meant to, then its design had to incorporate the responses of the learners from the poster activity. Hence the data from the poster activity was used in the design of the questionnaire.

This data collection instrument is not without its disadvantages in that it is weighed down by the time taken to design, pilot and refine it (Cohen et al., 2000). 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, data collection has to be quick and efficient whilst ensuring reliability and

validity. A structured questionnaire met the needs as far as this was concerned since the questions were preset and the responses fell within a prescribed range. Learners then selected a response from those that had already been preset. The validity of the data collected was paramount to the success of the study since it had to measure what it said it would. Walker (1985) pointed out that a questionnaire was quick and easy to fill in and was directly and immediately accessible to the researcher whilst ensuring confidentiality. According to Cohen et al. (2000) a properly designed questionnaire facilitates the process of analysis that can be made even easier when the researcher is involved in the design of it. A questionnaire was useful in this context because it did not have to be administered by the researcher since the teaching load of the educator, as researcher, does not allow sufficient time for this. For this reason I enlisted the assistance of my colleagues in the administration of the questionnaire.

I invited all the maths learners in grade eleven at Westlake High to participate in the survey in order to ensure that an adequate number of learners would respond to constitute a valid study. Out of 167 maths learners, 149 questionnaires were used in the study. The large number of participants was not anticipated but I chose to use all of the responses to ensure that the data was not skewed. Despite the fact that the number of boys and the number of girls were not equal it was decided that the statistics reflected the reality of the situation and that the status quo should remain.

3.4.2 Development of the Questionnaire

Developing, designing and piloting of the questionnaire had to be done within reasonable time constraints so that the questionnaire could be refined and the final questionnaire completed and administered in due course. Prior to the commencement of the study, preliminary studies highlighted the Fennema-Sherman Maths Attitude Scale as a good resource for the design of the questionnaire. The Fennema-Sherman Maths Attitude Scales have proved to be popular and have been widely used since its development in 1976. These scales consist of nine instruments, which measure the attitude of learners toward maths. Despite its popularity in the area of research, it is not without criticisms. Though the Fennema-Sherman Maths Attitude Scales claims to have nine instruments in it, recent research has questioned the reliability, validity and integrity of the scores. It has been suggested that the total number of factors that the scales purports to measure is less than is stipulated and that scales might not measure what they

intended to. The Fennema-Sherman Maths Attitude Scales have been criticised for their simplistic justification of maths performance as the interaction between affect and behaviour of learners during learning tasks. Critics are wary of the use of the Fennema-Sherman scales per se for current research as it is quite dated (Tapia & Marsh, 2004). As such, though the scales were used as a basis for the design of the questionnaire, they underwent many modifications to suit the needs of the study and make it more appropriate to the South African context.

The Fennema-Sherman Attitudinal Scales assessed aspects of attitude that fitted in with the themes that arose out of the poster activity. It was decided that the Fennema-Sherman Attitudinal Scales be used in conjunction with the themes that had emerged from the poster exercise to develop the questions for the questionnaire would suit the intent and scope of the research. Of the 9 instruments that the Fennema-Sherman Maths Attitude Scales measures, 5 of them were pertinent to the factors that emerged during the poster activity. The scales on which the design of the questionnaire was modelled and which matched the areas of affect that emerged as factors that influence learners and needed investigation, were the Confidence in Learning Maths Scale, Mathematics Usefulness Scale, Maths as a Male Domain Scale and the Teacher Scale.

In researching material to develop the questionnaire, I consulted attitudinal surveys from several studies. Reviewing these enabled me to consider various authors' perspectives on developing questionnaires. Tapia and Marsh (2004) developed a questionnaire out of a need for a shorter instrument with easy administration that was based on a reliable measure of attitude. To this end, they developed the Attitudes Towards Mathematics Inventory. The items in this instrument were meant to gauge confidence, anxiety, value, motivation, enjoyment and parent/teacher expectations. The scales, adapted from the Fennema-Sherman Attitudinal Scales, were used in conjunction with the themes from the poster activity to develop the scales for the questionnaire to be used with the grade eleven maths learners at Westlake High School. The following scales were included in the questionnaire (a) Self-efficacy Beliefs Scale, (b) Perceived Usefulness of Maths Scale, (c) Learner Attribution Scale (d) Perception of Maths as a Male Domain Scale and (e) Perceptions of Teacher Attitude Scale. The Self-efficacy Scale included in my questionnaire replaced the Confidence in Learning Scale from the Fennema-Sherman Scale because it was evident from the responses of learners that they displayed low self-efficacy beliefs in maths. This scale aimed to gauge learners' self-

concept of their performance in maths. Furthermore I felt that learner self-efficacy beliefs in maths played an important role in determining whether a learner would engage in a maths activity and the extent to which that effort would be made. The Perceived Usefulness of Maths Scale was included to determine whether the perceptions that learners had of maths was due to the perceived value and usefulness that they attached to maths. Though the issue of gender was not specifically a part of the study, it was important to note responses in terms of gender so that differences, if any, in responses between the genders could be identified. The Teacher Scale was included because it was apparent that the teacher was a factor in determining learner attitude to maths and hence in measuring the extent to which teacher attitude is perceived by learners as being a factor in forming learner perceptions of maths. In addition to these scales, a general scale was included to cater for statements that needed responses and that did not fall into the other scales. The general statements on the questionnaire were meant to gather information from learners about whether they harboured intentions of continuing their study of maths after their formal schooling.

3.4.3 Rating Scale

The choice of the rating scale depended on many factors. The poster activity established that learners did not just like or dislike maths and to provide those as responses would not have been sufficient to capture the extent of their feelings. Learners indicated varying degrees of like and dislike for maths. The questionnaire was designed to facilitate crossing off responses. The Likert Scale caters for a range of responses that exhibits varying degrees or intensities of feelings thereby making it a more flexible tool to use and yet enables one to generate statistics that can be easily analysed. A five–point scale was used and the responses ranged from disagree strongly, 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 to responding to the statements in the questionnaire. This facilitated the recording of responses on a spreadsheet that was used in the analysis of the questionnaire. To ensure consistency in answers, statements were worded in the positive and in the negative. The negative responses were reverse-coded and were included to validate authentic responses.

Using the data gathered in the poster activity, the pilot questionnaire was developed and administered to the grade 10 maths learners. This was done in order to find shortcomings in the design of the questionnaire. I also asked three of my colleagues to go through the questionnaire and give me suggestions on improving it. This enabled me to determine shortcomings in design with respect to: (a) rating scale used, (b) ambiguity of the questions, (c) user friendliness, (d) time taken to answer and (e) coding of the data. The pilot questionnaire was then refined to eliminate its inadequacies. The piloting of the questionnaire highlighted the following shortcomings: (a) the questionnaire was too long and had repetitive statements that learners could not distinguish between, (b) learners found the order of the statements to be confusing (I had jumbled the statements so that they were not by factor) and (c) more planning had to be given to the coding of data in order to facilitate the analysis of it. I reduced the number of statements from 53 down to 42, removing statements that I felt were duplicated. The statements on the questionnaire were rearranged according to the factors that were being investigated Some of the statements that were used in each of these scales were re-worded to make it user-friendly. Words such as ‘math’ reflect the American use of the word, were changed to ‘maths’ to suit the South African context. The number of statements per scale varied. Positive and negative statements were included in the scale, though not equivalent in number. A copy of the Questionnaire is found in Appendix B.

3.4.4 Analysis

Prior to the analysis the data was cleaned in order to remove suspect cases. The data from the questionnaire was captured on a spreadsheet in terms of actual numbers. This facilitated the statistical representation of data in terms of percentages and graphs. I used the data from the questionnaire to quantify certain responses in terms of gender. Reliability and validity are two important aspects of accuracy. Reliability refers to the extent to which the results of a study can be reproduced yielding similar results whereas validity refers to the agreement between the value of a measurement and its true value. The Cronbach’s Alpha coefficient was calculated to test the internal consistency of data. It measures how well a set of items measures a single one-dimensional latent construct. When the structure of the data is multidimensional, Cronbach's alpha will usually be low. Cronbach’s alpha is a coefficient of reliability and when the average inter-item correlation increases, the Cronbach's alpha increases too. This means that there is evidence that the

items are measuring the same underlying construct (Labate, 2006). The data for each instrument was tabularised so that percentages and proportions could be clearly defined. . The data from the questionnaire was analysed and used together with the data from the poster exercise. These were influential in the development of the interview statements.

3.5 GROUP INTERVIEW

> "By providing access to what is 'inside a person's head', [it] makes it possible to measure what a person knows (Knowledge or information), what a person likes or dislikes (values and preferences), and what a person thinks (attitudes and beliefs)" (Tuckman, (1972) cited in Cohen et al., 2000, p. 268).

The poster activity yielded data that was used in the design of the questionnaire and the questionnaire yielded data that was statistically analysed. Both sources of data revealed a revealed a rich collection of feelings, attitudes and attributions that learners have about maths but neither allowed the researcher to clarify issues or to probe into the responses of learners. It was decided that a group interview was the most suitable method of obtaining the data that was needed. Interviews provide the researcher with the opportunity to obtain in-depth answers and to clarify responses that would not otherwise be possible (Bell, 1995). It provides the respondent with the opportunity to express their interpretations of their world of maths. Group interviews bring together learners of differing ability and perceptions and minimise the intimidation of individual interviews. The success of a group interview is dependant on many factors. The desire to know more about the feelings and attitudes of learners requires the interviewer and interviewees to work together. Both must be committed to uncovering the true feelings and attitudes of the learners i.e. the context should be relaxed and the interviewer trustworthy so that the learners will be encouraged to respond truthfully. Responses from this interview will also need to be analysed (Cohen et al., 2000).

The aim of the interview was to allow the learners an opportunity to express their perceptions of maths, for the interviewer to probe into their responses and for them to suggest a way forward. According to Cicourel (1964), cited in Cohen et al. (2000), interviews will differ from one to the other, depending on factors such as mutual trust, social distance and how the interviewer controls the interview. To avoid any misconceptions, I had to ensure that communication was sincere and that the purposes

were apparent to the respondents. The purpose of the interview was to ascertain learners' experiences of maths, learners' attributions of success or failure and learners thoughts on factors that would improve their learning of maths. The questions for the interview were standardized and open-ended and it was hoped that that they would elicit the responses that would 'fill in the blanks' of the investigation. A copy of the interview questions and the interview transcript is found in Appendix C.

3.5.1 Sampling and Data Collection

Participants in the interview were grade eleven maths learners from Westlake High School. The interviewees were selected on the basis of their overall maths performance in the second term of the year. This was be done using their term mark, which was an average of all their assessments including the June examination. A list of twenty-four potential respondents was compiled based on their term marks, with at least six learners at each level of performance. This was done to ensure that if some of the learners refused to participate in each level, then there were others on the list who could be considered.

3.5.2 Design of the Interview

A list of interview questions was drawn up to direct the interviewer and the interview process. The interview questions were drawn up from the clarifications arising out of the poster activity and the responses to the questionnaire. Whilst questions that were asked were sensitive, it required that the researcher go beyond the emotional and descriptive outbursts of learners experiences and feelings, in an effort to tease out the deeper issues that would enable the researcher to understand the challenges that learners face in the maths class (Cohen et al., 2000). The responses from the poster activity (2004) that I found needed further explanation were drafted into interview questions (a) How would you best describe your experience of school mathematics? (b) Can you tell me about a time when you enjoyed maths? (c) Do you think that you are successful in maths? What do you think has contributed to your success/failure in maths? And (d) What do you think will improve your learning of mathematics in the classroom?

3.5.3 Data Collection Method

Letters of consent (see Appendix D) requesting learners' participation in the interview were given to the interviewees and their parents specifying the purpose, date,

time, duration and venue of the interview. Copies of the interview questions were given to the learners half an hour prior to the commencement of the interview so that learners would have time to peruse through the questions. The learners involved in the group interview were given some time to read through the questions and were told that they could jot down their thoughts and ideas if they wished to. Though they were not compelled to write down responses on the interview sheet, they were requested to fill in their personal details (this was necessary so that the interview sheets could be referred to in conjunction with the transcript of the interview during analysis) and to hand them in at the end of the interview irrespective of whether they had written down something or not. This was used to verify that learners said what they indeed felt during the interview and did not 'go with the flow' of what others in the group were saying. It also gave learners the opportunity to write down what they possibly did not want to say in the presence of the group. Hence having their names attached gave me recourse to further questioning subsequent to the interview. These were collected from them at the end of the interview.

At the start of the interview, I welcomed the learners, gave them a copy of the agenda then proceeded with an explanation of the research process. I re-iterated their rights as participants and outlined the interview process to them again reminding them that the interview would be audio-taped. Learners were informed that the data collected from this interview would be statistically analysed and used in the write-up of the dissertation, whilst respecting the confidentiality of the interviewees. The ground rules were explained to all participants to remind them that this was a co-operative effort. It was agreed by all at the start of the session that learners would raise their hands if they wanted to respond to a question. They agreed that for the sake of clarity and transcription thereafter, I could then address them by name. I informed them that their names would be coded in the write-up of the dissertation. I hoped that this would make them more comfortable about responding truthfully. The group interview was recorded on audiotape because I acknowledged the difficulty in trying to focus on the interview whilst attempting to ask questions and to manually record learners' responses simultaneously. Recording the interview on audiotape enabled me to focus attention on the interview, allowing me to ask probing follow-up questions not accounted for in the preset interview questions and to accurately transcribe the interview at some later stage. At the end of the session, I played the tape back to the group so that they could clarify their statements further. Learners were then thanked for availing themselves to participate in the

interview and for their honest responses. Cohen et al (2000) say that when a research involves respondents in a situation where their experiences of failure or self-esteem are involved, it is the responsibility of the researcher to ensure that a proper closure is given to the session to ensure that the respondents leave without feeling worse than when they started. A well-planned conclusion should include thanking the respondents for their participation and time, and perhaps a general conversation so that they might not feel aggrieved as though their worth is only in the data collection. The session was concluded with a general chat, to make the learners feel at ease. Once the audiotape was transcribed, I again met with the group, played the recording of the interview and read out the transcript. They were able to verify that the transcription was in keeping with what had been said and that what they had meant to convey was communicated.

3.5.4 Analysis

Analysing what respondents have said in an interview goes beyond the literary meaning of what has been said. It requires the researcher to relive the interview and to tie up the responses with the underlying theory whilst looking for evidence in support of the theories and those that contradict it (Gaskell, 2002). At all times, interpretations of the interview were supported by evidence from the same in order to justify the conclusions that were made. This part of the analysis began with producing the transcript of the group interview. I preferred to do the transcription on my own because I could recognise the respondents voices, the interview was still fresh in my mind so if the tape was unclear I would be able to recall what was said. It allowed me to revisit the interview going through the respondents' every word and expression in an effort to make sense of the data. Doing this allowed me to identify the various nuances in the data that gave me greater insight in analysing the data.

Once the transcription was done, I associated a unit of meaning with each response and substantiated why this was done. From this I noted all the responses that have similar meaning and used this as a category. I then showed how the research that I have done supports my findings. The analysis included the data from the poster exercise that was categorised in accordance with the coding used for the interview. Analysis of the data drew on the most relevant and outstanding facts from the poster exercise, group interview and the questionnaire and a theoretical explanation of these facts in terms of the research question and theoretical framework was highlighted.

3.6 ETHICAL CONSIDERATIONS

During the planning and implementation of research, due consideration was given to the ethical issues that could arise when using learners as part of the data collection process. The challenges that these ethical issues present are diverse and though it may be possible to consider as many of them as possible, it is not always possible to eradicate them without jeopardising the study. I had to acknowledge that the information that I sought to collect was of a sensitive nature and learners might not be willing to share this information. Furthermore I had to ensure that the methods used to conduct this research aimed at obtaining results that were valid and reliable, were not questionable. The poster activity, group interview and the questionnaire were instruments used in this study that asked respondents to give of their time and to share information about themselves that was sensitive. In addition, 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, 2000).

I applied for and was granted ethical clearance from the University of KwaZulu-Natal to conduct this research at the research site. In my application I outlined the type of research that was going to be done, the research methods and data collection instruments that were to be used. Included also were how the ethical issues concerning the participants were to be addressed. Once ethical clearance was granted the study commenced. At this research site, I was granted permission by the school Principal to use the school as a research facility within which the research could be conducted in accordance with the ethical guidelines that were presented to her. I was given the authority to pursue the research within the guidelines established. Permission was granted by the grade eleven mathematics educators of that year for me to undertake the research in their maths classes.

I assured the learners that there was no compulsion for them to participate in the study and that they should not fear reprisal from anyone if they chose not to participate or to withdraw from the study. According to Cohen et al. (2000) the researcher should first get consent from the adult in whose authority the learner is during the context of the research and secondly from the learners themselves. Letters of consent were given out to parents of the grade eleven learners who were participating in the group interview. The consent letter explained the area of research together with its broad aims and purposes. It also included: (a) a description of the sequence of events involved in the research procedure and their role in it, (b) the fact that they would be audio-taped and (c) that the data that was

collected would be used in drawing conclusions in the write-up of the research. The consent form also assured respondents of absolute confidentiality, which I thought was an important factor in getting respondents to answer truthfully. Seeking consent is a necessary process as it protects both the learner 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., 2000).

The authenticity of data was crucial to the credibility of the study. Sensitive questions concerning learners' perceptions about maths were being investigated and it was imperative that learners respond truthfully in order to avoid jeopardising the study. Approaching this activity required the researcher to be honest and approachable, and to create a climate of trust and respect for and between learners if authentic data was to be collected. Ensuring anonymity amongst participants was a good way of engendering mutual trust and building confidence in the study. Informed consent allows the researcher and respondent to engage in a relationship of trust. In the school situation where learners tend to treat many things light-heartedly, informed consent adds a degree of formality and seriousness to the study. The novelty of signing letters of consent made the learners feel as though they are a genuine part of the research process. The issue of anonymity prevailed throughout the process. The assurance of confidentiality and anonymity dictates that the write-up of the dissertation should at no point suggest or reveal information that can identify the respondent (Cohen et al., 2000).

3.7 SHORTCOMINGS AND SOURCES OF ERROR

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 teacher strikes and inclement weather. Many learners had varying definitions for what they perceived to be success and failure in maths. It would have been prudent to have formed a definition of these terms at the very beginning as part of the poster activity in phase one. It became apparent that to the high- performing learners, success was viewed upon as being an 'A' and yet by others as 90+ %. On the other hand, to many low-achieving learners, success was viewed upon in terms of a 'Pass' or a ' Fail'. It would

therefore have been a lot less confusing and easier to analyse had the terms ‘success’ and ‘failure’ been defined beforehand.

Table 3.2 Summary of data corpus and analysis methods

	Description	Data Obtained	Method of Analysis
1.	Observation	Description of learner attitude and behaviour in maths class	Interpretation using theoretical explanation discussed in the literature review.
2.	Poster Activity	Description of learner perceptions of maths	Interpretation
		Attributions of learner perceptions of maths	
		Learner suggestions as to what will make them want to learn maths.	
3.	Questionnaire	Learner self-efficacy beliefs in maths Perceptions of teacher attitude	Frequency counts of each response and means Cronbach Alpha Testing for correlation analysis
		Perceived usefulness of maths	Exploratory factor analysis and testing to validate instrument
		Attributions of success/Failure in maths	
		Maths as a male domain	
4.	Group Interview	Learners’ current perceptions and experiences of maths	Interpretation using theoretical explanation highlighted in the literature review.
		Attributions of success/failure in maths specifically self-efficacy beliefs	Analysis of data using themes from other instruments and including this one
		Learner enjoyment of maths	
		Strategies to improve learning of maths	

CHAPTER FOUR

RESULTS

This chapter is a summary of the analysis of the data that was gathered during the research process. I have chosen to report the findings with data from the poster activity and the group interview together with the data from the questionnaire. The purpose of this study was to generate and capture themes on learner perceptions of and experiences in maths and the reasons they attribute to their perception of maths. This was accomplished using the group interview and the poster activity. Furthermore, it intended to elicit learner perceptions of strategies that can be used to improve their learning in maths. The quantitative aspect of the study, the attitude questionnaire, was administered subsequent to the qualitative research, with the intention of determining whether the findings from the qualitative research were representative of all grade eleven maths learners. The data revealed emerging themes that provided responses to the main research questions. These themes enabled me to understand some of the challenges that learners face in the maths class.

The interpretations and implications of the findings will be reported under the following key headings: (a) Learner perceptions and experiences of maths, (b) factors to which learners attribute their maths performance with a focus on self-efficacy beliefs in maths, and (c) learner perceptions of strategies that will improve the learning of maths. I will discuss the findings in the light of the theoretical framework discussed in Chapter Two with a focus on self-efficacy beliefs, attribution theories and strategies that aim to improve maths learning. The findings provide a basis for the recommendations that will be made for the improvement of maths learning. This chapter focuses on each research question with several assertions being made in an attempt to answer the main research question. I will then describe the events that indicate how the analysis supports the interpretations that have been drawn. Evidence from the poster activity, group interview and the questionnaire are used to support the assertions made and the interpretations given.

When analysing the questionnaire, I first verified the reliability and validity of the results. The Cronbach alpha coefficient was calculated and an overall reliability score of 0.997 was obtained. This indicated a high degree of acceptable, consistent scoring for the different categories in the questionnaire, excluding the open-ended question. The factor analysis showed inter-correlations between variables, provided support for the theoretical structure of the questionnaire and was generally favourable with regard to the validity of the scores. The responses from the questionnaire have been tabularised according to the factors that were tested and have been represented statistically. In my discussion, I have used percentages to indicate learner responses as I felt that this would be more meaningful when comparisons were being made. The data from the questionnaire have been summarized with learner responses of 'Agree' and 'Strongly Agree' being reflected under the common heading "Agree" and responses of 'Disagree' and 'Strongly Disagree' under the heading "Disagree". Neutral responses have been acknowledged accordingly.

4.1 WHAT PERCEPTIONS AND EXPERIENCES DO LEARNERS HAVE IN THE MATHS CLASS?

Learners' responses suggested that whilst some learners experienced extreme stress due to the difficulty of the subject and pressure from their teachers and peers, there were others who cited positive perceptions of and experiences in maths. These will be discussed separately below.

4.1.1 Learners perceive maths to be a difficult subject

When learners were asked to talk about their perceptions of maths during the group interview, some of the interviewees stated that they believed maths to be a difficult subject and expressed their belief that they were not cut out for it. They attributed their poor performance to their perception that maths was a difficult subject. This was evident from the response of Leah, during the group interview (2005) when she commented *I don't know It's…I got a phobia about maths that it's hard and no matter how much I…I try to tell myself it's not, I still ...I don't know...that perception that maths is hard and I can't get it out of my head …*". During the poster activity children commented that they

found maths to be “hard” and “confusing” (2004). The following poster comment corroborates this ”I would like maths if it was more understandable because whenever I think I understand it or getting there it just get even more harder”. Learners were of the belief that maths was difficult and that therefore they did not perform well in it. This is supported by Blay’s findings (1995) that learners will be less willing to attempt mathematical tasks if they do not hold the belief that it can be done.

Statement 16 in the questionnaire was open-ended and asked learners to describe their feelings about maths using two words. I grouped learner descriptions such as “exciting”, “fun”, “relaxed” and “interesting” as being indicators of positive feelings and associated terms such as “confused”, “difficult” and “stressful” as indicators of negative feelings. Analysis revealed that only one in five word choices were positive (see Table 4.1). The other responses indicate negative comments about maths. Of these, 55% of the responses were emotional responses (for example, confidence, irritation, etc) whereas 26% of the respondents found the content of the subject matter difficult. The data shows that the

Table 4.1

Questionnaire Responses to Feelings about Maths

Feelings about Maths	Percentage Response
No confidence	3.8
Challenge	8.8
Confused/ complicated	7.3
Irritate/ paranoid/ depressed	3.1
Difficult	26.3
Stressful/ uncomfortable/ pressure/ frustrated	19.1
Nightmare/ hate	10.7
Useless	0.4
Exciting/ fun/ relaxed/ interesting	20.6
	100.0

number of learners who had negative perceptions about maths was overwhelmingly more than those who do not. In general, the responses from this aspect of the questionnaire showed that learners had a negative perception about maths as a subject and perceived it to be difficult.

4.1.2 Learners perceptions of maths as a useful subject

Learners were asked, in the questionnaire, whether they perceived maths to be useful to them. The responses to this aspect of the questionnaire showed strong agreements with the positively worded statements, and strong disagreements with the negatively worded statements. The overall perception (taking both kinds of statements into account), from the questionnaire, was that learners understood that mathematics was and always would form an important part of their lives, either in their daily existence or in their workplace.

Table 4.2

Questionnaire Responses to Perceived Usefulness of Maths

	% Responses		
Statements	**Agree**	**Neutral**	**Disagree**
Maths will help me get a good job	90	5	5
Maths will not be important to me in my life's work.	15	11	74
I will use maths in many ways as an adult	73	14	13
I don't know why I have to learn maths?	15	15	70
Doing well in maths is not important for my future	17	5	78

Table 4.2, above outlines learner responses in terms of percentages. Evidently, the majority of learners see maths as being important to their future. From Table 4.2, it can be seen that 90% of learners agreed with the statement that knowing maths would help them get a good job. 73 % of the participants agreed that they would use maths as adults. Similarly 74 % of the participants disagreed with the statement that maths would not be important in their life's work. In keeping with the above responses, 78% of the learners felt (agreed) that maths was important for their future and 70% of the participants disagreed with the statement that they did not know why they had to learn maths at all. In general, learners seemed to see maths as being a useful subject for their future. Upon consideration of the data from the questionnaire, it is evident that this does provide a somewhat positive outlook for the future of maths and math-related fields. This was supported by Pres, during the group interview (2005), when he said *I know in the end it will all be worth it*.

4.1.3 Learners encounter diverse experiences in the maths class

The first research question sought to determine the perceptions and experiences of learners in the maths class. Responses showed that learner perceptions were based mostly on their experiences in the maths class. The responses from the poster activity revealed predominantly negative experiences that many learners said contributed to their negative perceptions of maths. Some learners did cite positive experiences in maths and the interview revealed that these learners also indicated positive perceptions of the subject.

Negative experiences

The findings from the poster activity and the questionnaire showed that many learners perceived maths to be difficult and expressed a negative outlook to it. Comments from the poster activity in particular, indicated that learners had negative experiences in maths as indicated by one of the learners who commented *my lack of success causes me to lose hope in studying maths* (2004). Many learners also acknowledged that their performance in maths was poor. The group interview revealed that learners who were not performing well in maths displayed predominantly negative outlooks to maths. They described their experiences of maths in negative terms and regarded themselves as being unsuccessful in the subject. During the group interview, when learners were asked to relate their experiences in maths, Leah said *that it was really horrible as I never could grasp the concepts* and Sanira responded with *I enjoyed it to a certain extent… and as I got to grade eleven it got a lot harder therefore I couldn't enjoy it as much*. Similarly Teran *also enjoyed it to an extent…but now not as much as I did then, but now it's much harder*. Studies have shown that when learners experience many situations of failure, they start to develop a negative attitude to aspects of maths that quite easily develops into a negative attitude to maths in general (Renga & Dalla, 1993). Teacher-related issues are also instrumental in forming learner attitude to maths (Bolaji, 2001; Middleton & Spanias, 1999).

Successful experiences engender positive attitude to maths

From the group interview (2005) I was able to establish that learners who held predominantly positive perceptions of maths and who cited positive experiences in it were those who performed well in maths. Of the nine learners in the group interview, eight said

that at some point in their school lives they did enjoy learning maths. Three of the eight learners said that as they reached grades 10 and 11 their enjoyment of maths waned somewhat and so too did their performance in it. Some of the learners said that they did still enjoy learning maths as indicated by Rick, who consistently achieved well in maths and said *personally …I enjoyed it and I found it interesting and I still currently am enjoying maths*. Kally, acknowledged that *my experience I would have to say was most great and at times I was …just thinking about it, I've always loved and enjoyed maths. When I was in grade 10, maths was easy and I could manage it but in grade eleven it was a bit tough but I still love maths. Now that I'm in my final year and doing standard grade maths I must say I still enjoy it.* A comment from the poster activity (2004) supported the quotations above "I love maths and get high marks". Research in the area of affect has shown that positive attitudes can be achieved when learners have successful experiences in the maths class and positive attitudes tend to facilitate learning (Renga & Dalla, 1993). This view is supported by Middleton & Spanias (1993), whose studies also show a positive correlation between attitude, positive experiences, beliefs and achievement in maths. This is corroborated by Yokal's response of *I enjoy learning maths currently. I find it interesting…it allows me to…er to explore my intelligent side of my brain .. and…um… I feel that I can have… I have a lot of capabilities and I can find out my true capabilities when I'm working with problems* and further by a comment from the poster activity (2004) "I do enjoy maths but sometime I don't only if I don't understand the sums or the equations that we do that day". It was apparent from the group interview that the high-performing learners described their experiences in maths as being positive and had no complaints. The group interview revealed that learners who were satisfied with their progress in maths showed a positive attitude toward the subject.

4.1.4 Teacher behaviour plays a significant role in forming learner perceptions of maths

Learners feel ridiculed by teacher behaviour

A few of the learners indicated, in the poster activity, that they dislike being ridiculed by their teachers and peers in the class. Those learners say that teachers make fun of them when they answer incorrectly. Comments from the poster activity (2004) highlight the hurt and embarrassment that learners feel at being ridiculed by the teacher when they made mistakes in the maths class. This is evident in the following response: " the teacher

puts too much pressure on a pupil, like when you cannot grasp the information the first time and he makes fun of you or calls you names and insults you. This is what should change in maths". Another learners commented that " he tries to be funny but he doesn't know he actually embarrasses and hurts people's feelings". Learners are sensitive about their performance in the maths class and expect that their teachers will display some sensitivity towards their feelings. According to the comments from the poster activity, being ridiculed by the teacher ultimately contributes to their dislike of maths. In the group interview (2005) Cam indicated that he was afraid to ask questions in order to clarify concepts because of his anticipation of how his teacher might respond. According to him *you know you afraid to ask questions. Maybe the teacher will make you feel stupid*.

Table 4.3

Questionnaire - Learner Responses to Perceived Teacher Attitude

	% Response		
Statements	**Agree**	**Neutral**	**Disagree**
My maths teacher makes me feel like I have the ability to go on in maths	9	9	82
I wish my maths teacher would pay more attention to my maths learning in class	48	22	30
My teacher thinks that I could do well in maths.	11	11	78
I feel that my maths teacher ignores me when I try to ask questions in class.	91	3	6
My teacher makes me feel silly when I ask questions in maths class.	93	4	3
My teacher only worries about teaching the clever learners in class.	81	10	9

Questions based on teacher factors were asked with the intention of establishing representation of responses across the grade eleven learners of maths. The summary of responses as tabulated in the Table 4.3, indicate that most learners in general felt that teachers showed a negative attitude toward learners. From Table 4.3 it can be seen that 93% of the learners felt that the teachers made them feel silly when they tried to answer questions in class and 91% felt that their teacher ignored them when they tried to ask

questions in class. The overall perception was that teachers were not encouraging or supportive of the learners. Though the findings of perceived teacher attitude showed in both negative and positive responses, the indications are that there are a significant number of learners who consider the attitude of teachers to be negative. Upon further scrutiny of the data in Table 4.3, it was apparent that the score represented fairly strong views of the learners. From the statistics in this table, it has been pointed out that there is a fairly strong agreement for the comments that indicate perceived negative attitude of teachers. 82% of the learners disagreed with the statement that their maths teacher thinks that they have the ability to study maths further. There was just as strong a disagreement for the negative comments. These findings were in keeping with those of the poster activity where it was apparent that most participants reflected the perception that teachers showed a negative attitude to low performing learners. This was further highlighted in the poster activity when learners responded that the same teachers displayed a positive attitude to high performing learners. According to the learners, "the teacher should be more confident about our abilities. Should motivate us more". The response as to whether their teacher showed a belief that they could perform well in maths, was overwhelmingly negative. In this section of the questionnaire, a minority of learners chose to remain neutral thereby strengthening the case for learner perceptions that maths teachers have a negative attitude toward maths learners.

Teacher feedback plays a significant role in forming learner perceptions of maths

In the poster activity, learners listed that feedback from the educators either encouraged or discouraged them in the maths class. They indicated that positive comments made by the teacher motivated them but that negative comments hurt their feelings and de-motivated them. A learner commented in the poster activity (2004) that "teachers' reactions play an important role towards the child's efforts. To complement a child I think brings out the best in a learner." This was supported by the comment made by another learner: "I wish my teacher would understand that we all not masters in maths although we try our best. So I hope the teacher would cater for us too cause we are keen and interested in maths." It was apparent from the responses in the poster activity that some learners felt that the comments made by their maths teachers made them feel as though they were not worth being taught as in the following comment "He always asks the sharp people and makes us feel bad like we are not worth learning maths." I

understood from the responses of some of the learners that they regarded a lack of response from the teacher negatively, like in the comment " Should acknowledge when we are catching on and say something of encouragement when we get something right when we usually get it wrong." Learners perceived teachers' attitude in class as negative feedback when they displayed unsupportive behaviour. This is indicated in Table 4.3, where 91% of the learners felt that the teacher ignored them when they tried to ask questions in the class. These findings are supported by those of Edge and Freedman (1997) who claimed that disrespecting learner responses in the class was instrumental in damaging learners' feelings of self-worth. Teachers played a significant role in forming learner attitude to maths and should not give learners the impression that they were being looked at in negative terms in the maths class (Larcombe, 1985).

Learners perceive 'clever' learners to be privileged by the teacher

From Table 4.3, it is evident that 81% of the learners felt that the teacher only worried about the ' clever' learners in the maths class. Evident in the responses from the poster activity is that the behaviour of teachers in the classroom were as demoralising to the learners as the statements that they made. Learner responses indicated that teachers displayed unfair behaviour towards the 'not so bright learners' by being unsupportive and unapproachable and making fun of them when they asked or answered questions. In general learners indicated that teachers made them feel as though they were not worth teaching because they did not consider them to be 'bright' learners.

The poster activity (2004) revealed learners' feelings that the teacher's lessons were paced such that it advantaged the 'bright' learners and disadvantaged the 'not-so-bright' learners: " Teacher must be considerate- must not rush through exercises because the children who are good at maths understand, whilst others don't". Responses showed that learners felt that the pace of the maths lessons was based on what was suitable to the 'sharp' learners. They subsequently felt that the teacher was not considerate to the needs of the 'not so sharp ones'. According to some of the responses, the teacher seemed to convey the impression to the learners that the pace of teaching was done at a rate that supported the 'sharp' learners. The learners who did not feel privileged by their maths teacher felt that the teacher expected them to perform poorly. Learners felt that when teachers pay attention to only the 'sharp' learners and consistently called only them to provide answers in class, they were saying that the other learners were not worth taking

the time to teach. The following statements from the poster activity (2004) bear testimony to this: “He always asks the sharp people and makes us feel bad like we are not worth learning maths… and he does not put his feet in our shoes”. The behaviour of the teacher in the class very obviously influences the perceptions of learners.

Learners who display a negative attitude to maths base their ‘worth’ of maths on their perceptions of teacher attitude and behaviour toward them. Teacher attitudes towards learners are reflected in their behaviour whether it is their facial expression or the sarcasm and humour that they use to demoralise learners (Larcombe, 1985). Teachers play an important role in fostering learner attitude to maths. Studies done by Bolaji (2001) indicate that the attitude of learners is affected by the teacher’s personality, fairness, extent of involvement in the lesson and the approachability of the teacher. Middleton and Spanias (1999) showed in their studies that there is a positive correlation between attitude, experiences, belief and achievement in maths. Evidence from the poster activity indicates that learners found it easier to learn when teachers started a section with simple examples that got progressively more difficult. This suggests that the teacher was not doing this, thereby privileging the ‘ clever’ learners. When learners understand a concept and can do simple examples, they begin to feel more confident and capable of doing more complex exercises. By doing this, the teacher encourages learners to see improvements in their own performance and this enables them to develop confidence in their maths (Larcombe, 1985).

4.1.5 Lower performing learners feel stressed in “high flying” class

The setting of the maths classes in grade ten was based on learners’ maths performance in grade nine the previous year. The learners who had achieved the highest marks in maths were placed in the top maths class. Learners remained in those graded maths class until the beginning of grade twelve when they were re-graded according to higher grade and standard grade maths. The poster activity revealed that learners who initially had good results and whose results subsequently began to slip viewed the grading of classes in a negative light. Their views implied that graded classes did not work as well for the morale of the lower performing learners as it did for the higher performing learners. From the poster activity (2004) it was established that lower performing learners found that being in the top class was stressful and contributed to their poor self-image: “Being in the top maths class does stress me out … if I don’t do

well …" and " I hate being looked down upon". They felt that the stigma of being in a 'high flying' class put them under pressure to work faster and perform at a higher level than normal: "It is hard to learn in a top class because of the level of teaching. It is much faster than last year". Learners expressed that they felt ridiculed and subjected to humiliation by the teachers and their peers when they failed to produce the results that were expected from learners in the top class. This created feelings of resentment towards the high-performing learners in the top academic classes as it put the lower-performing learners under a great deal of pressure to attain results that were imposed by the teachers and their high performing peers: " There shouldn't be so much pressure on us to be the best others want us to but to do the best we can".

Some learners found the pressure of being in a 'supercharged class', which is the term that was coined for the maths class whose learners achieved the highest maths performance, to be too daunting for them. Consequently, they found that trying to keep up with their peers was an overwhelming task and eventually those learners performance began to deteriorate significantly. Those learners suggested that they would like to be in a class with learners who were at the similar level of performance as they were. Sanira said *I think that being surrounded by people who are like at the same intelligence level as you are will help a lot. It's because like they have like brainstorming on the sections that you don't understand and stuff but like.. like sometimes.. like you like just surrounded by people who just grasp all concepts like a lot more easier…"* (Interview, 2005). Comments from the poster activity (2004) highlighted learner feelings that "being in an average maths class and being with average children will make me want to learn maths". Though the high performing learners in maths did not complain about grading of learners, others did. Those who complained about graded classes said that had found graded classes to be pressuring for many reasons like the enormous workload that they had to contend with, the fast pace of work and the fact that being in the 'supercharged' class was damaging their confidence. Yokal, in the group interview (2005) says *I believe that maths is hard. But it's dedication that gets that 'A' symbol in maths. Unfortunately everyone does not have that discipline and drive to achieve that symbol.*

4.1.6 Poor performing learners feel disparaged by the behaviour of high performing peers

Learners have indicated that they would like the 'brighter' learners to be supportive and understanding to their needs as opposed to being critical and insensitive. The

responses from the poster activity and the group interview revealed specific factors that learners identified as being challenges to their learning of maths. They expressed their thoughts on what they felt would best improve their learning of maths. During the group interview, Sanira said that it was a good idea to put together learners who perform at the same level in maths. She indicated that she would be comfortable working with learners at the same 'level of intelligence'. To learners like Sanira, peer pressure is a strong contributing factor to the development of low self-efficacy beliefs. She does not aspire to perform better or to change her attitude to learning and to asking questions, but would rather be in a class where learner performance is more in keeping with hers so that she does not feel out of place. She wants to be with a group of learners where she can fit in and be comfortable with her current level of performance rather than feel embarrassed by being in a class with peers who find it easier to grasp mathematical concepts than she does and who perform exceptionally well as compared to her. The following excerpt made by Sanira during the group interview (2005) confirms this: … *like …how do you ask questions cos you don't understand why you don't get it and why they do and you sometimes you don't like to ask.*

Responses of learners in the poster activity indicate that comments made by their peers about their maths performance is a factor in determining their feelings about maths. Five learners in the poster activity (2004) claimed that when their peers made negative comments about their poor performance in maths, it impacted negatively on their belief in their ability to do maths: "having supportive peers is very important … unfortunately ... they always behave with an insulting attitude…making our self-confidence lower and making us believe that only they can do well." Learners who, after having made a concerted effort in maths, are faced with poor results face further embarrassment when they are repeatedly ostracised by their peers who generally perform well. Negative comments made by their peers tend to disparage those learners who do not perform well. The following comment, captured during the poster activity (2004), corroborates this: "children who make you feel stupid in front of them. They automatically put you down. I need to change my class" and "I think that I will be more confident in the subject if my friends won't keep putting me down and saying I am not capable…". Learners indicated that these kinds of comments undermined their ability in maths. Learners also expressed their disappointment with peers, who generally performed well in maths then boasted about how easy the paper was, whilst others found it difficult. "Unfortunately there are a

few people who do very well in maths and because of this they always behave with an insulting attitude towards others, making our self-confidence lower and making us believe only they can do well and " It's stressful being in a class where the majority of the pupils are intelligent and they make the weaker students feel … stupid". The following response from Kally, transcribed from the group interview (2005) shows just how much learners fear being ostracised by their peers and teachers: *e r... pressure probably because …er…there's a lot of intelligent students in the class. It's like peer pressure if you ... if you don't do good ….you're discouraged to… go on."* The following statement echoed this sentiment: *" ...and it's ... it's the children...the pupils in class I feel so stupid .. it's.. I'm I'm I'm afraid to ask questions in class they ... as they gonna say that I'm stupid or something.*

Table 4.4
Questionnaire - Learner Responses to Perceptions of Peer Attitude

	% Responses		
Statements	**Agree**	**Neutral**	**Disagree**
I am afraid to ask questions in class because my peers will think I am stupid	57	16	27
The 'clever' learners in my class make me feel stupid	61	11	28
My peers are understanding and help me to learn maths	19	30	51

Responses from the poster activity pointed to the fact that peers played an instrumental role in learner's beliefs about self-efficacy in maths. In order to find out whether learners felt that peers comments and attitudes were responsible for their perceptions about maths, statements about learner perceptions of peers were asked in the questionnaire. From Table 4.4 above, it is evident that learners felt strongly that their peers were not supportive in the maths class. More than twice the number of learners (61%) claim that their peers make them feel stupid in the maths class as opposed to 28% of learners who felt otherwise. Learner responses indicated that higher achieving learners in general were not sympathetic to their plight and unhelpful. Furthermore, poor peer attitude toward low performing learners discouraged learners from asking questions in class. It was also apparent from the data that learners were intimidated by peer comments and that it contributed to their negative experiences and perceptions of maths.

4.2 TO WHAT DO LEARNERS ATTRIBUTE THEIR PERCEPTIONS OF MATHS?

4.2.1 Learner perceptions of success in maths depends on their maths performance

The question as to whether learners considered themselves to be successful in maths received mixed responses. Learners, whose actual performance in maths was not in keeping with their expected levels of performance, indicated that they did not consider themselves to be successful in maths. Although these learners did pass maths, they define success in terms of their own expectations in terms of marks. The responses from the group interview (2005) in answer to whether learners felt that they had been successful in learning maths, showed this. In terms of this definition, as was evident in Krishen's response, these learners did not consider themselves to be successful in maths: *I would say no. I wasn't successful because every time I set a goal to …and when my test marks come back or exam mark comes back its not what I expect .. so .. er .. so .. er .. maybe because er in the class like as Leah says you know you afraid to ask questions. Maybe the teacher will make you feel stupid.* Kally's responds with *I'm not sure because it kind of feels like a failure in …er some way cos I couldn't cope with the tough work of the higher grade*.

Kally was doing maths on the standard grade. Although she did pass maths on the higher grade, she felt that her performance was not good enough for her to be doing maths at higher grade level and that she would rather have done maths on the standard grade. She believes that in this way she would achieve good grades without much stress than be stressed out with higher grade maths. Leah corroborated this with *no I would say that my maths experience was unsuccess ... unsuccessful. Its because no matter how much I tried I never could get the marks that I always wanted* ". Sanira seemed to judge her success on her expectations of what her maths marks should have been rather than in terms of a pass or a fail in the subject. Sanira's feelings about maths were in keeping with that of many of the learners interviewed who did not perform well in maths. Sanira responded with *okay ma'm honestly I think that I've become very unsuccessful at it because like once my marks started dropping then I just like just ….lost hope in it then like I saw that most of my friends around me had marks that that were like going up and then I didn't understand why my marks were dropping*.

During the group interview (2005) learners were asked whether they regarded themselves as being successful at maths and to attribute reasons for this. The interview revealed that whilst many learners saw themselves as being unsuccessful in maths, there were others who described their performance as being successful. Whereas some learners saw success in terms of a 'pass', there were learners who indicated that they rated their success in maths in terms of the marks that they achieved. Yokal was eager to discuss his success in maths: Y*es I feel that I was successful to a certain extent although I know that…I know I can do better. I feel that if I work harder on the..on specific aspects of maths er example geometry everyday I know that I can do better and with the practise I know I can get an 'A' at the end of the year which I which is my accomplishment.* Judging from Yokal's response in the group interview, it is apparent that he displayed high self-efficacy in maths. He had a positive attitude to maths and was realistic about his performance. He identified the aspects of maths that he had difficulty with and that he believed prevented him from being as successful as he would like to have been in maths. Rather than being negative about his shortcomings, he tended to view them as challenges that could be overcome. Yokal understood that success could be achieved in stages and that motivated him to overcome his challenges in maths. He was confidant that with some effort, he would be successful in aspects of maths that he found difficult. He had a belief in his own ability to do well in maths and that spurred him on to work consistently.

During the interview when I asked Jerico to justify why he declared himself to be successful, he responded spontaneously with *I think it's my positive attitude and my hard work*. It was evident from Jerico's response that he displayed high self-efficacy beliefs in maths. He attributed his obvious success to effort rather than ability. He had a positive attitude to work, which he identified as being contributing factors to his success and to his enjoyment of maths.

4.2.2 Learners Feelings About and Enjoyment of Maths Depends on their Success in Maths

Interviewees from the high performing class who were no longer performing well said that they found it difficult to explain why, in the earlier grades at high school, they were performing at the same level as some of their peers but, as they progressed to grades eleven and twelve, their peers had continued to 'excel' in maths without much

stress whereas they had started to lag behind and perform poorly. They expected that their performance would always be on par with all of their peers. According to the interviewees who acknowledged that their maths performance had deteriorated, they felt embarrassed and disillusioned about their ability to do maths. It was embarrassing, they explained, to ask the teacher to repeat work that they did not understand in the presence of their high performing peers. Learners had difficulty in comprehending why some learners found it easy to understand the mathematical concepts taught whilst they had difficulty doing the same. They acknowledged that their difficulty with maths was so extreme that it was difficult to know the questions that they should be asking in order to clarify the concepts that they had difficulty understanding. .

Most of the learners interviewed indicated that they did enjoy learning maths at some point in their schooling. They claim to have enjoyed maths and found it 'easy' until they reached grade 10. Many learners said that subsequent to grades eight and nine, learning maths became an extremely stressful activity because despite their efforts they were no longer performing as well as they did in their junior grades at high school. Teran, who was a diligent worker in maths, was not easily deterred by hard work or failure and believed that working hard at maths was worth the effort. Although he acknowledged that maths was not as easy as it was in grades eight and nine, he was determined to do his best. This was evident in the following response by Teran during the group interview (2004) *I enjoyed it then to a certain extent but now as much as ... not as … not as much as I did then but now its much harder …*. His response indicated that his enjoyment of the subject had waned. Yokal and Kally claimed in the group interview (2005) that they still enjoyed maths despite the fact that the level of difficulty had increased since grade ten. Yokal said he *enjoys doing maths but my performance was better in grades ten and eleven*. Kally, who generally performs well in maths corroborates this with: *My experience I would have to say was most great and at times I was … just thinking about it, I've always loved and enjoyed maths. When I was in grade ten, maths was easy and I could manage it but in grade eleven it was a bit tough but I still love maths. Now that I'm in my final year and doing standard grade maths I must say I still enjoy it*. However, the learners who had maintained consistently good performance in maths, had positive experiences to share during the group interview (2005). Jerico responded with *personally I enjoyed it and I found it interesting and I still currently am enjoying maths.* Yokal shared similar feelings about maths: *I enjoy learning maths currently. I find it*

interesting…it allows me to…er to explore my intelligent side of my brain ... and…um… I feel that I can have… I have a lot of capabilities and I can find out my true capabilities when I'm working with problems. This evidently was not the case with learners who had difficulty in maths. Leah, who was not enjoying maths, responded with *I would say that it was really horrible, as I never could grasp the concepts*.

In a group interview, the learners were face-to-face with and therefore known to the interviewer. I was therefore able to match learners with their maths performance and in so doing determine the relationship between the maths performance of learners with their perceptions of enjoyment and success. During the poster activity (2004), learners comments supported the assertion: " If I understand maths better I will enjoy it " and " I think if the teacher explains very well and does a lot of examples we would do well and enjoy the sections." In general, learners whose performance in maths had deteriorated indicated that their enjoyment of maths had gradually waned as well, as they progressed from grade eight to grade twelve. They felt that the maths had become more difficult and to an extent insurmountable and therefore less enjoyable. The learners who were passing maths without much apparent effort and with average marks acknowledged that though their enjoyment of maths had somewhat decreased, they still enjoyed it to an extent. Those who performed exceptionally well in maths seemed to have had a more positive outlook to the subject and claimed that they still enjoyed learning maths.

4.2.3 Success or Failure is determined by learners' Self-efficacy Beliefs in Maths

The findings from the poster exercise and the group interview showed that whilst some learners exhibit low self-efficacy beliefs in maths, there are others who display high self-efficacy beliefs in the subject. It was found that in general, learners who displayed disillusionment with their poor performance in maths believed that they did not have the ability to do maths. They were of the belief that learners who did perform well in maths were those who were blessed with a 'maths brain'. The myth that one had to be born brilliant to do maths was a common belief amongst the learners and this was evident in the following poster responses: "I am not confident enough to do maths and don't think I was born brilliant enough to do the subject". Their low self-efficacy beliefs in maths has led them to attribute their lack of performance in maths to a lack of ability in the subject. This ability that they claim to lack is the 'maths brain' that they believe

they must have in order to do well in maths. Their low self-efficacy beliefs in their ability to do maths, is evident in their responses: " I wish I had the brainz like Lashin …", which suggested that the respondent felt as though he lacked the capacity to do maths. Lashin was a learner in grade eleven who was noted for his consistently outstanding performance in maths and the ease with which he seemed to grasp mathematical concepts without the added advantage of maths tuition. In the group interview (2005) some learners claimed that despite the fact that they liked maths as a subject they lacked confidence in their ability to ever do maths. According to Sanira, *I feel that I am not good enough. I feel that I cannot be good enough*. Poor performance in maths have left learners, like Sanira, with feelings of immense disillusionment: *I can't pick myself up after my marks have dropped and after that I just lost interest just because I felt that I really wasn't all that good at maths*. Sanira's performance in maths used to be good in the junior grades at high school. This was consistently so until she reached the senior secondary phase of maths. Subsequently her marks in maths started to drop whilst the marks in her other subjects were maintained. After many experiences of poor maths performance despite much effort, she felt that she was just not good at maths and that added effort would not put this right.

Evidence in this research points to the fact that many learners believed they lacked the capability to do maths. It was apparent from the data that was gathered that the poster activity yielded similar feelings. Responses from the low achieving respondents indicated their belief that they did not have the capability to do maths. Their self-efficacy beliefs were evidently low. These learners had experienced repeated instances of poor performance and it seemed that this had led them to believe that some learners, the high performing learners, were 'cut out' to do maths but that they were not. In my opinion, their low self-efficacy beliefs in their ability to do maths influenced the level of effort, perseverance and the amount of resilience that they expended on a mathematical task.

On the contrary, learners in the group interview who indicated that they were satisfied with their performance in maths, exhibited high self-efficacy beliefs in maths. Even though some learners acknowledged that they fell short of achieving their goals, they still displayed satisfaction with their current performance and exhibited a belief in their capability to do maths. According to Krishen, group interview (2005), ... *I enjoyed it in grade8 and grade 9 cos then I was scoring good marks… and even grade 10, 11 and 12 was awright but… I think I got the capability to do better at math*. Those learners had

already identified their areas of ‘weakness’ and developed strategies to accomplish their goals. They had no doubt that with effort they could accomplish their goals. Findings from studies on self-efficacy have been consistent across many studies and reveal that learner self-efficacy beliefs are a strong predictor of achievement in maths (Miltiadou, 1999).

A common perception amongst learners in this study, is that one needed a ‘maths brain’ in order to perform well in maths and that their lack of a ‘maths brain’ justified their poor performance in maths. They believe that any effort on their part would therefore not be rewarded with success because they simply lacked the ability to do maths. Learners were therefore reluctant to make an effort in maths in the belief that it would not make a difference to their performance anyway. The belief that maths ability is something that one either has or does not have affects learner attitude to maths (Mcleod & Ortega, 1993). This is captured by Ames and Ames (cited in Renga & Dalla, 1993):

> “Within the classroom, where success and failure are so prevalent, examination, performance and social comparison provide constant and important inputs that in part determine self-worth … Concern with the self lies at the core of human experience and therefore must play a role in any theoretical formulation in the field of human motivation. “(p. 28)

The analysis of the questionnaire with respect to learner self-efficacy beliefs showed that irrespective of their opinions to the other questions, many learners believed that they did not have the ability to learn mathematics. This was in keeping with the findings of the poster activity and the group interview, which showed that most learners exhibited low self-efficacy beliefs in maths. Analysis of the data confirmed that the overall perception with respect to learner self-efficacy beliefs, regarding the learning of mathematics (and the factors responsible for this), was one of negativity. This meant that there were significantly more learners who responded negatively to the statements in this dimension as there were those who responded positively.

Table 4.5, below, indicates that 56% of learners agreed with the statement that they were not the type to do well in maths. Only 27% disagreed with it. 62% of learners disagreed with the statement “I am sure that I can learn maths” as opposed to the 10% who agreed with it. An overwhelming majority of 78% of learners agreed with the statement: I

do not think I can learn maths. It is evident from Table 4.5 that the majority of learners show feelings of low self-efficacy beliefs in maths.

Table 4.5
Questionnaire Responses to Learner Self-efficacy Beliefs in Maths

	% Responses		
Statements	**Agree**	**Neutral**	**Disagree**
I do not enjoy maths.	53	20	27
I find maths too difficult for me.	41	33	26
Doing maths makes me nervous and upset.	51	19	30
I'm not the type to do well in maths.	56	17	27
I'm just not good in maths.	48	21	32
I am sure that I can learn maths.	10	28	62
I am always anxious when asked to solve maths problems	40	27	33
Maths is my worst subject.	54	11	35
When I am in a maths class I feel relaxed.	50	28	23
I don't think I can learn maths.	78	11	11
I am always under a terrible strain in the maths class.	54	22	24

The findings from the poster activity brought to light positive and negative perceptions that learners had of maths due to their experiences with it. The analysis of the questionnaire data confirms the findings of the poster activity and the group interview and shows that they are representative of the population of learners doing maths in grade eleven at this school.

4.2.4 The teacher plays a significant role in forming learners self-efficacy beliefs in maths

Teachers play a vital role in influencing change in learners' self-efficacy beliefs. When learners were asked about their attributions of success or failure in maths during the group interview and the poster activity many respondents mentioned fear of being labelled as *stupid* by the teacher as one of the reasons why they did not ask the teacher questions when they did not understand the work. Evidence indicates that they attribute their lack of belief in their capability to do maths to their experiences and interactions with their maths teacher. As discussed in the literature review in Chapter Two, research indicates that the classroom environment and the instructional practices adopted by the teacher may be an encouraging one in which learners feel valued and enjoy their work or

it could be discouraging if a dissatisfactory relationship exists between teacher and learner (Rawnsley & Fisher, 1998). The findings of this study show that whilst some learners lack confidence in their ability to do maths, they believed that it was the role of the teacher to develop the same in them. This is evident in the following comments gathered from the poster activity (2004) as a suggestion to improve maths learning: " One thing that will want me to learn maths is the positive attitude I get from teachers and the inspiration. If we are to have inspiring teachers I would perform better" and " If you had a teacher that pushes you to do well and to have a teacher that treats you fairly, you would want to learn more and more." Responses showed that learners preferred a more positive outlook from the teacher. Learners comments, poster activity (2004), also indicated that the teacher affected learners negatively and that this was based on the role that the teacher played in the class, for example: "He always asks the sharp people and makes us feel bad like we are not worth learning maths… and he does not put his feet in our shoes". The role of the maths teacher in developing learners' self-efficacy beliefs is highlighted in learners' responses from the data in Table 4.3, which shows that 82% of the learners disagreed with the statement that their teacher made them feel as though they have the ability to go on in maths. According to Teran, *positive influences from teachers and pupils* were required to improve the learning of maths (interview, 2005).

Responses from the poster activity (2004) and the group interview (2005) revealed learners' suggestions about the role that teachers should play in developing confidence in learners. Learners suggested that teachers take cognisance of the learning styles of the individual learners and adopt teaching strategies that cater for them. Responses also show that learners found it encouraging when they were taught different strategies of learning maths. This is evident in the following poster activity comment " My teacher makes maths fun as (he) teaches us different methods to learn." It seems as though learners appreciated the teacher's attempts because they say it showed that teachers were interested in improving their maths performance. My understanding is that learners felt that learning different ways of doing maths helped them to develop an understanding of maths. This is corroborated by the following comments from the poster activity (2004): "They should not make work individual all the time, it should be in a group so others are able to share their methods of work" and " They should be able to explain in the capacity to which the child would understand." They also felt that due consideration had to be given to learners who took longer to grasp the concept being taught than others. They

expected that teachers would exercise patience and encourage learners by ascertaining their 'weak points' and by using strategies that were specifically aimed at strengthening them. According to Krishen, *the teacher should look at each child as an individual, and try to help them on a one to one basis* (Interview, 2005). Further suggestions included the teacher ensuring that the pace of the lesson was suitable to the majority of the learners, not just the 'bright' learners.

4.2.5 Peer comments contribute to the development of learner self-efficacy beliefs

Evidently, according to the poster activity (2004) learners were affected by the comments made by their peers when they performed poorly in maths. Learners felt that one of the reasons why they performed poorly were because of "children who make you feel stupid in front of them. They automatically put you down." Furthermore it was established that " unfortunately there are a few people who do very well in maths and because of this they always behave with an insulting attitude towards others, making our self-confidence lower and making us believe that only they can do well". Learners felt that their self confidence suffered as a result of their peers who constantly made them feel incapable: "I think I will be more confident in the subject if my friends won't keep putting me down and saying I am not capable of the marks I get." Sanira said that *its like peer pressure if you...if you don't do good …you're discouraged to…go on* (Interview, 2005). The comments distressed them and led to them being reluctant to respond in the class for fear of being ridiculed by the high-achieving learners.

4.3 WHAT STRATEGIES CAN BE USED TO IMPROVE THE LEARNING OF MATHS?

Learners were asked to explain their perceptions of what would improve their learning of maths. Their responses were varied and included belief in their capability to do maths (self-efficacy beliefs), teacher behaviour, learner attitude and class environment as being factors that were central to their improvement of maths.

4.3.1 Developing learners' self-efficacy beliefs will improve their maths learning

In the poster activity, learners were asked what would make them want to learn maths. Many learners said that if they believed that they had the belief, self-esteem and confidence in their maths ability then they would want to learn maths, for example: " If my attitude towards maths is changed i.e. from believing maths is very difficult to believing that maths is easy and that if I work hard, I can achieve good marks" and " If I approached maths with more confidence and believe I can work hard and can be the best then I will learn and be the best." Their responses indicate their belief that they are not confident enough or brilliant enough to do maths. The main constructs involved in developing self-efficacy that I have discussed in Chapter Two, are mastery, modelling and verbal persuasion. Evidence from the poster activity and the group interview supports the influence that goal setting, assessment, attribution, strategy instruction and feedback have on the development of self-efficacy beliefs in maths (Schunk, 1995). These will be discussed in terms of the main constructs of self-efficacy and their role in developing the same in the maths learner.

Using Mastery in Building Learners' Mathematical Self-efficacy

The responses of the learners from the poster activity (2004) and the group interview (2005) indicate that success is important to learners in the maths class. Learners have suggested that teachers can make their maths learning easier by giving them problems that they can work out. Learners suggested, in the poster activity, that their learning of maths would improve "if the maths questions were made easier for those that are not so good at the subject. Maths is something that you study and not learn off by heart so maybe the questions should be made easier for me to catch on better". Furthermore, learners felt that " only if I understand the subject well and to do homework everyday and the exercise work that I get daily in school. It would be nice if a teach(er) can explore what we learning if a student don't understand. Maths is such an exciting and challenging subject that I do enjoy. The nicest thing about maths is that when a teacher teaches you nicely and makes you understand". This is supported by Yokal's response, group interview (2005), *I feel that if I work harder on the …specific aspects of maths … I know that I can do better … which is my accomplishment.*

Using Vicarious Experience in Developing Mathematical Self-efficacy

Learners suggested in the group interview as well as the poster activity that they be placed with learners who are of a similar ability level as they are so that they can learn from each other and share ideas. Learning through vicarious experience expects that the learner will enlist the help of peers to assist learners with low self-efficacy beliefs in developing their self-efficacy in maths. When learners observe their peers, someone that they can identify with, being successful in a maths task, it raises their belief in their own capability to perform the task. A poster comment supports this: "work…should be in a group so others are able to share their methods of work" and " Teachers must be mindful of the fact that the choice of suitable peers who is doing the modelling is integral to the development of self-efficacy. There must be similarities between the model and the observer for this to happen. Learners believe that if they too follow the sequence of steps taken by the model then they can be equally successful (Schunk, 1995). If an appropriate model is not selected, learners can incorrectly base their expectations of their performance on that of the model and may be disillusioned when these expectations are not realised. This can be disastrous to the learner and to any possibility of future success in a maths task. This is evident in Sanira's response, during the group interview (2005) I *think that being surrounded by people who are like at the same intelligence level as you are will help a lot.* Sanira cannot identify with the learners in her class or model her performance on them because they are constantly achieving excellent results when she can barely manage to pass her tests. She understands the need to be amongst learners who are at a similar level of performance as she is so that she can 'communicate' with them. Situations like Sanira's make it difficult for learners to find suitable role models within their class.

Developing Self-efficacy Using Verbal Persuasion

The following responses made by learners verify this: " Also teacher's reactions play an important role towards the child's efforts. To complement a child I think brings out the best in the learner (Poster activity, 2004)". On the other hand, teachers' negative feedback to learners, even in jest, has a detrimental effect on them. Evidence from this study supports the fact that negative or embarrassing remarks are a contributing factor to the development of low self-efficacy beliefs in maths. On the poster, learners have said that they would like "a teacher who does not put me down and make me feel like a total

stupid in front of others (especially the extremely intelligent children). It is extremely stressful". On the contrary, when teachers comment positively on learners' participation in the class it contributes to the development of learner confidence in maths. Learners' interactions with teachers can empower them by boosting their self-efficacy beliefs or diminish them with negative judgements. This is exemplified by the following comment from the poster activity (2004): " One thing that will want me to learn maths is the positive attitude I get from teachers and the inspiration. If we are to have inspiring teachers I would perform better". Reflecting back to the literature review in Chapter Two, verbal persuasion is used to build learners' self-efficacy beliefs using " realisitic judgements about learners' performance in maths". Learners rely on the judgements of teachers and use this to base their judgements of themselves (Pajares & Schunk, 2001). When teachers show their confidence in the capability of a learner to do maths, they help the learner to develop confidence in their ability to do maths. The following responses from the poster activity indicate this:" My current maths teacher is a good example of achievement. He gives us talks about how we can achieve our goals. This makes me want to learn more and more everyday" and " the teacher is the main aspect in learner's progress… when a teacher has confidence in…his pupils and shows it, this automatically triggers the pupil's self-confidence…." (Poster activity, 2004).

4.3.2 Creating a positive class environment will improve maths learning

During the group interview and the poster activity learners suggested several factors that they felt would improve their learning of maths.

Implications of Peer Behaviour for the Learning Environment

Earlier in this chapter, I highlighted the detrimental impact that negative comments made by peers, had on learner confidence. Any behaviour within the class, that affects learning, plays a role in shaping the learning environment. A case in point is the comment made by a learner during the poster activity (2004): "Having supportive peers is very important." Learners said that that they did not want to ask questions in the maths class because they were afraid to be embarrassed by their teacher and peers. During the group interview (2005) Leah's comment about being afraid to answer questions for fear of being ostracised by the learners confirms this very point.

Learners must Develop a Positive Attitude to Maths

Kally acknowledged, in the group interview, that she did not ask questions in class because she was afraid to do so. However she did acknowledge subsequently that she needed to change her attitude to learning maths. She seems to have made the realisation that a positive attitude would help her to improve her maths learning. Kally also emphasised that in order to improve learning of maths, teachers had to change their style of teaching by focussing on each learner as an individual: "erm. Ma'm…er…. I think it depends on the children, they should probably change their attitude toward maths if they don't like it … and the teacher should look at each child as an individual and try and help them on a one to one basis." She emphasised that learners be allowed to learn at his/her own pace and suggested that this would facilitate the process of learning. During the group interview (2005) Teran also indicated that peers and teachers played an important role in influencing learner attitude to maths: *I would say positive influences from teachers and pupils.* Jerico, the learner who like Lashin achieves full marks for his maths paper, gave his reasons for his success: *I think it's my positive attitude and my hard work* (Interview, 2005).

Both the high performing and the low performing learners in maths acknowledged, during the group interview (2005) that their attitude to learning maths should be positive. Sanira says that learners *should probably change their attitude toward maths if they don't like it.* In the poster activity (2004) learners agreed that "if I approached maths with more confidence and believe I can work hard and can be the best then I will learn and be the best." They acknowledged that, despite all the negative factors they have pointed out, it was their responsibility to work hard in maths. That and self-motivation they agreed was an important factor in their learning of maths: " I should show more effort towards maths not blame my teacher or surroundings for my appalling results" (Poster activity, 2004). This was further corroborated by the following: "mathematics is not that easy but it is learnable when you have the right attitude and confidence…" and " It is easy to blame outside factors but one of the most important things is continuous work and self-motivation. Only hard work can bring you success" (Poster activity, 2004). This was further entrenched by the following response: " Our input. Very important because you can't depend on the teacher only, your own effort and work is required to make sure you succeed in this subject" (Poster activity, 2004).

Teacher's Play a Role in Building Self-confidence

Learners also felt that it was the teacher's responsibility to motivate them and in so doing to help them develop their confidence in themselves as maths learners by helping them to understand their maths. " a teacher should give a pupil confidence, by making their understanding better" (Poster activity, 2004). This implies that learners feel confident in maths when they understand their work. It is my understanding from the data presented that the teacher's disposition toward the learners, is an important factor in determining the amount of confidence learners have in their ability to do maths. It is evident from the poster activity (2004) that when teachers display a lack of confidence in learners' ability to do maths, learners too feel that they are not capable of doing maths.

Learners suggested that teachers take cognisance of the learning styles of the individual learners and adopt teaching strategies that cater for them. Responses indicate that learners found it encouraging when they were taught different strategies of learning maths. It seems as though learners appreciated the teacher's attempts because they say it shows that teachers are interested in improving their maths performance. Teaching learners different ways of doing maths, helps to dispel the myth that there is only one way to do maths. Due consideration must be given to learners who take longer to grasp the concept being taught. Teachers must exercise patience and encourage learners by ascertaining their 'weak points' and using strategies that are specifically aimed at strengthening them. The teacher must ensure that the pace of the lesson is suitable to the majority of the learners, not just the 'bright' learners. Despite this provision must also be made for the learners who cannot keep up with the rest of the class. Learners suggested that the maths teacher start the lesson with simple examples that get progressively difficult so that they can familiarise themselves with the basics of the new concepts before attempting more complex examples. When learners understand a concept and can do simple examples, they begin to feel more confident and capable of doing more difficult exercises. By doing this, the teacher encourages learners to see improvements in their own performance and this enables them to develop confidence in their maths (Larcombe, 1985).

As the learners progressed from grades eight through to eleven, their performance in maths started to vary. Some learners maintained their good performance and continued to excel, whilst many saw their marks and grades dropping. Evidently, it became difficult for learners whose maths performance suffered to watch their grades decrease, as the

marks of their friends increased. Learners, like Sanira (Interview, 2005) became confused when they were unable to justify their performance in maths*: Okay ma'm honestly I think that I've become very unsuccessful at it because like once my marks started dropping then I just like just …lost hope in it … then like I saw that most of my friends around me had marks that that were like going up and then I didn't understand why my marks were dropping. And after that I just lost interest just because I felt that I really wasn't all that good at maths.* They found it difficult to justify why they did not understand certain concepts that their peers found easy to grasp. It became especially more difficult to understand this when at some point in their recent schooling their maths grades were on par with the high performers.

Appropriate Teacher Feedback is an important motivator

Learners expressed the need for their teachers to provide feedback that would encourage them to persevere in maths. This was evident in the responses from the poster activity (2004) when learners agreed that the "Teacher should be more confident about our abilities. Should motivate us more ". They felt disappointed when their teacher did not make a point of praising them for participating in the lesson and suggested that the teacher "should acknowledge when we are catching on and say something of encouragement when we get something right when we usually get it wrong". Learner responses highlight the fact that "… teacher's reactions play an important role towards the child's efforts. To complement a child I think brings out the best in the learner". These responses indicate the significant impact that feedback from the teacher can have on the learning environment. Learners felt that it was also important for the teacher to acknowledge their successes in the maths class and that this was especially important when success was not a regular occurrence for the learner.

During the poster activity, the learners indicated that it would be beneficial to their learning if teachers were considerate of all the learners and not just the 'bright' ones in class. They suggested that when teaching: " Maybe it will be easier if he could address the entire class more often and not only address those that are sharp in the subject" (Poster activity, 2004). This was a common thread in most of the responses during the poster activity. Learners cited this as a contributing factor to their current performance in maths and reaffirmed this, during the group interview, as a factor that must be taken into

consideration during teaching. Kalvin (Interview, 2005) seemed to sum it all up when he said, “The teachers must make sure that every pupil understands a certain topic”.

Many suggestions involving the teacher were made during the poster activity. Learners felt that the teacher should be helpful to all the learners when teaching. In the poster activity, learners indicated that it would improve their learning of maths if teachers taught at a slower pace. They suggested that teachers take into consideration the ability of all the learners when they pace their lessons, not just those who grasp the concepts faster. Teachers, they say, must take cognisance of the different learners when planning the pace of a lesson. Kally (Interview, 2005) says that, “… the teacher should look at each child as an individual and try and help them on a one to one basis”. Furthermore, it was expected that teachers would not show favouritism towards the ‘bright learners’ in the class: ” It would help a lot if the teacher didn’t have favourites in the class and didn’t expect the best only from a selected few and expect the rest of us to fail “ (Poster activity, 2004).

Learners prefer a teacher who is friendly and approachable. They would not be afraid to ask questions in the maths class when they do not understand what is being taught. Learners indicated that they expected educators to be considerate to learners who took slightly longer to ‘absorb’ concepts: “This is an important factor because I believe that the teacher is the one who creates your impression of maths. He/she should be friendly, be considerate to those who take slightly longer to absorb concepts, should be highly qualified and should actually teach in the class in such a way that there is no need for us to go for tuition” (Poster activity, 2004). Learners suggested that the teacher had a responsibility to help them study and to teach them good study techniques. From the learners’ responses, it is apparent that teachers’ comments play a role in influencing learner confidence. Positive comments to learners tend to boost their confidence and this they say, makes them want to work harder. It was found that learners appreciated teachers showing them ways in which they can be successful. Learners see this as a sign of confidence in their ability to be successful.

4.3.3 Group Work

The poster activity elicited the following suggestions as alternatives to traditional teaching. Learners said that they would prefer to do more group activities as opposed to work that was based on individual effort all the time. They suggested, during the poster

activity (2004) that doing group work as an activity should be emphasised so that learners could share their methods of working out problems: “They should not make work individual all the time, it should be in a group so others are able to share their methods of work”. They also felt that group learning could help them learn from their mistakes: “More group activities will help so we can find out where we went wrong”. This indicated that learners were comfortable with the idea of learning from their peers.

4.4 SUMMARY

This chapter revealed diverse perceptions of learners about their (a) experiences and perceptions of the maths class, (b) reasons that they attribute to their performance in maths and (c) suggestions for strategies that can be used to improve their learning of maths. It was evident that learners had different perceptions of their maths performance, their maths teachers and their learning environment based on their experience with it. This study showed that some learners held positive attitudes, whilst others displayed negative attitudes to maths. The self-efficacy beliefs of learners was a factor that needed further investigation. Chapter Five discusses the findings of this chapter using the theoretical framework that has been reviewed to make interpretations and to draw conclusions.

CHAPTER FIVE

CONCLUSION

The aim of this research was to investigate learner perceptions and experiences of maths and in so doing understand the challenges that maths learners face in the classroom. This study was guided by the following research questions: (a) What perceptions and experiences do learners have in the maths class? (b) To what do learners attribute their maths performance and what are learners' self-efficacy beliefs in maths?, and (c) What are learners perceptions of strategies that will improve their learning of maths?

To provide answers to these research questions, I decided that the best method to achieve the aims of the study would be to elicit responses from the learners. As such, a qualitative methodology was first adopted in order to determine learner responses to the research questions. The poster activity was administered with a class of learners and this yielded a diverse range of responses. These responses were further investigated using selected learners in a group interview. The poster activity and the group interview were seen to be the most appropriate instruments in gathering data for the purpose of achieving the research aims. The questionnaire was used in the final aspect of this research and was administered to 151 learners doing maths in grade eleven, to determine whether the findings from the qualitative phase were representative of all learners.

5.1 PERCEPTIONS AND EXPERIENCES OF LEARNERS

The qualitative and quantitative aspects of the study revealed that learners encounter a diverse range of experiences in the maths class and that these experiences contribute to the development of their perceptions to maths. In general this study showed that more learners described their experiences of maths in negative terms than those who did not. Furthermore, it was evident that learners whose performance did not meet their expectation in maths held predominantly negative perceptions of maths as compared to

learners who seemed to generally perform well in it. This finding was supported with data that was gathered during the poster activity, the group interview and the questionnaire.

5.2 ATTRIBUTIONS OF MATHS PERFORMANCE

There were many factors to which learners attributed their maths performance. The most common factors that emerged from the study are: (a) teacher behaviour, (b) peer behaviour (c) the grading of classes, (d) perceptions of maths as a subject and (e) learner self-efficacy beliefs in maths. The findings from the poster activity and the group interview on the one hand contrasted with those from the questionnaire. Whereas the qualitative methods revealed that low-performing learners were disillusioned with teacher behaviour with regard to motivation and support, providing appropriate feedback and adjusting the pace of teaching, the questionnaire showed that the majority of learners felt that their teacher's behaviour was in keeping with their needs.

Both qualitative and quantitative methods showed that most learners did indeed have low self-efficacy beliefs in maths. The learners who were the exceptions, as was evident in the group interview, were the high-performing learners who exhibited high self-efficacy beliefs in maths. These learners whilst significant, were few in numbers. Although learners did acknowledge the importance of maths, they revealed that they did not feel positive about their capability in maths.

5.3 STRATEGIES FOR THE IMPROVEMENT OF MATHS LEARNING

The poster activity and the group interview allowed learners make an input as to what they thought would improve their learning of maths. They felt that their maths learning would be improved if their maths teachers were more supportive and motivating in their demeanour as well as in their feedback, if they would teach at an appropriate pace and use a wider variety of teaching techniques like group work. Although peer behaviour was considered as a factor that affected learners, this study brought to light the overwhelming and at times devastating effect that peers have on learners in the maths class. This result was not anticipated.

5.4 IMPLICATIONS FOR FURTHER RESEARCH

The TIMSS study, mentioned in Chapter One, highlighted statistics about the current status quo of maths in the country as well as South Africa's rank in the list of participating countries. The number of learners choosing to study maths at higher grade is fast declining. This is a cause for concern because it affects the number of learners who are eligible for the study of science-based professions at tertiary institutions. This is not a new phenomena as an article appearing in the Sunday Times (2000), said that for of a shortage of between 4000 and 12000 teachers in maths and science, only 300 will graduate to fill the gaps in maths education. The shortage of suitably qualified maths teachers has been linked to the poor maths results in grade twelve, and the poor maths results in turn influences students' decisions to take maths. Furthermore, the students who do take maths at University level choose to follow lucrative opportunities rather than teach (Sunday Times, 2000). Achievement in maths is the product of many variables including attitudes and perceptions, peer influences and teacher influences. Variables such as learner perceptions of maths, attributions of these perceptions, performance and attitude affect whether learners advance to tertiary education (Hammouri, 2004). It is therefore necessary that researchers investigate the impact that affect has on maths learning.

Using the findings from the study, it is hoped that the maths teacher can develop strategies to develop positive learner attitude to maths and to find ways to improve maths learning. It has been pointed out that the current classroom environment is one that provides an environment that is conducive to learning for some learners but at the same time undermines the efforts made by other learners. Finding creative ways in which one can improve the learning environment is a challenge to any maths educator. Research in this area will be valuable to the practicing educator and beneficial to the learner.

The question of why it is that some learners will persevere in maths tasks despite setbacks in expected performance and yet others will "give up" begs to be answered. Investigating this in particular might provide long-awaited answers to educators whose daily battle is getting learners to make an attempt in the maths class. This study has pointed out that most high-performing learners hold high self-efficacy beliefs in maths. A limitation of this study is that it was performed in just one school and with only learners doing maths in grade eleven. I believe that a more detailed study of high-achieving learners and their self-efficacy beliefs will enlighten us on the impact of self-efficacy beliefs on learning maths. Understanding what motivates high-performing

learners and helps develop their self-efficacy beliefs will impact on and influence the strategies that teachers adopt in the classroom.

Research in the area of affect must address the onset of attitudes to maths. During the course of this research, I have found links between self-efficacy and anxiety in maths as identified by Kanai & Norman (1997). It is my contention that further research into self-efficacy beliefs and its impact on maths anxiety will provide more insight into this relationship. It is hoped that early identification of the onset of maths anxiety will provide maths teachers with the insight needed to help prevent if not overcome maths anxiety in the learner. I am hoping that this research can help guide decisions on overcoming this challenge to learning. Most of the research done in the area of affect and achievement share similar views and that is (a) affect is a powerful factor in learner achievement, (b) self-efficacy beliefs are major contributors of affect that if developed can improve achievement in the maths class, (c) the study of maths is essential to the maintenance and development of the highly technological world in which we live. It is imperative that the attitudes of learners toward maths improve, if they are going to be given the opportunity to function effectively in this highly technological world.

The research that has been done thus supports the conclusions drawn above. The way forward would be to relate all of this research to classroom practice and to make this accessible to classroom practitioners. It would be helpful to teachers if schools could enable teachers to recognise when and how they treat high-performing and low-performing learners differently. Identifying that this occurs is the first step in the process of overcoming teacher behaviour associated with creating classroom bias in favour of high-performing learners. Whether this bias can be identified and eliminated successfully remains to be seen.

Attribution theories have been used to explain causal factors in learners' achievement in maths. Much research has been done in the area of affect and factors that influence the learning of maths have been highlighted. I believe that an important area of research would be to look into the development of intervention programmes that focus on building positive learner attitude in maths by investigating learner attitude and enjoyment of maths in the stages of primary schooling because that is when most learners acknowledge that they last enjoyed maths.

An area of concern that needs investigation would be the role of parents and society in shaping learner attitude to maths. Often, during parent meetings, I have heard parents

claim that they are quite satisfied with their child's performance in maths and that it was expected because they themselves were not good at it. Of significance would be determining whether the attitude of the learner to maths is as a result of the attitude of the parent. Researching the link between parental attitude toward maths and the transfer of this attitude to their children would be a step in determining how learners develop their attitude to maths. Furthermore, I think that a related field of exploration would be the easy acceptance of poor maths performance in relation to the fact that more learners perform poorly in maths than in most other subjects. Is it easier for learners to say that it is acceptable to fail at maths because most learners do anyway?

5.5 CONCLUSION

This research opened the doors for the investigation of affect in the field of maths education at school and allowed me to delve into areas of research surrounding affect. In the process, it has highlighted many more areas that need to be explored. My concern now lies with the fact that much research has been done into math education at school and yet not much of it is easily accessible to the maths educators who would benefit most from its existence. The South African Department of Education must find a way to work in tandem with the tertiary institutions to ensure that research pertaining to the field of maths education at schools is made readily available to schools by ensuring the delivery of these to the same. Research in maths education at schools has a direct bearing on what goes on in the classroom. As such math educators should be given more incentives, resources and research time to get involved in research in their classrooms with the aim of improving maths education at school.

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APPENDICES

APPENDIX A

POSTER ACTIVITY

Questions

1. What do you feel about maths?
2. Why do you feel this way?
3. What do you think will improve your learning of maths?

Responses

Summary of Learner Poster Responses

Poster Questions/ Responses	Poster Question 1	Poster Question 2	Poster Question 3
Self-efficacy	✓	✓	✓
Teacher	✓	✓	✓
Parents	✓	✓	✓
Class Environment	✓	✓	✓

MOST IMPORTANT

Question One

Self-efficacy

1. Fear when writing a test.

Teacher

1. Pressure. I feel that because I usually perform badly, and in the last term I did very well from an A to a C. I am under immense pressure by my parents, teachers to do well. I don't know.
2. It is hard to learn in a top class because of the level of teaching it is much faster than last year.
3. My lack of success causes me to lose hope in studying maths.

Parents

1. I think parents don't understand how challenging maths can actually be. They just put more pressure on us and it makes it harder for us to cope with the subject.

Class Environment

1. There are too many disruptions in class.

Question Two

Why do you feel this way?

Self-efficacy

1. Fear when writing a test. Is almost always the case and sometimes because of that fear I end up doing badly or failing which is even worse.
2. I don't think that I have what it takes to actually do maths. That's maybe caused by me lacking confidence. I think of the workload when I get to matric. What if I fail to write for an exemption.
3. Being in the top class in school does stress me out because if I don't do well maybe it would be better if we weren't rated according to marks. I hate being looked down upon.
4. Our Input: Very important because you can't depend on the teacher only, your own effort and work is required to make sure you succeed in this subject.

Teacher

1. But sometimes the teacher puts too much pressure on a pupil, like when you cannot grasp the information the first time and he makes fun of you or calls you names and Insults you. This is what should change in maths.
2. The teacher needs to go more slowly. The teacher goes too fast as he focuses on the brighter pupils only.
3. The reason I do bad in maths is because the teacher teaches too fast and he does not give learners who are slower than others (a chance) to grasp the concept. He also makes maths seem boring. He tries to be funny but he doesn't know he actually embarrasses and hurts peoples' feelings.
4. I feel that some sections are rushed, and perhaps if some sections were taught

thoroughly, I will enjoy the subject more.
5. If the teacher payed more attention to weaker students than the brighter ones.
6. I think what effects me from not performing at a good level in maths is that when you give an incorrect answer the teacher does not explain where you went wrong and what you must do in order to avoid that mistake.
7. if the teacher goes slower instead of fast then everybody will get good marks because your only as fast as the slowest student.
8. A teacher should give their pupil confidence by making their understanding better. They should be able to explain in the capacity to which the child would understand.
9. If the teacher didn't teach as fast and if he paid attention to the people who take a bit longer to catch on.
10. Try to help everyone not just the intelligent.
11. My teacher makes maths fun as (he) teaches us different methods to learn.

Peers

1. My peers around me are too self-revolving. If they stopped putting us down and passing their unwanted comments when we get an answer wrong then I will feel confident to do better. They make me feel like we ain't good enough.
2. Having supportive peers is very important. Unfortunately there are a few people who do very well in maths and because of this they always behave with an insulting attitude towards others, making our self-confidence lower and making us believe that only they can do well.
3. Children who make you feel stupid in front of them. They automatically put you down. I need to change my class.

Question Three

Self-efficacy

1. If my attitude toward maths is changed i.e. from believing maths is very difficult to believing that maths is easy and that if I work hard, I can achieve good marks.
2. I believe that mathematics is not dat easy but it is learnable when you have the right attitude and confidence….
3. It is easy to blame outside factors but one of the most important things is continuous work and self motivation. Only hard work can bring you success.
4. If my confidence and self-esteem is boosted I will feel that writing tests is easier.
5. I should show more effort towards maths not blame my teacher or surroundings for my appalling results.
6. If the maths questions were made easier for those that are not so good at the subject. Maths is something that you study and not learn off by heart so maybe the questions should be made easier for me to catch on better.
7. High self-esteem, confidence and determination.
8. Thinking about the long term benefits makes me want to be successful.
9. I will want to learn maths if I did better in tests.
10. If I approached maths with more confidence and believe I can work hard and can be the best then I will learn and be the best.
11. If I could perform more better in my subject.
12. Confidence.
13. Only if I understand the subject well and to do homework everyday and the

exercise work that I get daily in school. It would be nice if a teach(er) can explore what we learning if a student don't understand. Maths is such an exciting and challenging subject that I do enjoy. The nicest thing about maths is that when a teacher teaches you nicely and makes you understand…

14. If the student pays attention and are highly motivated they would enjoy maths.

Teacher

1. Teacher must be considerate – must not rush through exercises because children who are good at maths understand, whilst others don't.
2. Also teachers' reactions play an important role towards the child's efforts. To complement a child I think brings out the best in a learner.
3. The teacher must wait till everyone understands the work and then move on.
4. The teacher should be considerate to children that are not so clever.
5. Teacher should be more confident about our abilities. Should motivate us more.
6. Our teachers need to explain concepts in such a way that even the weaker students understand.
7. There shouldn't be so much pressure on us to (do) the best others want us to do but to do the best we can! Teacher should be aware that we have other subjects to do!
8. I do believe that there is nothing wrong with the subject. I do take time to catch on to the concepts but sooner or later I do catch on. I feel that the teacher is losing his touch in teaching the subject. Maybe it will be easier if he could address the entire class more often and not only address those that are sharp in the subject.
9. They need to make it more exciting add in real life experiences and how maths affects our life.
10. I wish my teacher would understand that we all not masters in maths although we try our best. So I hope the teacher would cater for us too cause we are keen and interested in maths.
11. If the teacher would teach more slower so that the people who are slow would be able to catch up with the work.
12. Teacher should not rush when teaching a new section.
13. If the teacher would slow down when teaching.

Peers

1. I think I will be more confident in the subject if my friends won't keep putting me down and saying I am not capable of the marks I get.
2. If I were not surrounded by people who always do well and then say it is easy.

Parents

1. Parents should be more understanding and shouldn't expect their children to expect things too far beyond their capabilities. Thye should help by not insulting their children when they do not perform as well as they used to.

Environment

1. Being in an average maths class and being with average children will make me want to learn maths.
2. I think that maths will be more enjoyable if the atmosphere was more lively.

VERY IMPORTANT

Question One

Self-efficacy

1. No more confidence

Question Two

Self-efficacy

1. Other people should stop telling us how difficult the subject is.

Teacher

1. Should acknowledge when we are catching on and say something of encouragement when we get something right when we usually get it wrong.
2. He always asks the sharp people and makes us feel bad like we are not worth learning maths. It feels it like for sharp people and he does not put his feet in our shoes.
3. It would help a lot if the teacher didn't have favourites in the class and didn't expect the best only from a selected few and expect the rest of us to fail.
4. Thinks by teaching us once we will all get it so they say we are in the top class. He is always teasing women like they have no value in maths.

Question Three

Self-efficacy

1. If I understand maths better I will enjoy it.
2. Also if we had more time to complete our maths syllabus it would make maths more enjoyable instead of very stressful and rushed.
3. If my concentration levels were high, I could actually sit and learn maths for longer periods at a time.
4. Confidence, it is with this that the pupil studies for his/her pleasure and realizes his true ability and if the pupil does well he maintains and improves.

Teacher

1. A teacher who does not put me down and make me feel like a total stupid in front of others (especially the extremely intelligent children). It is extremely stressful.
2. Less pressure from teachers and parents.
3. The teacher: This is an important factor because I believe that the teacher is the one who creates your impression of maths. He/she should be friendly, be considerate to those who take slightly longer to absorb concepts, should be highly qualified, & should teach in such a way that there is no need for us to go for tuition.
4. They should not make work individual all the time, it should be in a group so others are able to share their methods of work.
5. The parents and educators should be more supportive and pro-active in helping children to study well.

6. Having a teacher that encourages you all the time.
7. If you had a teacher that pushes you to do well and to have a teacher that treats you fairly, you would want to learn more and more.
8. I think if the teacher explains very well and does a lot of examples we would do well and enjoy the sections.
9. If the teacher does not rush through the syllabus.
10. The teacher must make sure everyone understands.
11. The math that we do should be hard but at the same time fun to do.
12. pupil should be comfortable with the teacher hence the teacher should be able to interact and understand with a child.
13. I feel that if the teacher could teach at a slower pace so that I as a student will be able to grasp everything that is said in the session.

Parents

1. Parents are also a curse. They push me too hard. All they want is for me to work hard. They want it to be done all the time. We must study 24/7. They fail to realize how difficult the syllabus is. It would help if the syllabus was easier.
2. Having my mum motivate me instead of comparing me to the top students.

IMPORTANT

Question One

Self-efficacy

1. I am not confident enough to do maths & don't think I was born brilliant enough to do the subject.
2. If I performed better in my past papers, I will be motivated to always perform well.
3. I do enjoy maths but sometime I don't only if I don't understand the sums or the equations that we do that day.
4. I love maths and get high marks but I feel that I am not good enough. I feel that I cannot be good enough.
5. must not insult students who are not very intelligent as we do not like to go to the class because of being embarrassed.
6. It is stressful being in a class where the majority of the pupils are intelligent and they make the weaker students feel like total stupids.
7. I believe that maths is hard. But its dedication that gets that "Ä" symbol in maths. Unfortunately everyone does not have that discipline and drive to achieve that symbol.
8. Maths is a waste of time. We have less sleep because of maths.
9. But I love the subject. I just don't know how to learn it.
10. Anyone has the ability to do maths, if they have the commitment and is prepared to be very hardworking.

Question Two

Self-efficacy

1. Lower the standard of thee questions in exams to match our ability.
2. More group activities will help so we can find out where we went wrong.
3. More commitment. Need to have a drive. Set goals to be achieved and work towards them.
4. The encouragement and motivation of the teacher, makes the subject enjoyable.

Teacher

1. The teacher's ability is a large factor. I would not feel comfortable being taught by an average" teacher.
2. Must not force or put pressure on us as we get nervous and do not perform at our best.

Question Three

Self-efficacy

1. I wish I had the brainz like "Lashin" so then I will like maths.
2. Maths so far is quite ok for me because I know I can do so much better than I'm

doing now its my fault my maths teacher is very good.
3. A motivating teacher, good results, to be around people who believe in me and not make me want to dislike maths, proving to myself and others that I am capable of handling the challenge.
4. I think our confidence for maths is not good therefore we do bad. WE must increase our confidence level by talking to someone, therefore we will show more interest toward the subject.
5. I would enjoy learning maths if it were not so confusing.
6. If we do well in a subject then that might encourage us to do better at it. More students should be encouraged to work at home as well as at school. This should improve results.
7. If I achieved better marks for assessments and tests, I would enjoy maths.
8. More self-confidence. Need to have a more positive attitude.
9. I would like maths if it was more understandable because whenever I think I understand it or getting there it just get even more harder.

Teacher

1. I think a teacher should be able to give individual attention for not everyone works at the same pace.
2. One thing that will want me to learn maths is the positive attitude I get from teachers and the inspiration. If we are to have inspiring teachers I would perform better.
3. I think that having a teacher that will motivate the student enough to go beyond his or her ability will definitely help towards people wanting to learn.
4. Don’t insult students whether they are intelligent or not.

APPENDIX B

QUESTIONNAIRE

The purpose of this questionnaire is to gather information about your experiences about and attitudes to mathematics and to ascertain the degree to which specific affective factors affect your learning in the mathematics classroom. Please answer honestly and completely. Your answers are Completely confidential. This questionnaire will be of no use unless you give your honest views.

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

5	**Strongly Agree**				
4	**Agree**				
3	**Neither agree nor disagree**				
2	**Disagree**				
1	**Strongly disagree**				
Please place only one cross in the appropriate column.		**5**	**4**	**3**	**2**	**1**
Example I love reading.		**x**				
Personal confidence about maths : Confidence/Self-efficacy		**5**	**4**	**3**	**2**	**1**
1. I am good at maths.						
2. I do not enjoy maths.						
3. I find maths too difficult for me.						
4. Most subjects I can handle but I just cannnot do well in maths.						
5. I am confident of myself when I do maths.						
6. Doing maths makes me nervous and upset.						
7. I'm not the type to do well in maths.						
8. I'm just not good in maths.						
9. I am sure that I learn maths.						
10. I am always anxious when asked to solve maths problems.						
11. Maths is my worst subject.						
12. When I am in a maths class I feel relaxed.						
13. I don't think I can learn maths.						
14. I am always under a terrible strain in the maths class.						
15. I often get scared when I open my maths book & see a page full of problems.						
16. Use two words to describe your feelings about maths.						
Perceptions of teacher attitude		**5**	**4**	**3**	**2**	**1**
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.						

Attributing Factors	5	4	3	2	1
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. My peers are understanding and help me to learn maths.					
5. Learning maths is too pressurising and stressful.					
Perceived usefulness of maths	**5**	**4**	**3**	**2**	**1**
1. Knowing maths will help me get a good job.					
2. Maths will not be important to me in my life's work.					
3. I will use maths in many ways as an adult.					
4. I don't know why I have to learn maths.					
5. Doing well in maths is not important for my future.					
Perceptions that maths is a male domain	**5**	**4**	**3**	**2**	**1**
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 trustworthy as a male in solving important maths problems.					
General	**5**	**4**	**3**	**2**	**1**
1. I would like to further my studies in maths.					
2. I would study maths at tertiary level only if I absolutely had to.					
3. I do not mind studying maths after matric, if it is necessary for my studies.					
4. I would prefer never to study maths ever again.					

APPENDIX C

Group Interview Questions and Transcript

Group Interview Questions

The purpose of this interview is to gather information about your experiences in the maths and to ascertain the degree to which specific affective factors affect your learning in the maths class. Your identities will remain completely confidential. This interview will be of no use unless you give your honest views.

Gender: _____ Grade: _____ Age: _____

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

   _____

   _____

   _____

   _____

2. Can you tell me about a time when you enjoyed maths? Why?

   _____

   _____

   _____

   _____

3. Do you think that you are successful in maths? What do you think has contributed to your success/ failure in maths?

   _____

   _____

   _____

   _____

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

   _____

   _____

   _____

   _____

Group Interview Transcript

04/10/2005

Thank you for availing yourself to attend this focus group. I know that time is important I therefore appreciate your participation. The purpose of this meeting is to establish your mathematics experience at school and to what do you attribute your success or failure in mathematics and what do you think will improve your learning of mathematics in the classroom. I would welcome any suggestions that you make on ways in which to improve your learning of maths. My task as a researcher is to listen and gather information, not to judge you or to argue with you. Okay?

Teach : How would you best describe your experience of school mathematics? Jerico.

Rick : Personally I enjoyed it & I found it interesting and I still currently am enjoying maths.

Teach : Thank you. Sheran…… Teran

Teran : I enjoyed it then to a certain extent but now as much as .. not as..… not as much as I did then but now it's much harder but I know in the end it will all be worth it.

Teach : Thank you. Kally

Kally : My experience I would have to say was most great and at times I was …. Just thinking about it, I've always loved and enjoyed maths when I was in grade 10 maths was easy and I could manage it but in grade eleven it was a bit tough but I still love maths . Now that I'm in my final year and doing standard grade maths I must say I still enjoy it .

Teach : Leah

Leah : I would say that it was really horrible as I never could grasp the concepts

Teach : Thank you….Kalvin

Kalvin : ….I enjoy doing maths but my performance was better in grade 10 and eleven

Teach : Can you tell me about a time when you enjoyed learning maths? …. Yokal

Yokal : I enjoy learning maths currently. I find it interesting…it allows me to…er to explore my intelligent side of my brain .. and…um… I feel that I can have… I have a lot of capabilities and I can find out my true capabilities when I'm working with problems.

Teach : Sanira

Sanira : I would say that I enjoyed maths more ..um.. from grade 8 through to grade

ten and as I got to grade eleven it got a lot harder therefore I couldn't enjoy it as much but I still kind … still enjoy it.

Teach : Krishen

Krishen: Ma'm I enjoyed it in grade 8 and grade 9 cos then I was scoring good marks.. er and even grade 11 grade 10, 11 and 12 was ..was awright but ma'm I think I got the capability to do better at math although its hard.

Teach : Sheran

Sheran : M'am we enjoy maths… we enjoy maths if its easier to understand…more … more easier to learn and everything at that time so you can go higher marks. Now that it has become difficult …. It's hard

Teach : Thank you. Do you think that you are successful in maths and if you do what do you think contributes to your success or failure in maths?… Jerico

Rick : Ya…and I think it's my positive attitude and my hard work.

Teach : Thank you. Kally

Kally : Yes. … er I used to do higher grade in grade eleven and now that I do standard grade it's much easier and….er …er I attend tuition so it serves as a guide for me……..

Teach : Okay . do you regard that as a success or a failure that you ….. are doing standard grade maths?

Kally : I'm not sure because it kind of feels like a failure in …er some way cos I couldn't cope with the tough work of the higher grade.

Teach : Why do you think ..er..you couldn't ?

Kally : er..pressure probably because …er…there's a lot of intelligent students in the class. It's like peer pressure if you..if you don't do good ….you're discouraged to… go on.

Teach : Thank you. Leah

Leah : Ehm .no. I would say that my maths experience was unsuccess… unsuccessful. Its because no matter how much I tried I never could get the marks that I always wanted. I don't know it's..I got a phobia about maths that its hard and no matter how much I try to tell myself its not, I still ..I don't know. That perception that maths is hard and I can't get it out of my head ..and it's ..it's the children..the pupils in class I feel so stupid .. it's.. I'm I'm I'm afraid to ask questions in class they..as they gonna say that I'm stupid or something.

Teach : Thank you. Teran

Teran : I would say I was successful to.. not completely but I have been to an extent. Ya it was a bit of hard work eh.

Teach : Krishen

Krishen: I would say no. I wasn't successful because everytime I set a goal to …and when my test marks come back or exam mark comes back it's not what I expect..so er..so er..maybe because er in the class like as Leah says you know you afraid to ask questions. Maybe the teacher will make you feel stupid.

Teach : Is it only the teacher?

Krishen: Er I think me too ma'm because I'm too afraid to ask……. Questions

Teach : Thank you. Kalvin

Kalvin : I think my desire is to be successful but I've maintained a constant symbol throughout the year and my downfall is I can't concentrate for more than half an hour.

Teach : Thank you. Yokal

Yokal : Yes I feel that I was successful to a certain extent although I know that.. I know I can do better. I feel that if I work harder on the..on specific aspects of maths er example geometry everyday I know that I can do better and with the practise I know I can get an 'A' at the end of the year which I which is my accomplishment.

Teach : Thank you. Sanira

Sanira : Okay ma'm honestly I think that I've become very unsuccessful at it because like once my marks started dropping then I just like just ….lost hope in it . then like I saw that most of my friends around me had marks that that were like going up and then I didn't understand why my marks were dropping. And after that I just lost interest just because I felt that I really wasn't all that good at maths….

Teach : Thank you. … what do you think will improve your learning of maths in the classroom? If you had to change something what is it that you would do to make maths learning ..maths…learning maths…right… to improve the learning of maths?

Rick : I think you need to be more relaxed and less stressed in the subject

Teach : Yokal?

Yokal : Er work on the areas that you find difficult and erm explain to teachers the areas that you find difficult and they'll help you.

Teach : Sanira:

Sanira : I think that being surrounded by people who are like at the same intelligence level as you are will help a lot. It's because like they have like brainstorming on the sections that you don't understand and stuff but like like sometimes like you like just surrounded by people who just grasp all concepts like a lot more easier… like …how do you ask questions c'os you don't understand why you don't get it and why they do and you sometimes you don't like to ask.

Teach : Thank you. Kally

Kally : Erm. Ma'm…er…. I think it depends on the children, they should probably change their attitude toward maths if they don't like it…….. and the teacher should look at each child as an individual and try and help them on a one to one basis.

Teach : Teran

Teran : I would say positive influences from teachers and pupils.

Teach :Thank you

Leah : Erm… smaller classrooms with individual attention focus on the needs of the pupils specifically

Sheran : Everyone...everyone in class should pay attention to the teacher in order...if they want to learn and do better because most of them don't do that because they feel they doing bad in math so they tend to lose interest and not pay attention and they disturb everybody else.

Teach : Thank you. Krishen

Krishen: I think they should focus and concentrate on whatever is being done and also if they don't understand something they should ask the teacher and if they ...if they don't understand it and then show them and tell them what's to be done.

Teach : What would you do if people are scared to ask questions? What do you think can be done in that case?

Krishen: er..

Teach : Do you think the teacher can do something or the learner can do something?

Krishen: I think the learner because he's the …what he thinks is important. I mean it's just everything in the head… like if he wants to ask questions and he got

that… it's it's just the fear inside him. He needs to break that fear.

Teach : Kalvin

Kalvin : I think that people must not be too textbook and think in a straight line. Must think from outside the box. The teachers must make sure that every pupil understands a certain topic.

Teach : Thank you. Thank you for your time and responses. Your comments have been audio taped and will be used in my research with the intention of providing more positive and meaningful experiences for learners of mathematics in the future. Thank you very much.

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APPENDIX D

LETTER OF CONSENT

Dear Parents

I am currently a Masters student in Mathematics Education at the University of Kwazulu-Natal, working on my dissertation relating to the attitude of learners towards the learning of mathematics, the challenges it poses to the learning of mathematics and ways to produce a positive disposition to the learning of mathematics.

As part of my project, I would like learners, who are currently in Grade 11 and have been through the process of mathematics learning, to participate in my study which will involve a focus group session as well as a questionnaire.

The focus group will take approximately one hour and will be conducted on Wednesday, the _____. I would like your permission to interview your child/ward and to use his/her responses from the group interview and the questionnaire, as data toward my research project.

Your child's/ward's participation is entirely voluntary and if at any time you wish to withdraw your permission for the use of this data, you may do so. In my write-up of the study, no real names will be used and your child's/ward's identity will be kept anonymous. The data will be used in my dissertation at the University of Kwazulu-Natal. I will not use it for any other reason without your permission.

Thank you for your assistance. If you have any questions, you can contact my course supervisor, Sally Hobden (031 260 3435).

Yours Sincerely

_____

Suri Moodley

I, _____, parent/guardian of _____, have read the above and agree to allow my child/ward permission to participate in the abovementioned study. I consent to his/her responses being used as data in the research project. I understand that participation is voluntary and that my child's/ward's name will not be used in the write-up of this project.

_____ _____ _____

Name of Parent/Guardian Signature Date