LEARNERS' PERCEPTIONS OF MATHEMATICAL LITERACY IN THE FURTHER EDUCATION AND TRAINING (FET) BAND IN THREE SELECTED HIGH SCHOOLS

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By

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DEDICATION

I dedicate this research to my late father, Sandile, my mother, Nosipho Mbatsha, my four sisters :- Noxolo, Thembisa, Nobathembu, Anele, my only brother Zuko, and to my late son, Songezo, may his soul rest in peace.

University of Fort Hare
Together in Excellence

DECLARATION

I, Zonke Mbatsha hereby declare that:

- this dissertation is my original work
- it has not been submitted for degree purposes at any other university.
- the information derived from published and unpublished work of others has been acknowledged in the text and a list of references is given.

Signature:

Date: 18-04-2013

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ABSTRACT

This study investigated perceptions of Mathematical Literacy of learners in three Further Education and Training schools. The study was conducted as a qualitative case study in three high schools in Mdantsane in the East London District in the Eastern Cape Province. A constructivist perspective has been used in the study to explore learners' perceptions of ML. The data were collected through interviews, focus group interviews and document analysis. Individual semi-structured interviews were conducted with three participants in each school and focus group interviews were conducted with six learners in each school. Research methodology and research design were selected for this study. The study employed a qualitative case study approach.

The findings were followed by recommendations which sought to address the problems discovered in the investigation. One of the findings was the fact that doing Mathematical Literacy improved and boosted learners' self-confidence in engaging in mathematics. Learners showed a high level of enjoyment of ML because it is about real life situations and about issues they are familiar with. The study revealed that most of the learners were positive about Mathematical Literacy while some learners highlighted some challenges in the teaching and learning of the subject. The study concludes with recommendations for better classroom practice, learner education and further research and conclusions.

It is hoped that this study might be beneficial to the learners in the three schools where the study was conducted. It might also benefit other learners and teachers of Mathematical Literacy. in the entire Eastern Cape and the country as a whole.

LIST OF ACRONYMS

ACE: Advanced Certificate in Education

AS: Assessment Standard

CAPS: Curriculum and Assessment Policy Statement

DoE: Department of Education

FET: Further Education and Training

FGD: Focus Group Discussion

GET: General Education and Training

LO: Learning Outcome

ML: Mathematical Literacy

NCS: National Curriculum Statement

NCTM: National Council of Teachers of Mathematics

PISA: Programme for International Student Assessment

S.A. South Africa

TIMSS: Third International Mathematics and Science Study

OECD: Organisation for Economic Cooperation and Development

ZPD: Zone of Proximal Development

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CHAPTER 1

Introduction and Background

1.1 INTRODUCTION

This chapter presents the background to the study and the context of the study on the research on learners' perceptions of Mathematical Literacy, the problem statement, research questions, the purpose and the objectives of the study and definition of key words. An outline of the chapters in the research study is also given at the end of the chapter.

1.2 BACKGROUND TO THE STUDY

The adoption of the Constitution of the Republic of South Africa provided a basis for curriculum transformation and development in South Africa (DoE, 2003, p.1). Educational changes in the country have been stimulated by the major political changes resulting from the abolition of apartheid and the establishment of a new democratic South Africa in 1994. A need for educational change was required in South Africa (a developing country) to be in line with other developing and developed countries. This was to provide equity in terms of educational provision and to promote a more balanced view so that education in South Africa would progress in line with that of developed countries by developing learners' critical thinking powers and their problem solving abilities.

The vision for education that emerged helped to integrate education and training into a system of lifelong learning. A new curriculum, Curriculum 2005, was developed for implementation. Curriculum 2005 had three distinctive features: it was based on a philosophy of learner-centred education, it used Outcomes Based Education as its

delivery mode, and it adopted an integrated approach to knowledge (Chisholm, et.al, 2000). Curriculum 2005 also applied to all bands of education, including Early Childhood Development (Grades 00 – Grade 0), General Education and Training (GET, grades R -9) and FET (grades 10-12).

The school curriculum in the post-apartheid South Africa has undergone, and is still undergoing, major transformational changes. At the same time, international emphasis on the importance of Mathematics (Maths) education has found reflection locally which resulted in many calls for the development and introduction of Mathematical Literacy (ML) as part of the school curriculum in the FET band. Mathematical Literacy is now offered in Grades 10-12 in the FET band. With the new curriculum, learners are encouraged to be numerically literate by either choosing Mathematics or Mathematical Literacy. The aim is to develop learners' Mathematical skills in order that they cope with the demands of everyday life, and to improve their Mathematical competency (Department of Education: 2003 p,9).

It is the view of the National Department of Education that Mathematical Literacy can provide learners with the necessary mathematical skills which will enable them to become self-managing people, who can be critical when analyzing situations and solving everyday mathematical problems, contributing workers and participating citizens (DoE, 2003: p,10). Christiansen (2006) states that one of the reasons for the introduction of Mathematical Literacy is to "... reach the 200 000 additional learners learning grade 12 every year without mathematics and the 200 000 additional learners who fail mathematics yearly."

The Eastern Cape government together with the provincial Department of Education, like the other provinces, identified training in Mathematical literacy as a priority area as it was a newly introduced subject which was considered a fundamental component of the FET band. In order to build capacity amongst educators in the FET band in the National Curriculum Statement (NCS), the Directorate for FET entered into a partnership with the Consortium of all Higher Education Institutions (HEI).The Consortium obtained registration for the Advanced Certificate in Education (ACE) in FET Mathematical Literacy from the National Department of Education in 2004. Subsequently, one educator from each school in the FET band was trained in the ACE (Mathematical Literacy) qualification at NQF level 6.

Mathematical Literacy, as it is called in South Africa, has differed in name and conception in different countries in curriculum policies and in research. The term Numeracy is used in the UK (Askew, 2002) while Quantitative Literacy is used in the USA (Steen, 2001). Askew (2002: p,5) says Mathematical Literacy is the ability to process, communicate, and interpret numerical information in a variety of contexts, whilst Steen (2001) describes it as comprising those mathematical skills that "... enable an individual to cope with the practical demands of everyday life." Thus, Mathematical Literacy was introduced in 2006 in South Africa to help learners to think numerically so that they can cope successfully with the practical demands of everyday life. Mathematical Literacy was structured as an alternative option to Mathematics. Since January 2006 all learners entering the FET band have to take either Mathematics or Mathematical Literacy as the new learning area was to be implemented from Grade 10 in 2006, Grade 11 in 2007 and Grade 12 in 2008.

Mathematical Literacy is considered as a subject related to Mathematics but different from Mathematics in terms of its nature and its aims (Venkat & Graven, 2008). Mathematical Literacy is a subject driven by life-related applications of Mathematics. It is assumed to enable learners to develop the ability and confidence to think numerically and spatially in order to critically analyse and interpret everyday situations and to solve problems, whereas Mathematics is based on observing patterns; with rigorous logical thinking, which leads to theories of abstract relations (DoE, 2003: p,9). According to Brombacher (2007: p,2), Mathematical Literacy is a way of thinking, a way of relating to the numerically-based world in which we live. This means in Mathematical Literacy, more emphasis is laid on real-world connections and the application of knowledge.

Mathematical Literacy is believed to have the potential to provide learners, who previously did not continue with Mathematics beyond grade 9, with access to the kind of skills that are crucial in order for them to participate meaningfully in the modern world (Bowie and Frith, 2006: p,5). Brombacher (2007: p, 4) on the other hand, mentions two reasons why ML was introduced. Firstly, the nature of the world has changed in such a way that effective participation requires some confidence in using some forms of Mathematics. Secondly, the mathematics of traditional school programme is largely abstract in nature and, though important for developing individuals with interest and ability in the discipline of mathematics (and related fields of study and work), it does not meet the everyday needs of the majority of individuals, workers and citizens.

Research studies show that developments in Mathematical education, like in other subjects, raise questions about the curriculum, for the teachers and their teaching, and for the learners and their learning (Bishop and Vithal, 2006: p, 2). There is a great need to share the variety of experiences, concerns (Bowie and Frith, 2006), successes (Graven and Venkatakrishnan, 2006) and aspirations for Mathematical Literacy (Bishop and Vithal, 2006) as felt by the various stakeholders affected by the introduction of the new subject. We learn from other countries' experiences that the introduction of a new subject curriculum not only makes greater demand on the teachers, but also demands more from the learners. Learners need to accept a greater share of responsibility for what they learn and how they learn it.

The introduction of Mathematical Literacy in South African schools presents both exciting opportunities and enormous challenges, especially on misconceptions by teachers and other stakeholders, like curriculum developers, about the new subject (Bowie& Frith, 2006:p,5). I developed an interest in investigating learners' perceptions of the Mathematical Literacy in grades 10, 11 and 12 in the FET band. Hence I decided to conduct this small scale research study to investigate the perception of Mathematical Literacy of learners in Grades 10 – 12 in three high schools in Mdantsane Township in the East London District in the Eastern Cape.

1.2 **PROBLEM STATEMENT**

Research that has been conducted on Mathematical Literacy so far has focused mainly on the teachers' voices. For instance, Mavugara-Shava (2005) identified factors experienced by teachers in dealing with the Mathematical Literacy curriculum, focusing on the didactical practices relating to mathematics, while

Mbekwa (2006) investigated teachers' views on Mathematical Literacy. Mthethwa (2007), on the one hand, investigated teachers' views on the role of context in Mathematics Literacy, and Julie (2006) investigated teachers' preferred contexts for Mathematics Literacy and Mathematics for Action. Venkat and Graven (2008) also have concentrated on teachers' perceptions of Mathematical Literacy. As such, there seems to be a gap with regard to the learners' voices. The voices of the learners learning Mathematical Literacy could definitely have implications on the teaching and learning of the subject. Hence this study, as stated earlier, aims to explore the learners' perceptions of Mathematical Literacy in the Further Education and Training (FET) band in three selected high schools in Mdantsane location.

1.3 **RESEARCH QUESTIONS**

This study aimed to investigate or find answer(s) to the following research question:

1.3.1 Main Question

- What are the perceptions of the learners in Grades 10 – 12 in three high schools of Mathematical Literacy?

1.3.2 Sub-questions

In order to find the answers to the main question, answers to the following sub-questions were sought:

- What do learners understand by Mathematical Literacy?
- What are learners' views
  - about learning ML?
  - about comparison between mathematics and M>?
  - on integration of ML with other subjects?
  - on the reasons for doing ML?

- on how ML is taught and learnt?

- on parental support and teacher involvement in ML?

- What are the implications of the learners' views of Mathematical Literacy?

1.4 **PURPOSE OF THE STUDY**

The purpose of the study was to investigate learners' perceptions of the Mathematical Literacy Curriculum in grades 10, 11 and 12 in three selected High Schools. The aim was also to present the findings, descriptions of learners' perceptions, to help students develop the skills and values they will need to function in a free and just society. It also aimed to find out how their perceptions affect their performance in the subject. The study also aimed to reflect on the implications of the learners' perceptions on the teaching and learning of Mathematical Literacy. It was hoped that the study would assist the teachers in teaching the subject.

1.5 **SIGNIFICANCE OF THE STUDY**

The study might help curriculum developers and teachers in planning because they might be able to take cognisance of the learners' perceptions about Mathematical Literacy, while planning and implementing the curriculum in the subject. It might also help learners to have a better understanding of the subject so that they might develop an interest in learning the subject. Knowledge of the challenges could assist the teachers in developing strategies to overcome them.

1.6 SCOPE OF THE STUDY

The research study was limited to selected learners who chose Mathematical Literacy in Grades 10 to 12 in 2011 in three schools. In total I interviewed only 9 learners individually and 18 learners in three focus group interviews. Hence I cannot assume that perceptions of these learners about ML might be representative of the views of the learners across the province and the country. Scope of this work was limited by the time available to the research as well as proximity to schools and constraints of resources.

1.7 DEFINITION OF TERMS

1.7.1 Mathematical Literacy

Mathematical Literacy is a subject driven by life-related applications of Mathematics, which enables learners to develop the ability and confidence to think numerically and spatially in order to interpret and critically analyse everyday situations and to solve problems. (DoE, 2003, p5)

OECD PISA (2003, p.15) defines Mathematical Literacy as:

"an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgements and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen."

1.7.5 **Experiences**

Experiences are knowledge of, or the skill in or observation of an event gained through involvement or exposure to that event (Zuber-Skerrit & Roche, 2004). In the context of this research, experiences refer to the learning experiences of learners with regard to Mathematical Literacy.

1.7.6 **Literacy**

It is a creative activity through which learners can begin to analyse and interpret their own lived experiences, make connections between those of others, and in the process, extend both consciousness and understanding (Walsh, 1991 as cited in Venkat and Graven, 2008).

1.8 LIMITATIONS OF THE STUDY

The study was limited to the selected learners who study Mathematical Literacy in grades 10, 11, and 12 in three schools in Mdantsane. Nine took part in the individual interviews. Eighteen learners were involved in the focus group interviews. Therefore, the findings of this study cannot be generalised as the general view of all learners in South Africa or elsewhere.

1.9 OUTLINE OF THE CHAPTERS

Chapter One: Introduction

This chapter focused on the background to the study, the problem statement, the research questions, the purpose of the study, the significance of the study, and the definition of terms related to the study on learners' perceptions of Mathematical Literacy.

Chapter Two: Literature Review

This chapter provides a literature review and a detailed theoretical framework of the research. There is also a brief focus on issues related to Mathematical Literacy based on learners' perceptions of Mathematical Literacy. Issues discussed, as well, are : Mathematics and Mathematical literacy, integration of Mathematical Literacy with other subjects, language and mathematical education, mathematics, culture and mathematics education, parental attitudes and success in mathematical literacy, learners' perception of teachers' attitude, teaching atmosphere and the success in Mathematical Literacy and the place of theories in Mathematical Literacy.

Chapter Three: Research Methodology

The chapter looks at the research methodology and research design selected for this study. The study employed a qualitative case study approach. Data was collected through interviews, focus group discussions and document analysis.

Chapter Four: Findings and Discussions

This chapter consists of the presentation of data that was gathered, analysis, interpretation and discussion. Data collection techniques to gather information that specifically answers research questions were used. After gathering the information was completed, the data was analysed and a summary of results for each question under investigation was discussed.

Chapter Five: Conclusion and recommendations

This chapter gives the summary of the findings about the research, the conclusions and the recommendations. The findings are based on the research questions that were asked and mentioned in chapter one.

1.10 CONCLUSION

In this chapter the researcher discussed the background to the study and the central problem of the study has been outlined as the investigation into the learners' perceptions of the Mathematical literacy curriculum in the FET band in three selected High Schools. The purpose of the study, the research questions and the scope and limitations of the study were also included. Definitions of the major terms used in the study, such as perceptions, experiences and Mathematical Literacy, and an outline of the research study were also presented.

The next chapter deals with the literature review. In this chapter that the issues related to the learners' perceptions of Mathematical Literacy are addressed. The chapter explores, among other issues, the meaning of mathematical education, together with learning theories in mathematics education.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter gives a detailed theoretical framework and the literature review surrounding the research. The researcher's aim in this study was to investigate how learners perceive Mathematical Literacy and what constitutes their understanding of ML. I also wanted to find out what challenges and advantages do these learners experience with regard to learning Mathematical Literacy. I also wanted to explore what learners thought would make them want to learn Mathematical Literacy. The aim of the study was also to gain a deeper understanding of the way in which factors such as classroom environment, teacher and student attitudes, parental attitudes, gender differences, etc. play a role in how students perceive Mathematical Literacy in the selected high schools. The Literature review also focuses on the role that different theories play in mathematics education.

2.2 THEORETICAL FRAMEWORK

2.2.1 THE PLACE OF THEORIES OF LEARNING IN MATHS EDUCATION

A constructivist perspective has been used in the study to investigate learners' perceptions, their understanding and knowledge of the subject. The way learners perceive ML is shaped by their knowledge and experiences of Mathematical Literacy. Snowman, McCrown and Biehler (2009) pointed out that most constructivist theories take one of the two forms: cognitive constructivism or social constructivism.

Cognitive constructivists emphasize the effect of one's cognitive processes on meaningful learning, while social constructivists emphasize on the effect of sharing other people's arguments and points of view on meaningful learning. According to

social constructivists meaningful learning occurs when people are explicitly taught how to use the psychological tools of their culture (e.g. language, mathematics) and to use these tools in real-life activities.

Orton and Wain (1991) as cited in Mavungara-Shava (2005) discuss the place of learning theories in supporting and enlightening the process of learning Mathematics. They point out that, due to the complexity of the nature of human abilities, general theories of learning cannot be ignored. They further posit that, among other things, learning theories enable educators to explain what they see in their schools and take appropriate actions. From what Orton and Wain (in Mavugara-Shave, 2005) are propounding, it can be deduced that specializations in learning seem to have a fertile yield when they are informed by a sound framework of learning theories.

In South Africa as in most parts of the world, mathematics education has also undergone reforms. Mathematics, as a subject, is seen as the "construction of knowledge that deals with qualitative and quantitative relationships of space and time" and has both utilitarian and intrinsic value (South Africa, DoE, 1997: p.1a) as reported in Mavungara-Shava (2005). Here, he further explains that mathematics is viewed as a "human activity that involves observing, representing and investigating patterns and quantitative relationships in physical and social phenomena and between Mathematical objects themselves" (South Africa, DoE, 2002). Nelson, Joseph, and Williams (1993) as cited in Mavungara-Shava, (2005) suggest a multicultural approach to the teaching of maths in their book, thus pointing to the relationship between mathematics and culture, which itself, is a sociological aspect.

2.2.2 THE PLACE OF LEARNING THEORIES IN MATHEMATICS EDUCATION AND LANGUAGE

One of Vygotsky's main contributions has been in helping us understand how language (including oral and written language, mathematical "language" and other symbolic systems, develops as a tool of cognitive development (Lolwana,1997). Because language contains many of the cumulative meanings (social constructions) of any community of people, it is a very powerful vehicle, or carrier, of values, information, and ways of understanding. Lolwana (1997) further says, in short, language is both a carrier of understanding and a means for its development. This process occurs both horizontally (across people and in groups, communities, and cultures), as well as vertically (in the process of individual cognitive development).

With regards to the vertical process, Vygotsky shows, for instance, how developing inner speech is a key process in early cognitive development. Briefly, children begin with talking aloud in order to organize their actions, perceptions, and experiences. Vygotsky (1978) views learning as a social process where language plays an important role in mediated cognitive growth.

In socio-constructivist learning theory, emphasis is on interactions rather than actions themselves. Vygotsky, as well as Piaget, examined how children acquire language. Vygotsky placed greater emphasis on the child's interaction with the social environment, whereas Piaget visualised the young child as a natural scientist, experimenting with the environment.

.2.3 THE ROLE OF SOCIAL INTERACTION IN MATHEMATIC EDUCATION AND HE INFLUENCE OF THEORIES

Schoenfeld (1978) points out that maths education places emphasis on learners' ability to use and apply maths knowledge, for problem solving within and outside the school setting. Thus, solving of problems of maths in the real world, particularly problems that are relevant to the lives and the social environment of learners, indicate meaningful knowledge of learners.

Pea (1987) perceives social environments as fertile grounds for discussing, reflecting upon and establishing maths thinking. He further states that recognising and encouraging maths as a social activity in the world would not only be beneficial and more realistic, but would also make maths more enjoyable, sharable rather than sufferable. According to Piaget, as suggested by Higgs et al (2000), during intellectual development, learners engage in more abstract thinking. Thus, they may be able to think about 'if – then' situations which involve abstract relationships.

The secondary and high schools fall in the concrete operation and formal operational stage, more especially the formal operational stage. Since the formal operational stage is characterised by abstract thought operations, learners are able to formulate theories, generate and test various hypotheses. Students move between a concrete operational stage and a formal operational stage when confronted with new concepts, skills and principles.

Piaget's developmental stage indicates that knowledge of mathematics is social and physical as well as logical. Learners therefore construct their own knowledge

through interaction with the environment in a cognitive structured way. The capacity for formal operational thinking does not mean that learners cease to need concrete examples and illustrations to help them understand abstract relationships. This is often overlooked in both secondary and tertiary education (Higgs et al., 2000).

While Piaget is concerned mainly with how cognitive development takes place form 'the inside out', Vygotsky is more concerned with how it happens from 'the outside in' (Moll, 1989 in Higgs et al, 2000). According to Vygotsky's theory, development takes place through social relationships.

Socio-constructivist learning theory advocates that learners master new approaches to learning through interacting with others (Doise, 1990). This theory is an extension of Piaget's theory that focused on the reasons for cognitive development in individuals. Vygotsky's approach to cognitive development, as 'social constructivism', works on the assumption that action is mediated and cannot be separated from the milieu in which it is carried out (Wertsch, 1991).

Lave and Wenger (1991) view learning as an aspect of participation in communities of practice, which increases gradually in engagement and complexity. This is supported by Lesh and Doer (2003) that the conceptual development of an individual does not occur in a vacuum. Students are part of learning communities, and the shared constructs and social norms of these communities strongly influence the conceptual development of individuals.

Vygotsky sees the child as needing assistance at a critical point; and refers to the range of skills that a child can exercise with assistance but cannot perform independently as the zone of proximal development (ZPD). According to the zone of

proximal development where the learner may not quite understand something on her own, s/he has the potential to do so through interaction with another person who does have the capacity. Helping students answer difficult questions or solve problems by giving them hints or asking leading questions is an example of a technique called "scaffolding." Just as construction workers use external scaffolding to support their building efforts, Vygotsky recommended that teachers similarly support learning in its early phases.

Vygotsky (1987) insists on the centrality of the construction of knowledge. In his view, peer interaction, scaffolding, and modelling are important ways to facilitate individual cognitive growth and knowledge acquisition. This means that through such support, or scaffolding, the child is enabled to reach a new level of competency, which she or he could not have attained alone.

The purpose of scaffolding is to help students acquire knowledge and skills they would not have learned on their own (Snowman et al, 2009; Durkin and Shire, 1991). A critical component is the concept of proximal learning, based on the work of Vygotsky (1978), which posits that learning takes place by the learner completing tasks for which support (scaffolding) is initially required. For Vygotsky, individual conscious awareness is an internalized outcome of activity in a social context. He asserts that individual cognitive structures are actually formed through social interaction, and development constitutes a move from an inter-psychological to an intra-psychological plane.

Experiences of success in the maths class strengthen the learners' belief in their own ability to do maths (Bandura,1994). He further claims that creating situations for success in an attempt to build self-efficacy in maths can create a sustained feeling of efficacy (Bandura, 1994).

2.2.3.1 The role of self-perception in motivation

Researchers have consistently found a moderately positive relationship between measures of self-esteem and school achievement. Students who have a positive self-concept tend to be intrinsically motivated, have a high level of curiosity, are interested in schoolwork, and prefer moderately challenging tasks.

Learners who take mathematics as their favourite subject may have mathematical self-concept and those who judge themselves and pretty smart in mathematics have self-esteem. Self-concept, self-esteem and self-efficacy are types of self-perception (Bandura, 1996). Self-esteem seems to decline when students move from elementary grades to middle school and from middle school to high school. Learners may not be motivated to do a complex task as much as they are motivated to learn Mathematical Literacy. Motivation may vary in both intensity and direction which are difficult to separate. The intensity of motivation to engage in one activity may depend in large part on the intensity and direction of motivation to engage in alternative activities Higgs et al,(2000)

Learners may present different problems, e.g. not doing projects, not showing interest in a task, not having learning material, may do tasks but do not follow the correct procedures to do a particular task, some work hard to achieve high marks,

yet the teacher has to teach the entire class. The vision for education that emerged was to integrate education and training into a system of lifelong learning.

Many critiques, such as that of Kilpatrick, Swafford and Findell (2001) have argued for a more literate agenda within mathematics, in order to facilitate flexible conceptual understanding and the willingness to make sense of situations alongside procedural fluency. On the other hand, The (NCTM 2000) Learning Principle stresses the importance of "conceptual understanding in becoming proficient in a subject."Furthermore, it is also mentioned that students must function beyond the procedural level or they will not attain the "flexible knowledge" that can be applied to a variety of situations. In order to increase conceptual understanding, teachers are encouraged to have students gain proficiency in the planning of a solution to a problem.

Research shows that one of the major factors influencing students' motivation is how they explain their successes and failures. There are four explanations that students commonly give for their academic successes and failures: ability, effort, task difficulty, and luck. In one study done by Posamentier and Jaye (2006: p, 279), junior high school students completed a questionnaire on their beliefs about mathematics achievement.

The questionnaire was completed both before and after a mathematics exam. The results showed that girls tend to attribute failure in mathematics to low ability and bad luck and they tend to attribute success in mathematics to high ability. Also, girls were more likely than boys to hide their papers after failure and to have less pride in

their successes. These results lead to the conclusion that how students explain their successes and failures in mathematics may also depend upon the students' gender.

Teaches should help students in general, and girls in particular, to realize that they have the ability to control their own academic destiny, and that the specific efforts they make, or don't make, lead to specific outcomes (Posamentier and Jaye, 2006).

Changes in self-perception are best made by helping students become more effective learners than by constantly telling them they should feel good about themselves. Learning how to use the cognitive skills that result in meaningful learning takes time because of the complexity and the doubts that learners will have about their ability to master these skills.

2.2.3.2 **Self-efficacy**

Of all the thoughts that affect human functioning and standing at the very core of social cognitive theory, are self-efficacy beliefs. Self-efficacy refers to how capable or prepared we believe we are to handle particular kinds of tasks we have to perform (Bandura, 1997, 2001, 2002 in Snowman et al., (2009). For example, a student may have a high level of self-efficacy for mathematical reasoning – a feeling that s/he can master any maths task s/he might encounter in a particular course-but have a low level of self-efficacy for critical analysis of English literature. Students with the same level of mathematical skill may, for example, have different attitudes about mathematics and perform differently on tests of mathematical problem solving because of differences in their self-efficacy beliefs (Bandura, 2001; Martin, 2004) in Snowman et al. 2009).

2.2.3.3 **Beliefs about Self-efficacy**

This concept is an important aspect of Bandura's theory and refers to our beliefs about personal competence in a given area (Higgs et al., 2000). Clearly, our expectations for succeeding or failing at a particular task will be influenced by our sense of self-efficacy in that area. Sense of self-efficacy affects our motivation through goal setting, influencing the goals we will attempt to reach and our persistence. If we have a high sense of efficacy in a given area, we will set high goals and persist when we encounter difficulties. If our sense of efficacy is low, however, we may avoid a task altogether or give up easily when problems arise (Bandura, 1993); Zimmerman, Bandura & Martinez-Pons, 1992 in Higgs et al. 2000). Self-efficacy beliefs provide the foundation for human motivation, well-being and personal accomplishment. This is because unless people believe that their actions produce the outcomes they desire, they have little incentive to act or to persevere in the face of difficulties. (Bandura 1986)

The NCTM (2000) Equity Principle states, "Excellence in mathematics education requires equity-high expectations and strong support for ALL students." In order to achieve, students should be supported by providing an approach that will be most effective for the student's particular learning style and providing feedback that is useful to the student. The "formative assessment" should enable students to perform an error analysis to determine precisely why they obtained the wrong answer. In addition, this feedback should help students find the correct solution by pointing them toward similar problems that have been solved correctly.

2.3 THEORETICAL FRAMEWORK

2.3.1 MATHEMATICAL LITERACY

Different definitions of Mathematical Literacy (South Africa, DoE, 2003: p,9 & PISA, 2003) are mentioned and there seems to be an interrelatedness among them to give a somewhat clear picture of the meaning of the term. From the definitions one can deduce that, in Mathematical Literacy, there are some competencies, perceptions and beliefs and patterns of thinking rooted in relation to world contexts and cultural feelings. Mbekwa (2006) also maintains that all definitions of Mathematical Literacy provided in the literature highlight the functional dimension of mathematics by focusing on its applications in the lives of citizens.

Mbekwa (2006) reports that when learners [illegible] the content, what would create their perceptions of it is their experience in the subject (Mathematical Literacy in this case), learning material, IQ, gender (Shaffield, 1999), socio- economic background, learning styles (NCTM, 2000), the level of knowledge of the teacher, different characteristics of the learner and the way they experience the curriculum (Schulman,1992). Factors pointed out here, together with other expectations in modern society, urge that instruction in mathematics must focus on training learners to be mathematically literate; learners whose mathematics is meaningfully integrated into real-life contexts NCTM (2000).

Mthethwa (2007) mentions teachers' views about Mathematical Literacy and the challenges they faced in the teaching of the subject. One of the main challenges was learners' negative attitude toward Mathematical Literacy because of lack of understanding about the subject. Another aspect is under- achievement in the

subject due to poor participation. Another aspect is lack of motivation to do the subject.

According to Mbekwa (2006) when teachers were trained in Mathematical Literacy, they expected the subject to be a watered-down version or easy Mathematics. Some teachers viewed it as Mathematics with applications in everyday life, whilst others perceived the course content to be "difficult". Other teachers had the view that engaging themselves with Mathematical Literacy would enable them to teach Mathematics, in other words, they had the perceptions that Mathematical Literacy prepares them to teach Mathematics (Mbekwa, 2006).

Graven and Venkatakrishnan (2006) in sharing some anecdotes (real-life stories) in the form of quotes from teachers and stu[illegible] their perceptions of the subject reported that teachers had the perception that Mathematical Literacy was meant for those learners who have failed Mathematics. They went on to report that students had explained that their families' perceptions of them and their roles in relation to their families (especially in relation to dealing with finances) changed as a result of the introduction of the subject.

Verster (2011) gave a short background of some of the issues affecting learner participation and performance in Mathematical Literacy. They included, namely, negative parent and learner perceptions, assessment, diverse multilingual and multicultural settings as well as report on the difficult journey through technology in the quest to establish an online ecology of learning for ML teachers.

Madongo (2007) investigated perceptions of the notion of Mathematical Literacy as a competence and as a subject. The study is a result of the foregoing trends in the academic conversation regarding the concept of 'Mathematical literacy' and its relatives, and seeks to further explore the nature of this concept through an evaluation of mathematics and mathematical literacy student teachers' perceptions and views about what it really means to be 'mathematically literate' and why they think a person should be 'Mathematical Literate' in this modern society.

Bishop and Vithal (2006) describe ML as a "hot topic" with various authors debating the use of the term "Mathematical Literacy" as well as what it actually means in different countries including South Africa (Christiansen 2006; Venkatakrishnan and Graven 2006; Brown and Schafer 2006; Bowie and Frith 2006; and Mbekwa, 2006).

Vithal and Bishop further ask what are the implications for the learners and how can learners be empowered to bring their unique perspectives from home and from their community and society into any mathematical classroom activity. They further mention that there are a number of different forces that have led to a strong concern about the quality of the mathematical knowledge, skills, values and attitudes of learners in the last few decades. That is, not only a concern about those expected to continue in further studies and the professions related to mathematics, science, technology and economics but also the mathematical competence of the general school population. These questions often revolve around how mathematically literate learners are and its importance for how they will enact their citizenry in a rapidly advancing scientific and technological world once they leave school.

Different researchers investigated on Mathematical Literacy. Mbekwa (2004) investigated on how teachers perceive Mathematical Literacy and their reflections as students of Mathematical Literacy. Mbekwa and Julie (2005) investigated on the context, the learning material in other areas, teachers' view on Mathematical Literacy and on their experiences as students of the course. As I have mentioned earlier,I, identified a gap in literature that requires an investigation into learners' perceptions of Mathematical Literacy in the FET band and hence the research.

In order to find out about learners' perceptions of Mathematical Literacy and their experience of the subject, I will briefly present some views on Mathematics and Mathematical Literacy and related issues.

2.3.2 MATHEMATICS AND MATHEMATICAL LITERACY

Mathematics (Maths) and Mathematical Literacy are different subjects. They both deal with numbers and other mathematical knowledge and skills and are, as a result, quite obviously interrelated, but because they serve distinctly different purposes, they must necessarily be different in kind (Brombacher, 2007). In Mathematical Literacy real life contexts are more important and are more emphasized than in Mathematics.

The Department of Education also emphasizes the importance of 'contexts' in developing mathematical literacy in learners, and argues that this can be achieved through engaging learners in situations of a mathematical nature experienced in their lives DoE (2003). Madison (2006) and Steen (1999) also shared similar views on the

importance of "contextualised mathematics" in the development of mathematical literacy.

In theory, the learning outcomes represent sound mathematical pedagogy. Bohlmann (2006) claims that, for the contexts to be used effectively in practice. They need to be available (with implications for resources in the school and home) and accessible (with implications for learners' reading levels). Learners need to access information and understand the context and content before they can even begin to apply any of the Mathematical skills they have learnt.

The idea that Mathematical Literacy is mainly concerned with Mathematics used in context is fundamental to all the definitions of Mathematical Literacy, whether it is seen as a social practice, form of literacy, a critical approach, or behaviour (Bowie and Frith, 2006, p.2). This is supported by Mbekwa (2006) who claims that one can view Mathematical Literacy as mathematics with concrete and practical value in day-to-day existence. Mathematics focuses on climbing the ladder of abstraction while quantitative literacy (as ML is called in the United States) clings to context (Bowie and Frith, 2006).

Expectations of numeracy have risen at least as fast as have the demands for literacy. Daily news is filled with statistics and graphs, with dates and percentages. From home finance to sports, from tax policy to state lotteries, and from health insurance to new drug approvals, citizens are bombarded with information expressed in numbers, rates and percentages (Thomas, Shaw and Irvine, 2004). This view is also expressed by Steen (2001) that nothing we use on a daily basis – houses,

automobiles, bicycles, furniture, not to mention cell phones, computers, and Palm Pilots – would be possible without mathematics. Neither would our economy nor our democracy; national defence, social security, disaster relief, as well as political campaigns and voting, all depend on Mathematical models and quantitative habits of mind. Steen (2001) reinforces the idea that quantitative literacy practice, unlike mathematics, is always embedded within a

context. Therefore, the practice in many mathematics classrooms in South Africa should engage with content in relevant contexts.

Steen (1997) also says that to be Mathematically Literate, individuals need all competences, namely, mathematical thinking and reasoning, and mathematical knowledge. This is supported by Bro[illegible] (2007) who says that being Mathematically Literate is to be able to engage with, make sense of and act with confidence with regard to (South Africa, DoE, 2003: p,9) the numerically based information that characterises the world in which we live. Steen in Edge (2001) differentiated between numeracy and mathematics with a clear implication that teachers require numeracy as well as mathematical knowledge. For Steen, elements of numeracy include cultural appreciation, mathematics in context and number symbol sense. This means that Mathematical Literacy is social because its contents depend on a particular social context.

Edge, Kilpatrick, Swafford and Findel (2001: p, 116) use the word 'proficiency' to mean

"... phrases that have all been used to describe in some way an individual's capacity to function mathematically at some competent level in a particular society or culture."

They developed five strands of mathematical proficiency, namely, conceptual understanding, procedural understanding, strategic competence, adaptive reasoning and productive disposition, which are intertwined, to help boost students' confidence in mathematics and be able to reason to overcome their fears. These strands should be included in the learning and teaching to help learners develop and demonstrate mathematical proficiency (Kilpatrick, 2001). According to Kilpatrick (2001: p,116) conceptual understanding refers to "an integrated and functional grasp of mathematical ideas, meaning bringing isolated facts, methods and organize them into a whole." The learner must have the will to understand and remember methods learned and relate them in appropriate ways so as to gain confidence.

Suh (2007) says, "having a chance to make [redacted] of their understanding individually helps students to feel confidence about their understanding if they share their ideas with a partner or class." Conceptual understanding frequently results in students having less to learn because they can see the deeper similarities between superficially unrelated situations and learn to avoid critical errors in solving problems.

Kilpatrick (2001, p.124) further explains procedural fluency as knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately and efficiently. Procedural fluency is needed to support conceptual understanding of place value and the meaning of rational numbers. It also supports the analysis of similarities and differences between methods of calculating, such as addition, to written procedures, mental methods for finding certain sums, differences, products, quotients, and effective use of computers or manipulative materials such as blocks and beads. When doing calculations such

as addition, subtraction, multiplication and division, learners will do these if they follow the correct procedures to solve problems that include these calculations if they reason efficiently and this will help them maintain fluency.

2.3.3 MATHEMATICAL COMPETENCE

Strategic competence, which Kilpatrick (2001: p, 125) refers to as, "the ability to formulate mathematical problems, represent them and solve them," can be improved by means of using it in collaboration with models. He further says, "becoming strategically competent involves an avoidance of 'number grabbing' methods." Students need to formulate the problem and use mathematics to solve it even in real life situations when they come upon every situation that involves maths problems and, by so doing, they practice and gain experience and become proficient problem solvers.

Kilpatrick (2001: p, 129) refers to adaptive reasoning "as the capacity to think logically about the relationship among concepts and situations and be able to think and explain mathematics concepts." Through adaptive reasoning, learners reason about numbers and their properties and assess their conceptual understanding.

Productive disposition according to Kilpatrick (2001: p,131) refers "...to the tendency to see sense in mathematics, to perceive it as both useful and worthwhile, to believe that steady effort in mathematics pay off, and to see oneself as an effective learner and doer of mathematics".

Reasoning and conceptualizing about Mathematics is vital if learners are to progress toward Mathematics. Learners will use their contextual knowledge and Mathematics skills such as reading and interpreting tables of financial information in situations where they will work.

In order to promote and develop geometric reasoning van Hiele (1988: p, 24) (in Schoenfeld (1987) put forward a hierarchy of levels of thinking from the ages of about five years through to academic adults. The levels, with examples, help to clarify the differences that are seen to characterize children's spatial learning as they move from one level to another as follows:

First Level: Gestalt recognition of figures. Students recognize entities such as squares and triangles, but they recognize them as wholes, they do not identify the properties or determining characteristics of those figures.

Second Level: Analysis of individual figures. Students are capable of defining objects by their properties. (e.g. 'a rhombus is a four-sided figure in which all four sides are the same length') but do not see a relationship between classes of objects (e.g. 'a square is a rhombus with a right angle.')

Third Level: Analysis of relations. Students can conclude (for example) that every square is a rhombus, because of the properties of squares (e.g. 'all sides are equal, and a quadrilateral with four sides is a rhombus). However, they have not attained sequences of statements to justify observations.

Fourth Level: Deductive competence, the goal state of the 10th grade geometry. If asked to prove, for example, that the inscribed angle subtending a given arc of a circle has a measure half that of the central angle subtending the same arc, the

student can do so by producing a series of statements that logically justify the conclusion as a consequence of the 'givens'.

Fifth level: Understanding of axiomatic (rarely achieved). Students appreciate the role of axioms and the role of logic in deductive systems.

As this description indicates, the levels move from

- The visual
- To the descriptive and analytic
- To the abstract/rational
- To formal deduction and, finally,
- To a level characterized as Mathematical and involving rigour.

Pupils should be able to recognize when to apply mathematical reasoning to understand information in newspapers and other print media, and to help in decision making with regard to personal investments and major financial options. Proficiency in Mathematics should, therefore, enable children or learners to cope with the mathematical challenges of daily life and to continue their study of Mathematics in high school and beyond. (Steen, 2001, Madison, 2006, Kilpatrick, 2001: p,133).

According to Madison (2006) characterization of quantitative reasoning in relation to mathematics, from his perspective, is carried out in real-life, authentic situations its application is in the particular situation, one dependent upon context, including socio-politics. The problems are ill defined, estimation is crucial, and an interdisciplinary approach is often needed. Madison's table below illustrates this:

Mathematics	Quantitative Reasoning
Power in abstraction	Real, authentic contexts
Power in generality	Specific, particular applications
Some context dependency	Heavy context dependency
Society independent	Society dependent
Apolitical	Political
Methods and Algorithms	Ad hoc methods
Well-defined problems	Ill-defined problems
Approximation	Estimation is critical
Heavily disciplinary	Interdisciplinary
Problem solutions	Problem descriptions
Few opportunities to practice outside the classroom	Many practice opportunities outside the classroom
Predictable	Unpredictable

For professional mathematicians, engineers, physicians and economists (among others), Mathematics provides the tool for their trade. They use Mathematics to develop complex mathematical models, as well as using mathematics itself. Models and mathematics enable them to solve problems that are mathematical and/or applied in nature. For professional users of mathematics the priority is to use sophisticated mathematics in complex settings which require a deep understanding of the structure of the mathematics they are using. Mathematical Literacy people use Mathematics and mathematic artefacts to make sense of the world. For these people the priority should be to interpret and to act on the day-to-day contexts that define their lives and the world in which they live.

Madison (2006) further argues that teaching and learning for quantitative literacy (or mathematical literacy) requires a different approach to both the curriculum and pedagogy, and this should involve bringing together Quantitative Literacy and formal mathematics through more contextual teaching. He says that mathematics alone cannot teach quantitative literacy. Changes should include integration of quantitative literacy concepts across the curriculum by other disciplines.

In order to make sense of, to participate in and to contribute to the world in which they live, Mathematical Literacy people use more elementary mathematics with confidence in a wide range of activities, [illegible]athematics is used in different subjects. DoE(2003) maintains that Mathematical Literacy enables learners to develop the ability and confidence to think numerically and spatially in order to interpret and critically analyse everyday situations and to solve problems.

2.3.4 Confidence

Ford (2008) mentions that in order to develop confidence in Mathematics, as mentioned by DoE (2003) and Steen (2001), is to provide the opportunity to use Mathematics in a real context. On the one hand, NCTM (2000) has emphasised affective issues, setting two of its major goals as (a) helping learners to understand the value of mathematics and (b) developing the confidence of learners in mathematics. On the other hand, Renga and Dalla(1993) maintain that learners base

their confidence in themselves on the way that teachers perceive them and try to find their various experiences and the feedback that they get to suit this perception.

Teachers need to help learners develop confidence in their maths ability. According to Renga and Dalla (1993), self- confidence in Mathematics leads to the development of Mathematical understanding. Kilpatrick (2001) supports this by mentioning that when students have acquired conceptual understanding in an area of mathematics, they see the connection among concepts and procedures and can give arguments to explain why some facts are consequences of others. They gain confidence, which then provides a base from which they can move on to another level of understanding. Improving Mathematical Literacy requires a learning environment that stimulates students cognitively as well as allowing them to collect practical experiences through connections to the real world (Jablonka, 2003); Brombacher, 2007: p,5). In order to achieve this, students should be confronted with many different facets of reality.

Students should be given an opportunity to participate in carrying out experiments, to be exposed to verbal argumentative discussions and to be involved in model-building activities. Research shows that scientific activities and their connection with reality lead to well-based discussions (Jablonka, 2003). This leads to the idea of integrating science and other subjects into mathematics and Mathematical Literacy education.

2.4 THE INTEGRATION OF MATHEMATICAL LITERACY WITH OTHER SUBJECTS

The South African curriculum stresses that integration across subjects is very important. As seen in most of the NCS documents, "Integration is achieved within and across subjects and fields of learning. The integration of knowledge and skills across subjects and terrains of practice is crucial for achieving applied competence (South Africa, DoE 2003).

According to Pellegrini and Blatchford (2000), ".... competence begins with repeated experiences in individual settings, and expands by interacting with different people and different materials. The ability to transfer competence to different contexts resides in the ability of participants to find [illegible]ties in the activity rules governing mathematics in different contexts. They further suggest that teachers must understand the competence that children come to school with if they are to learn mathematics. Pellegrini and Blatchford (2000) and Parker (1990) support this by arguing that brain research has shown again and again that retention of information requires context. This means for the learner to understand the concept of the topic to be taught, the learner needs to link the topic to a context that the learner knows so that he can be able to remember and not forget the concept again, and also have a mental picture and make connections of facts and skills.

The type of learning that can be achieved in Mathematical Literacy can be considerably strengthened through integration. If the design of curricula purposefully create spaces for integration, then it will be more feasible for classroom teachers to act on this. For example, if in the Life Orientation and Mathematical Literacy

curriculum understanding and managing personal finances was seen as a crucial skill to develop, then an extremely beneficial integrated learning experience could be developed (Bowie and Frith, 2006: p.5).

Steen (2001) and Madison (2004) argue that because quantitative literacy is everywhere, there are good opportunities to teach it across the curriculum. This argument suggests that Quantitative Literacy is a competency that can be achieved through contextual teaching of mathematics in an integrated manner, and not as a separate subject of study.

As suggested by Steen (2001):

> During the last half-century, as mathematics in school grew from an elite to a mass subject, mathematics education expand[illegible]tfolio of mathematical sciences that now include, in addition to traditional pure and applied mathematics, subjects such as statistics, financial mathematics, theoretical computer science, operations research and more recently, financial mathematics and bioinformatics.

Schoenfeld (1990) also claims that in the best of all possible worlds, instruction in all subject matters should touch on quantitative literacy whenever appropriate. Patterns of sense-making in science are often heavily quantitative, likewise in the social sciences. The study of history has been transformed though economic (i.e. quantitative) analysis.

2.5 **LANGUAGE AND MATHEMATICAL EDUCATION**

Mathematic education begins and proceeds in language and its role in mathematics is crucial. It is important to bear in mind that language itself is something which children are learning, and which presents enormous challenges in its own right.

Hence, in learning about numbers and mathematics through speech, children are faced simultaneously with demanding tasks in different areas (Durkin and Shire 1995).

Mathematics depends on verbal skills and contains items that have linguistic, cognitive and contextual dimensions (Gibbs and Orton, 1994); Madison, 2006). The linguistic dimension involves both the receptive level (e.g. reading) and the productive level (e.g. writing, discussing). This is supported by the DoE (2002) when saying that without well-developed reading and language skills, learners will not be able to "develop mathematical thinking skills such as generalising, explaining, describing, observing, inferring, specializing, creating, justifying, representing, refuting and predicting."

The cognitive dimension reflects the level of complexity of the concepts and cognitive skills such as logical reasoning, critical analysis and interpretation of abstract concepts. The contextual dimension reflects the level of contextual support provided. Difficulty with any of these aspects has serious implications for studying mathematics.

Madison (2006) further says that schools need to teach English and mathematics, and separately at times, but then they also need to help students combine their research, mathematics, logic, reading and writing skills in various contexts – be it in a physics, chemistry, or biology laboratory or in a history, social studies, or economic class. In short, he argues that schools must not only teach mathematics; they must also provide opportunities to practice quantitative reasoning (Madison, 2006).

The conceptual complexity and problem-solving nature of mathematics makes extensive demand on the reasoning, interpretive and strategic skills of learners, especially when these activities are done in a language that is not their primary

language. Many of the studies have investigated the role of language in mathematics, such as that of Ellerton, Clarkson and Clements (2000) and they all show that poorly developed language skills undermine mathematical performance.

One of the principal functions of language is to transmit meaning and one of the principal problems of language in mathematics is that the meanings to be conveyed are often complex, and the words we use to convey them are often endowed with other meanings, meanings which maybe more familiar to children in everyday language.

Cooper (2000) as cited in Mavugara-Shava (2005) sees Mathematical Literacy as referring to education in Mathematics itself and also sees it as referring to "familiarity with Mathematical language and to [illegible]intance with fundamentals of Mathematics." In other words, Cooper sees Mathematical Literacy as the attainment of education in Mathematics, which in turn, enables one to be knowledgeable and conversant with its fundamental skills, concepts and language. Language influences students' thought by moulding perception and structuring ideas.

Language plays an important role in communication and thinking and is a tool for exchanging ideas and concepts between individuals (Mbekwa, 2006). This is supported by Osborne, Bell and Gilbert (1983) who claim that students use language to communicate and to understand mathematics facts, concepts, principles, and problem solving. However, this knowledge and these skills are new, unfamiliar and different form the language used in everyday life. This, therefore, means that mathematical knowledge and skills can only be delivered through language.

2.6 MATHEMATICS, CULTURE AND MATHEMATICS EDUCATION

Professional discourse and literature relating to culture, Mathematics and Mathematics education can be characterised by the domains of culture and Mathematics, culture and Mathematics education, and the effects of culture on mathematics achievement.

Mathematics learning in cultures focuses on the importance of using culturally specific contexts in teaching and learning Mathematics including:

- using relevant examples from the student's own culture; and
- exposing students to a variety of cultural contexts (multiculturalism).

According to Bush (2003) examples in the first category include making mathematics curricula more accessible to different cultu[illegible]e examples in the second include using multicultural children's literature to teach mathematics and integrating ethno-mathematics principles in middle and elementary classrooms. NCTM (2000) refers to ethno-mathematics as "forms of mathematics that vary as a consequence of being embedded in cultural activities whose purpose is other than "doing Mathematics." This means therefore, that students are very much aware of social and cultural issues in a school community and that much mathematical knowledge is acquired outside school.

Jablonka (2003) highlights the fundamentally situated nature of the concept of Mathematical Literacy, and she argues that Mathematical Literacy is linked to social and cultural practices. This is in regards to the different meanings or definitions of the terms relating to Mathematical Literacy.

2.7 GENDER DIFFERENCES IN COGNITION AND ACHIEVEMENT

Students' academic performance is strongly influenced by their cognitive, social, emotional and gender characteristics (Snowman, McCrown and Biehler 2009). A large body of research shows that there are reliable gender differences in cognitive functioning and achievement. In some tests, boys outscore girls, and, on other tests, girls have the upper hand (Halpern and LaMay, (2000); Marsh and Yeung 1998; Keller and Eccles, (2002) as reported in Snowman et al (2009). Generally, research on gender differences has found that males tend to outscore females on visual-spatial ability, mathematical reasoning and college entrance (Snowman et al., 2009). The NCTM equity principle also states that teachers must make conscious efforts to ensure that female and male students are treated equally NCTM (2000).

Shaffield (1999) mentions that one of the main reasons girls do not succeed in mathematics is not through any lack of ability or effort – it is simply that they are not expected to. He further says that stereotypes influence perceptions and performance in school and in life, and they are often cited as contributing heavily to girls' shortcomings in schools. Unfortunately, mathematics is often thought of as a field for men and our society's traditional images of scientists, engineers, and mathematicians are almost always men.

Evidence exists that girls are regarded as less capable in mathematics by some of their teachers and parents. The views of the teacher, peers and society in general affect the way that male and female learners see themselves as learners of mathematics. There is also a perception that if parents were not good at

mathematics, then their children will not be either. Parents are often instrumental in reinforcing the beliefs that their children hold about mathematics.

2.8 PARENTAL ATTITUDE AND THE SUCCESS IN MATHEMATICAL LITERACY AND MATHEMATICS EDUCATION

A correlation between parental attitudes and success in Mathematical Literacy is a crucial step in forming a partnership that can help shape positive attitudes and student success in Mathematical Literacy and mathematics education. Posamentier and Jaye (2006) as well as Zaslavysky (1999) say that parents exert a more powerful and more direct effect than teachers on children's attitudes towards mathematics. Parents' gender-stereotyped [illegible] are a key cause of sex differences in students' attitudes towards mathematics. This means, therefore, that parents can drive their children in the wrong direction.

Zaslavysky (1999) further says parents may believe that women's careers do not require knowledge of mathematics, while mothers tend to consider maths difficult for their daughters. They discouraged them from taking advanced courses and this may encourage learners to develop a trait that psychologists call "learned helplessness." Other studies also found that students' attitudes towards mathematics and the decisions to continue with Mathematics were linked to their parents' conceptions of the educational goals of school mathematics and the perceived relevance to their children's long-term life goals. Mbekwa (2006), Mthethwa (2007).

2.9 LEARNERS' PERCEPTIONS OF ML CONTEXTS

Learners' perceptions can be deduced from the way they relate their everyday contexts in Mathematical Literacy. These are examples of contexts used in Mathematical Literacy as mentioned by Mthethwa (2007)

- Health-contexts that deal with HIV/AIDS issues and Body Mass Index (BMI).
- Finance-contexts that deal with banking related issues such as accounts, investments, loans, interest (simple and compound).
- Contexts that deal with marketing related issues such as income and expenditure, selling price, profit and breaking even.
- Contexts that deal with budgeting, municipality tariffs -water, electricity and sewerage costs. (Monthly charges).
- Transport and communications-cont[illegible]at deal with telephone cards and cell phones.
- Contexts that deal with mailing (ordinary and fast mail envelope sizes and postcards.
- Sport – entrance tickets.
- Mathematics- contexts that deal with mathematic content like linear equations and algebraic graphs.
- Contexts that deal with baking and cooking.

This is also mentioned by Zaslavsky (1999) when she argues that using mathematics on the job or as preparation for a career is only one aspect of the influence of mathematics on the way we live. As claimed by her in *Everybody Counts*, the ideas of mathematics affect us on many different levels. Some of them include:

- Practical-figuring unit prices in the supermarket, understanding the effects of inflation, balancing a bank account, helping kids with their homework.

- Civic-understanding such public policy issues as tax rates, the education budget, health care, preserving the environment, and the effect of racism, sexism, and other forms of discrimination. A graph or a table in a newspaper article often tells us as much in a short space as a whole column of text.

- Professional-applied to fields ranging from business management and health care to machinist and physicians. Scientists and economists use mathematics to investigate and hopefully solve the severe problems that confront the world, among them global warming, AIDS, [illegible] disposal, and war. Mathematical knowledge helps to analyse data and make informed decisions about important issues.

- Leisure-games of changes and games of strategy, puzzles, and predictions and analysis of sports events.

- Cultural-"the role of mathematics as a major intellectual tradition, as a subject appreciated as much for its beauty as for its power. Like language, religion, and music, mathematics as a universal part of human culture."

2.10 LEARNERS' PERCEPTIONS ON TEACHERS' ATTITUDE, TEACHING ATMOSPHERE AND SUCCESS IN MATHEMATICAL LITERACY

Perceptions in the context of research refer to the teachers' perceptions of Mathematical Literacy teaching and what thoughts and personal opinions they have about Mathematical Literacy teaching. This perception, consequently, influences their teaching behaviours. Throughout the teaching process of developing learners' ability and beliefs to learn Mathematical Literacy, teachers have a very important role to play. It is in their capacity as teachers that they play an important role in cultivating the love for and interest in Mathematical Literacy in learners.

The teachers' passion for the subject, which is naturally expressed through their methodology and approaches, has the power to influence the learners' interest and perceptions to life. Needless to say, it is up to the teacher to create and promote a positive environment and learning attitude for students to feel comfortable with learning Mathematical Literacy and not to feel scared and intimidated by the complexity of the text chosen.

Teaching atmosphere refers to the mood and flow of the classroom as the lesson begins and ends. This mood and flow, in effect, determines learners' interest and concentration. Probst (1984) asserts that the teaching atmosphere in the classroom should be in the non-threatening mode – conducive, non-competitive, and thought-provoking, thus allowing learners to enjoy the lesson that is going on. This is supported by Rawnsley and Fisher (1998) when they emphasised that the learning environment created by the teacher can make learning maths enjoyable and learners feel valued if it is an encouraging one. This means that discouraging environments lack good teacher-learner relationships and can impact negatively on maths learning.

2.11 THE RELATIONSHIP BETWEEN THE COGNITIVE COMPONENT, THE FEELING COMPONENT, AND THE ACTIONS OR BEHAVIOURAL COMPONENT

The three components are interrelated; they are always present whenever a person holds attitudes. Different attitudes manifest themselves in different manners. Their manifestations are linked to concepts such as perceptions, personality and perceptual selectivity (David, 2002).

The review of cognitive psychologists shows that, as we move about the world, we create a model of how the world works. That is, we sense the objective of the world but our sensations map to percepts, and those percepts are provisional, in the same sense that Mathematics hypotheses are provisional. As we acquire new information, our percepts shift. Belief and perceptions are not in action. Beliefs are life we do not question or filter our own beliefs. We fare t[illegible]s they are. They include the values that we have perceptions however relate to a method or way of thinking or point of view. It is the filter of any input based on our beliefs.

An important aspect of how we perceive objects or people has to do with what we think they are or should be (Morris 1973 in David 2002). How Mathematics is perceived depends on what students themselves think mathematics is. So, because students are limited in what they can perceive, they are highly selective in whether they choose to perceive and that which is relevant to them. In the process of filtering, different people will react differently even when they are from the same physical environment. They would not always have the same experiences, hence not the same perceptions (David, 2002)

Attitudes, therefore, relate to the way we react. The way we perform our thinking (perceptions) is what results in our attitudes. Our actions, therefore, depend on our attitudes. The ability to filter sensory experience is called "perceptual selectivity"

David (2002).Perceptual selectivity is influenced by both external and internal factors. External factors relate to stimuli and contexts in which people find themselves interacting while internal factors relate to, for example, learning, personality and motivation.

For some decades now, poor results in mathematics have been associated with the cognitive than with the affective domain. Meanwhile, other researchers in their investigation on students' perceptions and attitudes about science and mathematics have reported the problem to dissatisfying interest in this learning among students (Raat and Devries, 1985; Ornmerod and Duck Worth, 1975; De Kerk, 1989) in Davis (2002).

Kilpatrick (2001), as suggested earlier, explains that to be successful in Mathematics learning, the kinds of cognitive changes, namely conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition enable learners to cope with the mathematical challenges of daily life as productive disposition is about habitual inclination to see Mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy.

The researcher was concerned with lived experiences, beliefs and feelings, perceptions of Mathematical Literacy learners, and the place of theories in learning in the subject. Hence the theoretical framework which the study was based on is Vygosky's socio-constructivist model and Piaget and how socio-constructivist learning theories view all aspects of change – in practices, learning, perceptions as products of shifts in experience (Vygosky, 1978).

2.12 **CONCLUSION**

In this chapter the researcher focused on the literature review surrounding the research and based on the contribution of different studies and the place of theories in Mathematics education. The chapter also mentions the role of social interaction in Mathematics education and the influence of theories. The concept of Mathematical Literacy and how it is related to mathematics, the integration of Mathematical Literacy with other subjects, language and mathematical education, learners' perceptions on teachers' attitude, teaching atmosphere and success in Mathematical Literacy, were also areas that the researcher focused on. The researcher also focused on areas that would have an impact on learners' perceptions of Mathematical Literacy and to understand the challenges of learning Mathematical Literacy. The next chapter will focus on the research methods that were used in the investigation on learners' perceptions of Mathematical Literacy.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter looks at the research methodology and research design (the case study design) selected for this study. The chapter also includes the data collection methods as well as the data analysis used in the study.

3.2 RESEARCH PARADIGM: INTERPRETATIVE

The researcher adopted an interpretive paradigm because the paradigm allows the researcher to focus on contextual meaning making. Carson, Gilmore and Gronhaug (2001) mention that the interpretive approach allows the focus of the researcher to be on understanding what is happening in a given context. In the interpretive paradigm, the researcher's interest is in the meaning that people make of phenomenon (Peshkin, 1993). As a typical interpretive paradigm the study focuses on the subjective understanding of the participants, who are learners doing Mathematical Literacy in Grades 10 – 12 in FET schools. Cohen, Manion, and Morrison (2000) declare that, "... the central endeavour in the context of the interpretive paradigm is to understand the subjective world of human experience." Ritchie and Lewis (2003) believe that the social researcher is concerned with explorers and their understanding of the social world using the participant's construction and understanding of their world.

Taylor and Bogdan (1984: p.7) point out that, "... by observing people in their everyday lives, listening to them talk about what is in their minds, and looking at the documents they produce, the qualitative researcher obtains first-hand knowledge." I

believe that learners deserve to be given the opportunity to speak out of their experiences and their individual perceptions about Mathematical Literacy about. In this study I listened to what learners were saying about their perceptions of Mathematical Literacy and the documents that I looked at, was their books where class-works, home-works and evaluation tests were written.

According to Merriam and Associates (2002: p, 6) a qualitative researcher, as a primary instrument for data collection and data analysis, can establish a meaningful relationship with his participants through verbal and non-verbal communication. Communication will help in enhancing the researcher's information about the study and the participants and also enable him/her to make meaningful interpretation of data. As suggested by Merriam and Asso (2002: p. 6) information that was interpreted in this study was collected through verbal communication from the learners as my respondents.

This study, as a typical interpretive paradigm study, sought to understand the learners' perceptions of Mathematical Literacy in their own understanding, as suggested by (Babbie and Mouton 2001: p. 270). Merriam and Associates (2002: p,6) concur by saying that if you want to understand a phenomenon, uncover the meaning a situation has for those involved, or delineate the process (how things happen), then a qualitative design would be most appropriate. I sought to uncover learners' perceptions of the Mathematical Literacy and to achieve this, a case study design is considered to be the most suitable for this study.

3.3 RESEARCH APPROACH: QUALITATIVE

The approach used in this study is qualitative and it employed interpretive research as a paradigm of social research. Merriam (1998: p. 5), Denzin and Lincoln (1994: p. 4) and Neuman (1999) describe qualitative research as a concept that explains the meaning of several phenomena with as little disruption of the natural setting as possible. On the other hand, Mwanje (2001) explains that the qualitative method focuses on the analysis of information so as to generate qualitative explanations of a social phenomenon. He further explains that the qualitative method is better suited to description, whether dealing with meanings or patterns of behaviour, as it tends to rely on a detailed and complex description of events or people. Lancy (1997) mentions that this method usually takes place in natural situations which exhibits control, behaviours and settings. Qualitative research typically entails analysis of relatively few subjects for which a rich set of data is collected and organized and emphasizes understanding verbal narratives (Creswell, 1998).

Denzil (1994: p, 4) states that qualitative research is a field of inquiry in its own right. It crosscuts disciplines, fields and subject matter. It refers to a complex interconnected family of terms which include the traditions associated with positivism, post structuralism, and the many qualitative research perspectives or methods connected to cultural and interpretive studies. This means that qualitative researchers study things in their natural settings, attempting to make sense of or interpret phenomena in terms of the meanings people bring to them.

According to Sherman and Web (1990: p, 7) the key philosophical assumption upon which qualitative research is based is the view that reality is constructed by

individuals interacting with their social environment. Sherman and Web further maintain that qualitative researchers are interested in understanding the meaning people have constructed, how they make sense of their world as it is "lived" or "felt" or "undergone."According to Denzil (1994: p.4), qualitative research is multi-method in focus, involving an interpretive, naturalistic approach to its subject matter. Qualitative research methodology according to Newman (1999) involves documenting real events, recording what people say, observing specific behaviours, studying written documents, or examining visual images.

Most researchers agree that the qualitative research approach, in its broadest sense, refers to research that elicits a participant's accounts of meanings, experiences or perceptions. Haralambos and Holborn (19[illegible]pport this by mentioning that the qualitative method helps a researcher to gain a true reflection of the way of life, of people's experiences, perceptions, attitudes and beliefs.

The above description of qualitative research methodology equips the researcher to have a full understanding of the approach to use when conducting the study on investigating learners' perceptions of Mathematical Literacy (ML). The approach that was followed in this study is the interpretive qualitative research which views the world as a product of human consciousness (Denzin, 1994: p,7). I, therefore, adopted the qualitative research methodology because the respondents in my study were learners in their school setting who could interpret their experiences of Mathematical Literacy at their school.

The qualitative method has its own limitations. For instance, it is believed that the qualitative method follows no strict rules but researchers are cautioned that this research is not allowed to be mindlessly inventive. The research methodology was suitable for my study because it deals with learners' views about Mathematical Literacy as they experienced it in their context. According to Babbie and Mouton (2001: p, 273) the qualitative approach has an element of objectivity which is understood in two ways: It is firstly given the central place. Firstly, the role of the researcher as the observer and interpreter is also acknowledged hence the researcher is seen as the most important instrument in the research process. Secondly, the main challenge of the qualitative researcher is to get close to the research subject in order to generate legitimate insider descriptions. This means that the researcher has to be unbiased in order to make correct judgements about the phenomena in life. As Babbie and Mouton suggested (2001: p, 273) in this study I was able to work closer with the learners as to generate information about their perceptions of Mathematical Literacy. Brannen (1993) mentions that qualitative research facilitates research by helping the researcher with the choice of subjects for a qualitative investigation. The researchers who do not want to use statistics and numbers usually adopt this approach to prove the validity of the phenomenon. The validity and reliability are established in the qualitative approach by using triangulation. The type of subjects that I have chosen for this qualitative study is Mathematical Literacy learners in three selected high schools in Mdantsane.

The characteristics of qualitative research outlined by Bogdan and Biklen (1996) are as follows:

- Qualitative research demands that the world be approached with the assumption that nothing is trivial, that everything has the potential of being a

clue that might unlock a more comprehensive understanding of what is being studied.

- ❖ Qualitative researchers are concerned with process rather than simply with outcomes and products.
- ❖ Qualitative research is descriptive.

On the other hand Schulze, Myburgh and Poggenpoel (2002) mention as one of the characteristics of qualitative research that data is in the form of words and analysed by extracting themes. In this research, themes are extracted from learners' responses about their perceptions of Mathematical Literacy.

Newman (1995: p.331- p.335) outlines six characteristics of qualitative research:

a) Qualitative researchers emphasize the importance of social context for understanding the social world. They hold that the meaning of a social action or statement depends in an important way on the context in which it appears.

b) A qualitative researcher may use a case study approach; immersing him into the group for purposes of data collection. Immersion gives the researcher an intimate familiarity with people's lives and culture. He/she looks for patterns in the lives, actions and words of people in the context of the complete case as a whole.

c) A researcher's integrity is a real issue. Readers of qualitative research ensure that their research accurately reflects the evidence and they include checks on that evidence. They also assume that it is impossible to eliminate the effects of the research completely. A qualitative researcher's presence is always an explicit issue. A qualitative researcher takes advantage of personal insight feelings and

perspectives as a human being to understand the social life under study, but is aware of his/her values or assumptions.

d) A qualitative researcher begins with a research question and little case. Theory develops during the data collection process. It is an inductive process whereby theory is built from data or grounded in the data. Conceptualization and operation occur simultaneously with data collection and preliminary data analysis. A qualitative researcher builds theory by making comparisons.

e) The passage of time is an integral part of qualitative research. Qualitative researchers look at the sequence of events and pay attention to what happens first, second, third, and so on.

f) Qualitative research reports rarely include tables with numbers. The only visual presentations of data may be maps, photographs or diagrams showing how ideas are related. The data is in the form of words, including quotes or descriptions of particular events. A qualitative researcher interprets data by giving them meaning or making them understandable.

3.4 RESEARCH DESIGN: CASE STUDY

According to Kumar (1999, p, 161) a research design is a plan, structure and strategy of investigation so conceived as to obtain answers to research questions or problems. On the other hand, Babbie and Mouton (2001, p, 270) mention that a research design refers to the course the research is going to take. Qualitative research design includes features consisting of a detailed engagement or encounter with the object of study, selecting small cases to be studied, an openness to multiple sources of data, and flexible design features that allow the researcher to adapt and make changes to the study where and when necessary.

Schulze, Myburgh and Poggenpoel (2002) mention the following characteristics of qualitative research design:

- A qualitative research design does not give step-by-step instructions or a fixed recipe to follow. The design is flexible and may change during the research. Even the research problem may change as the research progresses and the researcher gains a better understanding of the phenomenon being investigated.
- More than one method of data collection is used, including interviewing, focus groups, observation and document analysis. This is called triangulation of methods and improves the trustworthiness of the data.
- Qualitative research design requires data that is rich in description of people and places. Thus the qualitative researcher uses purposive sampling methods. The strength of this is that a few cases studied in depth yield many insights about the topic. This means that the researcher carefully hand picks participants who would be most able to give him/her information about the phenomenon under investigation.
- Data collection needs to be continued until the data is "saturated." In other words, data collection is continued until the researcher does not hear any new information- everything has been said. If in-depth interviews are conducted, saturation point is normally reached after about eight participants have been interviewed. If focus groups are used, this normally happens after the third or fourth focus group.
- Qualitative research is context bound. It is also called field research since it is conducted in the natural setting of the participants.

3.4.1 CASE STUDY

This study adopted a multiple case study approach to investigate learners' perceptions of the mathematical literacy in three selected high schools in Mdantsane location. Leedy and Omrod (2005: p,114) define a case study as a type of qualitative research where in-depth data is gathered relative to a single individual, programme or event for the purpose of learning more about an unknown or poorly understood situation. This is also mentioned by Smith (1994) as cited by Mirriam (1998) that case studies are types of qualitative research that are intensive descriptions and analyses of a single unit of a bounded system like an individual, programme, event, group, intervention or community. This term is further defined by Yin (1994), as cited in Creswell (1994) as a study in which the researcher explores a single entity or phenomenon bound by time and activity and collects detailed information by using a variety of data collection procedures during a sustained period of time.

Henning, van Rensburg and Smit (2004) further argue that a case study is an in-depth investigation into a relatively small area of interest to gain an in-depth understanding of the situation and meaning of those involved. It is a key empirical strategy in qualitative field studies that allows the researcher to blend together a wide range of methods and to find out as much information about the case as possible.

Since qualitative researchers deal with multiple, socially constructed realities that are complex, they regard their research task as coming to understand and interpret how the various participants in a social setting construct the world around them. To make their interpretations, the researchers must gain access to the multiple perspectives of

the participants. Clesne and Peshkin (1998) explain that because the researchers focus on in-depth interaction with relevant people in one or several sites, the researcher becomes the main research instrument as he or she observes, asks questions and interacts with research participants. Therefore, the main focus of qualitative research in this study was on the natural setting as it dealt with learners' true reflection of the way they understand and perceive Mathematical Literacy. It tried to understand how the learners make sense of and interpret Mathematical Literacy in the way they understand it. I also handled the participants, in this case the learners, in the natural setting of their classrooms, in the ways that would be most suitable and free for them to give information about their perceptions of Mathematical Literacy, what they go through in their schools and classrooms when dealing with Mathematical Literacy.

Gummesson (2000) argues that a case study is the one that investigates an individual, or group or community in order to answer specific research questions. Further, he adds that it searches for a string of evidence that will not be summarized and analysed to get the best possible answers. The researcher, therefore collected data through the use of various methods, like interviews and focus group interviews where the participants had an open-ended opportunity to give their views.

Cohen, Manion and Morrison (2000) believe that a case study provides a unique example of real people in real situations enabling the readers to understand ideas more clearly than simply by presenting them with abstract theories or principles. Cohen *et al.* (2000) further explain that the case study methods afford an opportunity to observe the "characteristics of individual units" within their natural habitat and that

a case study can be defined by participants' roles and functions in a case. Therefore, it was of importance in this study to use a case study approach so that the participants (learners) portray and speak for themselves 'what it is like' to be in a participant's situation (of learning Mathematical Literacy).

In this study I have explored the learners' perceptions of Mathematical Literacy. Case studies benefit researchers in a number of ways and according to purposes of intended studies. Researchers study cases for different purposes. Stake(1995) includes three other types of case studies:

- An intrinsic case study is where the study is undertaken to get a better understanding of a particular case and the researcher has an interest in the case.
- An instrumental case study occurs where a case is examined to provide insight into an issue or refinement of theory and the case is used to understand more than what is obvious to the observer.
- A collective case study is undertaken on a number of cases jointly in order to inquire into a particular phenomenon.

This study which the researcher investigated on learners' perceptions of Mathematical Literacy in selected high schools in Mdantsane, in the East London District can be concluded as a collective case study intrinsic to the researcher.

Steenhouse (1985: p, 49) as cited by Bassey (1999: p, 27) mentions that case study methods involve the collection and recording of data about a case or cases and the preparation of a report or a presentation of the case. Steenhouse (1985:p, 49) identified four broad styles of case studies: ethnographic, evaluative, educational

and action research. A case study has got strengths which outweigh its limitations. It is the best plan for answering one's questions.

3.4.1.1 Strengths of case studies

According to Merriam (1998), the strengths of a case study are that it offers a means of investigating complex social units consisting of multiple variables of potential importance in understanding the phenomenon. It results in a rich and holistic account of a phenomenon. It offers insights and illuminates meanings that expand its reader's experiences. It plays an important role in advancing a field's knowledge base. It has proved to be useful for studying educational innovations, for evaluating programs and for informing policy (Merriam, 1998: p, 40).

According to (Denscombe 1998: p, 39) the following are the advantages of a case study:

- The main benefit of using a case study approach is that the focus on one or a few instances allows the researcher to deal with the subtleties and intricacies of complex social situations. This researcher is aware that there are many activities which take place in schools (e.g. sports, cleaning, teachers' meetings, etc.). This study intends to focus on one aspect of the school activity, which is learners' perception of the Mathematical Literacy.
- The case study approach allows the use of a variety of research methods and it fosters the use of multiple sources of data. The research assumptions made identify different data sources to be used in order to prove assumptions made. The research objective of this study identified the multiple methods used to achieve the objective. For example, interviews, focus group

interviews and document analysis were conducted to explore the learners' perceptions on Mathematical Literacy.

- ❖ The case study approach is particularly suitable where the researcher has little control over events.
- ❖ The case study approach can fit well with the need of small-scale research through concentrating effort on one research site.
- ❖ The case study can be used to build and to test theory.

3.4.1.2 Limitations of case studies

- ❖ Although rich, thick analysis of a phenomenon is desired, a researcher may not have time or money to devote to such understanding. In order to cut cost and time so as to be able to collect data, three schools were selected in the East London District.

- ❖ Case studies can oversimplify or exaggerate a situation leading to erroneous conclusions about the actual state of affair in so much that readers may think that case studies are accounts of the whole, meanwhile they are but part.
- ❖ Research biases can be dangerous in case studies Merriam (1998: p,42). I tried not to be bias and influence participants during the research interviews as I am teaching Mathematical Literacy.

3.5 DATA COLLECTION METHODS

Data includes materials people doing the study actively record, such as interviews, transcripts and observation field notes. Data also include what others have created and the researcher finds, such as diaries, photographs, official documents and newspaper articles (Bogdan and Biklen 1996: p, 106). According to Terre Blanche and Durkheim (1999: p,286) data represents bits of discrete information that can be extracted from their context and analysed as numbers, whereas qualitative

researchers typically work with material that is richly related to its context and would lose its meaning if broken into discrete bits. Additionally the word "data" conjures up images of some kind of knowledge factory, where raw materials (data) are processed (analysed) to manufacture products (results).

According to Denschombe (1998) three data collection techniques dominate in qualitative inquiry, namely; participant observation, interviews and document analysis. Ideally, the qualitative researcher draws on some combination of techniques to collect research data, rather than a single technique. In this study the data was collected by using interviews, focus group interviews and document analysis.

3.5.1 Sampling

According to Scwandt (1997: p, 128), in purposive sampling, site or cases are chosen because there may be a good reason to believe that, "what goes in there is critical to understanding a process or concept, or to test or elaborate an established theory." In line with Scwandt, Bogden and Biklen (1996: p, 106) assert that the primary consideration in purposive sampling is the judgement of the researcher as to who can provide the best information to achieve the objective of the study. Purposive sampling was employed in the selection of school sites, due to the fact that the study is qualitative in nature. The research was based on three selected public schools in Mdantsane, in the district of East London. The learners selected for this study are those who study Mathematical Literacy whom were considered most suitable to provide the necessary data for the study. Hence the sample selected for this research can be considered purposive sample and involves multiple case as three schools are selected. All three selected schools are from the East London

District in Mdantsane, where learners are admitted from grade eight to grade twelve. All participants speak IsiXhosa as their mother tongue language. Mathematical Literacy is offered from grade 10 to grade 12. There is only one Mathematical Literacy class in each grade in all three schools. The data collection techniques used were the same in all three schools.

Two samples were used, one for the individual interviews and the other for the Focus Group Discussion (FGD). Individual interviews were done to give a chance to each participant to give his/her perceptions of Mathematical Literacy. After carefully conducting the individual interviews, I felt that not enough information was provided by the participants and decided also to conduct Focus Group Discussions using the same type of questions. This gave participants the chance to open up and to afford a rich insight into the learners' perceptions of Mathematical Literacy as communication within the group becomes multidimensional, interpersonal and trans-personal. Hoggart, Lees and Davies, (2002: p, 494). This also offered debates, arguments through interaction.

I carefully used the purposive sampling method of selecting one learner in grade 10 who had just started doing Mathematical Literacy, one in grade 11 and one in grade 12 in the three selected high schools. I chose learners for a purpose as they were respondents expressed their perceptions' of Mathematical Literacy. The length of the interviews took one to three hours with a sample of three learners from each of the three selected High Schools. With the FGD six learners were selected, three girls and three boys from each grade.

Strauss (2005) claims that when a population is too large, the researcher has no option but to draw a sample from the population to be studied. Hence only nine

participants in three schools were selected from a population of learners in Mdantsane.

3.5.2 Triangulation

Triangulation is one of the most popular terms in the history of qualitative research. Triangulation may be defined as the use of three or more methods of data collection. Triangulation forces the researcher to combine, among other aspects, multiple data sources, research methods, etc. to link aspects of different perspectives on a study phenomenon (Mwanje, 2001; Denzilan[illegible] Lincoln, 2003:p,49). Terre Blanche et al. (1999:p. 287) describe triangulation as a method that entails collecting material in as many different ways and from as many diverse sources as possible. According to Bauer and Gaskell(2000:p, 90), Cohe[illegible]al. (2000:p,112), Merriam and Associates(2002: p,184)and Ritchie et al.(2003) triangulation involves the use of different methods and sources to check the integrity of, or the extent to which inferences can be drawn from the data. This type of method has been developed to ensure convergence of both data and conclusions for qualitative researchers. As mentioned earlier three methods interviews, focus group interview and document analysis were employed in the collection of data as a way of enhancing reliability and validity in the study.

3.5.3 Data collection tools

3.5.3.1 Interviews

The interview is defined as a two way conversation initiated by the interviewer for the specific purpose of obtaining research information, and focus on the content specified by the research objectives of systematic description, prediction or

explanation using the art of asking questions and listening (Cohen and Manion, 1994: p, 272). It is not a neutral tool for at least two people create the reality of the interview situation, that is, information is gathered through direct verbal interaction between individuals.

Berg (1995) shares a similar definition and views the interview as a conversation with a purpose. Specifically, the purpose is to gather information. On the other hand, Neuman (1999) says that a qualitative interview is an interaction between an interviewer and a respondent in which the interviewer has a general plan of inquiry but not a specific set of questions that must be asked in particular words and in a particular order. It is an exchange of views between two or more people.

Merriam(1998) also defines interviews as the person to person encounter in which one person elicits information from another. Merriam further says that the main purpose of an interview is to obtain a special kind of information. Meanwhile, Patton (1990), in Lancey (1997), describes interviews as a situation where the researcher wants to find out what is "in and on someone else's mind."

The rationale for utilizing interviews stem from the fact that "they allow for greater depth than is the case with other methods of data collection" (Cohen and Manion, 1994: p, 272).

According to Miller and Dingwall (1997) the consequences in interviews is that the data produced are social constructs, created by the self-presentation of the respondents and whatever international cues have been given off by the interviewer

about the acceptability or otherwise of the accounts being presented. With interviews the respondent can expand on some issues if she/he sees fit to do so. The interviewer also is free to intervene and seek "clarification or further explanation (Bless and Higson-Smith, 1995: p, 107). For the purpose of this research study interviews were open-ended and constructed in such a manner that the respondents were free to provide as much information as possible.

Interviewing has a wide variety of forms and a multiplicity of uses:

The most common type of interviewing is an individual, face-to-face verbal interchange, but it can also take the form of face-to-face group interviewing, mailed or self-administered questionnaires, and telephone surveys. Interviewing can be structured, semi-structured, or unstructured. An interview can be a one-time, brief exchange, say five minutes over the telephone, or it can take place over multiple, lengthy sessions, sometimes spanning days, as in life-history interviewing (Denzin and Lincoln, 1994: p, 361)

Denzin and Lincoln (1994: p, 361) mention three types of interviews namely:

- Highly structured interview in which the questions and their order are determined ahead of time. There is little room of people to express their own views. The participants are confined to the set of questions prepared by the researcher. Highly structured interviews differ from unstructured interviews by the fact that they are characterised by being a closed situation.
- Unstructured interviews in which an interviewer prepares an interview schedule with issues that will be explored. The interview schedule

varies between the participants. Unstructured interviews are used when the researcher does not know the phenomenon to ask relevant questions.

- ❖ Semi-structured interviews are sometimes regarded as more or less structured interviews in which the interviewer is able to adopt the research instruments to the individuality of the respondents. In this type of interview specific information is desired from all the respondents, in which case there is a highly structured section to the interview. Furthermore the researcher asks the questions in the same way unlike in unstructured interview where questions can be changed in sequence and wording Denzin and Lincoln (1994: p, 362).

Babbie and Mouton (2001: p. 289) mention three ways of interviewing, namely:

- ❖ Basic individual interviewing which is an open interview which allows the object of the study to speak for him/herself rather than to provide respondents with a battery of predetermined hypothesis-based questions. It is therefore flexible, iterative and continuous rather than prepared in advance and locked in stone.
- ❖ Depth individual interviews in which the researcher is not all that interested in the content of the conversation, but rather in the process by which the content of the conversation has come into being.
- ❖ Focus group interviews which tend to allow a space in which people may get together and create meaning among themselves rather than individually. These focus groups can be used in two ways. The first way is when the researcher chooses between eight and twelve

respondents and themselves in a circle. The researcher would manage the focus group by going around in the circle, ensuring that everyone speaks and ending up with the individual responses of all the members of the group. The second way is to use the group to find information you would not otherwise be able to access.

Bogdan and Taylor (1984) believe that the success of the research interview depends largely on the person conducting the interview. They state that the interviewer, not an interview schedule or protocol, is the research tool. Anderson (1998) and Yin (2003) also claim that interviews are the most vital sources of case study information and they have rich data. Therefore, conducting an interview is a natural form of interacting with people and gives the researcher an opportunity to get to know people quite intimately so that he or she can really understand how they think and feel Kelly (2006: p,297). It is therefore necessary for the interviewer to develop the following skills and traits.

- Interviews must be non-judgemental. The informant must be assured that he/she will not meet with denial, contradiction, competition and other harassment.
- Allow people to talk. Good interviews need to display patience. Force yourself not to interrupt even though you are not interested in a topic.
- Pay attention. Listen to what people say. Ask for clarification if you do not understand.
- Probe. A key strategy for the qualitative interviewer is to avoid as much as possible questions that can be answered by yes or no.
- Carry out cross checks. Be alert to exaggerations and distortions.

- ❖ Establish good relations with informants. An interviewer should not hold back his/her feelings completely.
- ❖ Interviewing requires flexibility. To be flexible means to respond to the immediate situation, to the informants that are sitting before you, not to some predetermined set of procedures or stereotypes.

As suggested by Bogdan and Taylor I conducted the research as the interviewer, using semi-structured interviews schedule. An interview schedule (Appendix A) with a list of questions was prepared for the respondents to answer verbally in either their mother tongue language or English. In drawing up the interview schedule, I had to refer to the research questions in Chapter 1. This gave me a basis from which to work. I had to keep in mind what my research aims were, and how I could achieve them through these various types of questioning.

Semi-structured interviews were used to allow the respondents (learners in this case) to feel free to express their own views about the research questions. When conducting interviews, individual or group interviews can be used. Merton et al. (1956) notes three specific skills needed by the group interviewer. The skills required of a group interview are not different from those needed by an interviewer of individuals. The interviewer must be flexible, objective, empathetic, persuasive and a good listener. Firstly, the interviewer must keep one person or small coalition of persons from dominating the group. Secondly, he/she must encourage recalcitrant respondents to participate. Thirdly, he/she must obtain responses from the entire group to ensure the fullest possible coverage of the topic. In this study individual interviews were used, one learner from each grade in each school, and also a FGD

was used which consisted of a sample of six learners per each grade in each school, and respondents were encouraged to participate.

3.5.3.2 Focus Group Discussion (FGD)

A focus group discussion is an interview with a small group of people on a specific topic Patton, (2002). Kruger (1988) as cited in Struwig and Stead (2001), as well as Litoselliti (2003) view a focus group as 'a carefully planned discussion designed to obtain perceptions on a defined area of interest in a permissive, non-threatening environment, where participants share and respond to comments, ideas and perceptions. Kruger further mentions that such discussions often enable the participants to discuss issues they consider to be important. Litoselliti (2003) further defines focus groups as small structured g[illegible]with selected participants normally led by a moderator. Respondents in this study were structured in small groups as mentioned earlier and were set up in order to explore specific topics and individual views and experiences, through group interaction. As further mentioned by Litoselliti focus groups are special groups in terms of purpose, size, composition and procedures. They are normally made up of people with certain common characteristics and similar levels of understanding of a topic rather than aiming for diversity.

Krueger, (1988) in Struwig and Stead (2001: p,99) also further say that focus groups generally comprise of four to eight research participants whose participation is voluntary and who are homogeneous in some respects. He further mentions that the focus group is held in an environment that is free from noise and comfortable. Babbie and Mouton (2004) support the fact that the optimum size for a focus group

interview is around eight to twelve participants. In practice one would have to strike a balance between similarity and difference as regards to potential participants, as often too homogeneous a group may result in a few diverse opinions and experiences. The FGD should be homogeneous in terms of socio-economic status but incompatible in terms of gender. This is usually determined by the research questions being investigated Litoselliti (2003).

Hoggart et al. (2002: p, 500) further highlights the following advantages of FGDs:

- They afford rich insight into the realities defined in a group context and in particular the dynamic effects of interaction on expressed beliefs, attitudes, opinions and feelings.
- They are communication events in which the interplay of the personal and the social can be systematically explored.
- Members become more aware of their perspective and when confronted with disagreement they are prompted to analyse their views more intensely than during the individual interview.
- Focus group discussion can replicate social relations and interactions because communication within the group becomes multidimensional, intra-personal, inter-personal and trans-personal. As a result, group responses are more than the sum of individual responses.
- Focus groups provide a forum for people to share and test their views with others.
- The researcher hears not only what people say, and how they say it, but how participants interact, whether views are challenged and how people respond to challenges.

- ❖ While interviews reflect individual views, values and opinions, focus group discussion offer conversation, argument and debate through interaction.
- ❖ Interaction among group members can draw new insight into respondents' beliefs and values.

In support of the above advantages, Patton (2002) states that FGDs are conducted to get a variety of perspectives and increase confidence in whatever patterns emerge. Despite the above advantages, Hoggart, et.al. (2002: p, 500) states that the centrality of the researcher in the focus group method is problematic in that the researcher is responsible for the whole process. This places the researcher in the position of interviewer and researcher at the same time. In this study, I avoided this by facilitating and not controlling the proces[illegible] bearing the above advantages in mind. This approach gave learners the opportunity to discuss issues without the interference and domination by the researcher.

Kingry et al. (1990) as cited in Struwig and Stead (2001: p, 100) mention the following disadvantages:

- ❖ Focus group requires skilled group facilitators.
- ❖ The facilitator may be biased in directing the discussion.
- ❖ The participants may be unwilling to disclose all their thoughts on the topic.

Following the guidelines from the various authors mentioned above I chose my focus groups by selecting six learners from each grade in the selected high schools. I assumed as suggested by Hancock (2002) and Litosellite (2003) that members of each focus group have something in common and characteristics which are important to the topic under investigation. The respondents in this focus group

discussion were all learners doing Mathematical Literacy. Anderson (2000) also defines a focus group as a group comprised of individuals with certain characteristics who focus discussion on a given issue or topic. The questions the FGDs addressed in this study were based on the research questions:

- What do learners understand by Mathematical Literacy?
- What are learners' perceptions of Mathematical Literacy?
- What are the advantages and challenges of learning Mathematical Literacy?

I conducted three focus group discussions as suggested by Litoselli (2003) and Krueger (1988) in Struwig and Stead (2001: p, 99) who had commonality of being learners doing the grades under investigation. In this study they are referred to as FGDs. In this study focus groups were learners of grades ten, eleven and twelve. The composition of these focus groups was:

FGD 1= Six Grade 10 learners

FGD 2 = Six Grade 11 learners

FGD 3 = Six Grade 12 learners

The use of FDGs in this study enabled me to obtain quality data in a social context. Learners could, therefore, consider their own views in the context of the views of the others through participation in the group discussion. Learners could also get closer to understandings of and perspectives on the issues under discussion.

I have found that children responded better to group interviews. Group interviews with children are less intimidating for them than individual interviews. A group interview is often quicker than individual interviews, and they allow for discussions to develop during the interview. They also bring people of varied opinions together, the result of which could be more information than individual interviews. I had chosen to

work with the selected group of grade 10, grade 11 and grade 12 as mentioned earlier, because it was less intimidating for them, and because these interviews led them to further discussions. Bringing children of varied opinions together was found to be more informative and less time consuming than individual interviews. Not all respondents spoke freely about how they felt, and some dominated the interviews whilst others withheld information. I also had difficulty in transcribing the interviews, as sometimes three pupils would speak at once, making it difficult to hear what they said.

When interviewing children in groups, Simons and Lewis (as cited in Cohen et. al. (2000), found the following difficulties. I have personally responded to each difficulty. My responses are given in italics

- Some children dominated the conversation. *This I found to be the case as some learners naturally speak more than others. I tried to give all an equal opportunity to speak.*
- Some felt exposed in front of their friends. *I did find some of the pupils were shy to speak out in front of their peers. I overcame this by chatting informally with them during the interviews. This helped them to relax and speak more freely.*
- Some felt uncomfortable or threatened. – *I did not experience this aspect.*
- Some told lies. *I did not, to my knowledge, find this to happen.*
- It was harder to get beyond the expected response. *I find this when I asked the question about what they did not like in Mathematical Literacy. Their answers were very minimal, I tried to get them to elaborate.*

- ❖ One had to overcome the problem that children will say anything rather than admit that they don't know. *Sometimes children tended to speak regardless of knowing the answers or not.*

3.5.3.3 Document Analysis

Document Analysis refers to the perusal of documents such as books, records and policies that are used by an institution. Lincoln and Guba (1985: p, 277) distinguish between document and records on the basis of whether the text was prepared to attest to some formal transaction. Thus records include marriage certificates; driving licenses, building contracts, and banking statements. Documents, on the other hand, are prepared for personal reasons rather than official reasons and include diaries, memos, letters, field notes and so no. Likewise Patton, in Lancey (1993) maintains that document analysis in qualitative inquiry yields extracts, quotations, or entire passages from organizational, clinical or programme records, personal diaries, and open-ended written responses to questionnaires and surveys. Documents used in this study included written work of learners especially those that involved their evaluation tasks and also some perusal of other tasks like projects and assignments.

Erlandson, Harris, Skipper and Allen (1993) assert that the term "document" refers to the broad range of written and symbolic records, as well as any available materials and data. Documents include practically anything in existence before the investigation. In the study the researcher looked at the books that learners use for studying, writing homework, tests and projects as per the assessment guidelines from the National Curriculum Statement (NCS) documents. Bauer and Gaskell (2000: p, 346) note that good documentation elicits data which is an essential part of

quality work enabling the researchers to reconstruct what has been accomplished for evaluation purposes. I used learners' books as documents to analyse and compare whether what they were saying about Mathematical Literacy as being an "easy subject" was reflected in their books.

3.6 **DATA COLLECTION PROCESS**

3.6.1 Piloting

A pilot study is a standard tool for research, allowing researchers to conduct a preliminary analysis before committing a full-blown study. (Simon,2008). For the purposes of reliability and validity of the instruments as suggested by Cohen et. al. (2000), an interview schedule was developed and pilot-tested. The pilot study in this research was limited to fewer subjects in one school, which is amongst the schools sampled for the main research. The same instruments as the ones which were used in the main study were also used during the pilot phase to check whether tools intended for the main research would be effective. This also helped the researcher to condition himself for the various kinds of reception he might get from different kinds of people who would participate in the main research (Simon, 2008).

Piloting was meant to check the duration of the interviews, the strengths and weaknesses in questions. I discovered that 30 minutes which was originally set for the interviews was not enough to get all questions answered appropriately. As a result of piloting the duration of the interview was adjusted. Pilot study was done to reduce errors when the main data was collected and to check whether this study is researchable

The pilot study conducted helped me to negotiate access to the respondents verbally first before the formal procedure of giving them consent forms to sign. This helped to ease any tension that may occur and the researcher got a chance to familiarize herself with the participants before the actual interviews. Tape recording was part of the interview process as it helped to listen after interview to pick out those parts of the interview which were left out when taking notes during the interviews.

3.6.2 Interviews

3.6.2.1 Individual interviews

I used one learner from each grade in the pilot school. I tried to encourage learners to participate, where I sensed difficulty in responding I used scaffolding and code-switched since English is a second language for them. I had to keep in mind what my research aims were through various types of questioning. I tried to allow the learners to feel free to express their own views about the research questions. Unlike focus group interviews learners were tense at the beginning of the interviews but I tried not to be a stranger to them by asking simple English this also helped to see the weaknesses and strengths to prepare for the real study.

3.6.2.2 Focus group interviews

A selection of six learners from each grade in the pilot school was done. They had something in common as they all did Mathematical Literacy. They showed interest and were curious of the group interview as it something that they were never engaged in. They were responding well as compared to individual interviews. If not for the ground rules, it would have been difficult to control them as they showed interest and enjoying to talk about Mathematical Literacy. There were arguments and they offered their opinions about their perceptions of Mathematical Literacy. I tried to make the environment a non-threatening environment to be at their level.

3.6.2.3 Document Analysis

Documents used in the study included written work of learners especially those that involved their evaluation tasks and also some perusal of other tasks like projects and assignments. Their documents were used to analyse and compare whether what they were saying about Mathematical Literacy was reflected in their books like obtaining good marks, although I could not compare them with what they were obtaining in Mathematics.

3.7 DATA ANALYSIS

Data was analysed by means of triangulation using individual interviews, group interviews and document analysis. Yin (1984) mentions that data analysis in a case study consists of examining, categorizing, [illegible]ting or otherwise recombining the evidence to address the initial propositions of a study. The analytic phase of qualitative research is characterised by the important role the qualitative researcher plays in the production and interpretation of data Denscombe, (1998). Merriam (1998) states that data analysis refers to data that is "compressed and linked together in a narrative that conveys the meaning, that the investigator has derived from studying the phenomenon.

Murdoch (2002: p,23) defines data analysis as a procedure of organizing data into "more manageable categories". In addition, Denscombe (1998) argues that the beliefs and values of the investigator are likely to influence the process of data analysis. In a qualitative research study, findings are believed if the reader is convinced that the findings are credible. Readers therefore need to be persuaded to believe that the findings are worthy of attention.

There are several strategies of doing that in a qualitative research study. Two of the most important strategies in a qualitative research are measures to ensure reliability and validity in the study. How the two aspects were used to ensure trustworthiness specifically in this study is discussed below.

3.7.1 Reliability

The reliability of a measuring instrument is the degree of consistency which measures whatever it is measuring (Babbie and Mouton, 2001). Babbie and Mouton further refer to validity as the extent to which a measurement provides data that relates to commonly accepted meaning of a particular concept. Tuckman (1994) and Anderson (1998) explain that reliability means that the test is consistent every time it is measured, i.e. it will give the same results every time it is administered.

Verma and Mallick (1999: p, 202) refer to reliability as the extent to which a test or technique functions consistently and accurately by yielding the same results". It is the term used to deal with the accuracy of the data that is collected during a research project. It also has to do with the fact that another researcher might find the same results by employing the same methods. In this study the researcher used the same methods and questions with the participants who were involved in the investigation under study. During focus group interviews learners' responses and their way of answering given the same questions, were the same as when they were in individual interviews.

3.7.2 Validity

Anderson (1998) and Verma and Mallick (1999: p, 202) define validity as the "degree to which a test, tool or technique measures what it is supposed to measure."

Validity assures the researcher about the correctness of the direction that one is taking. It means that if the test instrument that is being used has not been validated, the results as well will be invalid. Validity has to do with the soundness and the effectiveness of the measurement instrument in the research. It indicates the extent to which a test complies with the aims it was designed for. The researcher through the face-to-face interviews, focus group interviews and document analysis investigated learners' perceptions of the Mathematical Literacy. The questions that were asked in both interviews were formulated from the research questions to make sure that I was asking them valid questions related to the research. I also made sure that the information I searched from the documents was to verify the learners' responses in the interview.

Johnson (1998) in Verma and Mallick (1999) also mentions descriptive validity which has to do with the factual accuracy of the amount as reported by the researcher. He further states that it is only present to the degree that the account reported by the researcher is accurate. I also made sure that I presented the information collected accurately in the research report. Questions were valid and related to the research under study.

3.7.3 Ethical consideration

In conducting this study the researcher made it a point that strict ethical standards were adhered to and the research was conducted in a morally acceptable manner. The researcher took the rights and interests of those affected by the research into consideration. The researcher protected the identities of those who were participating in the research, that is, the learners, in order to ensure confidentiality. I

ensured that data was not distorted or misrepresented. The researcher also made sure that data was not plagiarized and republished as an original contribution without proper acknowledgement. Approval or permission to conduct research was sought from the school principals where the investigation took place.

During the course of this study, the following ethical considerations were adhered to:

Self- determination: Participation were not forced upon participants

Privacy: No individual identified his/her name

Anonymity: Personal information about the participants was not revealed. The schools were coded as A, B, C and the learners were coded as A1, A2, B1, C3, etc. to keep the participants anonymous.

Confidentiality: Whenever and wherever necessary, pseudonyms were used e.g. for the purpose of the discussion of data.

Fair treatment and protection from discomfort or harm: Participants were not discriminated against in any way.

Informed consent: Participants who participated in the study were requested to sign a letter to indicate their consent to participate in this study.

I was granted ethical clearance from the University of Fort Hare to conduct the research in the selected schools. The type of research to be done was outlined for ethical purposes. At the selected high schools, I sought for permission from the school principals to use the school as a research facility within which the research could be conducted. I was also granted permission by the different teachers teaching Mathematical Literacy in the different grades to undertake the research with their Mathematical Literacy learners.

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. Forms of consent which explained the area of research with its aim and purposes were given to learners who participated in the group interview. Before the interview I explained the content of the form to them.

The consent form also assured respondents of absolute confidentiality, which I thought was an important factor in getting respondents to answer truthfully. According to Cohen et al. (2000), 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.

The authenticity of data was crucial to the credibility of the study. Sensitive questions concerning learners' perceptions about mathematical literacy were being investigated and it was important 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. Anonymity was ensured amongst respondents as a good way of engendering mutual trust and building confidence in the study. 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.

3.8 REFLEXIVITY

Researchers need to be reflexive if their research is to be useful McIlveen (2008: p, 14). Reflexivity is self-critical sympathetic introspection. The idea of awareness that researchers are reflexive when they are aware of the multiple influences they have on research processes and how research processes reflect on them. Through the research process, researchers would do well to write, reflect upon, and discuss what is going on for them and how they are doing may affect their research participants/subjects.

In this chapter critical personal reflections of the researcher's own experiences were drawn. Having read that it is important to choose a topic that one has a keen interest in (Phillips & Pugh, 2005:p, 110), the rese[illegible], driven by curiosity, chose to find out about learners' perceptions of Mathematical Literacy. After identifying a gap in literature on the research topic chosen, a case study approach was undertaken. The researcher intended to be self-reflexive about the details of the research process, starting from the chosen topic, to the challenges experienced to the discussion of the findings.

One of the challenges experienced was the fact that it was not easy to get information from learners as they have fears of not being familiar with the process of research, as a researcher you have to be at their level to win their trust so that communication could be possible.

3.9 CONCLUSION

This chapter has described the research design and methodology for this study. The research strategy which is a qualitative research approach was described. The

research method and the data collection techniques used in the study is also presented. The chapter also describes how the data was analysed as well as how the issues of reliability, validity and ethical considerations were taken care of. The next chapter discusses the findings of the research about the investigation.

CHAPTER 4

RESEARCH FINDINGS AND DISCUSSIONS

4.1 INTRODUCTION

This chapter consists of the presentation of data that was gathered in the process of the study. The researcher used the data collection techniques mentioned in the previous chapter to gather information that specifically answers research questions and meets the objectives of the study. I tried to elicit answers to the following questions from the learners:

a) What do learners understand by Mathematical Literacy/ML?

b) What are learners' perceptions of Mathematical Literacy as a subject?

c) What are the advantages and challenges of learning Mathematical Literacy?

The aim of the study, as stated in Chapter 1, was to investigate the learners' perceptions of Mathematical Literacy (ML) in three selected high schools in Mdantsane in the East London District. Respondents were selected to have one learner from each grade in the three selected high schools. As stated in Chapter 3, the data was collected through individual interviews, FGDs and document analysis and triangulated. The data gathered through the three methods was triangulated to find out the emergence of patterns in answers to the research questions of this study. The triangulation was used also to improve the trustworthiness of the data.

I, the researcher, personally went to each high school in the sample group. There were agreed dates of appointment to conduct the interviews. For ethical purposes respondents were informed that a tape recorder would be used to assist the researcher when listening to it alone because some information is usually left out when writing whilst listening at the same time. This was done to ensure that

information collected was valid and reliable. I therefore asked for permission from the learners to record the interviews.

There were ground rules which were explained to all participants especially during the focus group interviews to remind them that this was a co-operative effort. Recording the interviews on audiotape enabled me to focus attention on the interview questions and to accurately transcribe the interview at some later stage. At the end of the interviews learners were thanked for availing themselves to participate in the interview and for their honest responses. After the interview, the data was transcribed and analysed and a summary of results for each question under investigation was discussed.

The interview schedule had two sections, section A and section B. The information in Section A is about the characteristics of the respondents according to age, gender and grade. The biographical data or characteristics of respondents only served to give information about the respondents that helped to describe the nature of learners. Section B is about the learners' understanding, knowledge and advantages and challenges on their learning of Mathematical Literacy.

4.2 **Description of the three schools**

The schools were coded as school A, B and C. Learners or respondents were also coded, the Grade 12 learner in school A was A1, the Grade 11 learner was A2 and the Grade 10 learner was A3. For school B, the Grade 12 learner was B1, the Grade 11 was B2 and the Grade 10 one was B3, and in school C the Grade 12 learner was C1, the Grade 11one was C2 and the Grade 10 one was C3. This was done, as

explained under ethical issues, to preserve the anonymity of the schools and the learners who took part in the study.

All three schools were from Mdantsane in the East London District. In these high schools learners are admitted from Grade eight to Grade twelve. The majority of learners come from disadvantaged communities. More than 50% of their parents are unemployed. As a result learners do not have the necessary resources (calculators, mathematical instrument sets) needed during lessons. They have to buy them on their own which in many cases resulted in them not having those resources. Other homes are headed by learners themselves due to the high impact of HIV/AIDS which caused them to lose their parents. They live in their own shacks and this has an impact on the performance of their work at school as they are not guided or supported at home after school hours when they have to do their homework.

All learners speak IsiXhosa, which is their home language (mother tongue), inside and outside the school premises. English is a foreign language to them. All three schools developed a policy regarding the language of Learning and Teaching (LOLT). The schools have decided on English as the language to be used to teach all the subjects except for IsiXhosa which is their mother tongue. They use IsiXhosa beyond the classroom during breaks, talking socially in class, when they are paired in group work, and when the teacher code-switches by explaining certain concepts. English is used mostly when giving instruction, and doing tasks, homework and other activities. Learners have limited opportunities at home to improve their general literacy levels. They have poor reasoning skills especially when it comes to certain mathematical concepts. In all three schools the learners make a choice of their

subjects in grade 10. They either choose pure Mathematics or Mathematical Literacy. There is only one Mathematical Literacy class in each grade from grade 11 to grade 12 in all three schools.

4.3. Profile of learners

Although the expected age in high school is between 14 and 18, some learners repeated a class because of not being able to meet the requirements for promotion to the next class; as a result they exceeded the maximum expected age of 18 in grade 12.

A table is provided below showing the distribution of respondents by gender.

TABLE 4.1: Number of respondents by gender

SCHOOL	GENDER		TOTAL
	MALE	FEMALE	
A	2	1	3
B	1	2	3
C	1	2	3
TOTALS	4	5	9

As shown in the table, in School A, 2 males and 1 female were interviewed. In both schools B and C, 1 male and 2 females, were interviewed. This was done to have a fair distribution of gender representation in the study. This does not mean that there were more females than males in each selected high school. In each of the three selected high schools, the number of learners ranged from 50 to 70 per class in

grade 10, 50 to 60 per class in grade 11, and 40 to 50 learners per class in grade 12. Learners' ages ranged from 15 years to 16 years in grade 10, from 17 to 18 years in grade 11 and from 18 to 20 years in grade 12.

The following section presents the findings which came from the respondents' response to the questions in Section B of the interview schedule. The content, sequencing and wording of questions were entirely from the researcher. I tried to probe the respondents' understanding and perceptions about the subject and also to have the information as first hand data. Learners' responses are given in italics and bold. My views about the learners' responses are included at the end of the learners' responses for each question.

4.4 DATA PRESENTATION AND ANALYSIS

In this section (Section B) the learners' responses of their perceptions of Mathematical Literacy were categorised into the following themes:

- General perceptions
- Integration of Mathematical Literacy with other subjects
- Comparison between Maths Literacy and pure Mathematics
- Reasons for doing Maths Literacy
- Language of Maths Literacy
- Enjoyment
- Labelling/stigmatizing
- Confidence and self-esteem
- Helpful mathematics

4.4.1. GENERAL PERCEPTIONS

In response to the question where learners were asked to respond to what they think is Mathematical Literacy by giving their own definition, one learner responded by saying:

"It is mathematics that is easy to understand" - "yimathselula"(meaning easy maths) (A1).

A similar view was said when asked how friends perceive Mathematical Literacy:

"They say it is a waste of time, "ilula" (easy maths),

Whereas another learner gave a different response:

"It is mathematics that involves talking, you don't use numbers only but also language "(A3).

From the responses it seems that some learners had a general understanding of what Mathematical Literacy is. Learners did not clearly know what Mathematical Literacy is as they had different definitions and versions. Hence some gave definitions that were not related to Mathematical Literacy as it is defined in the NCS document.

Learners described Mathematical Literacy as easy as it is presented as practically as possible by means of including contexts in their real life situations because they mentioned financial issues like savings, cell phones and budgeting.

Mathematical Literacy is defined as:"...a subject driven by life-related applications of mathematics. It enables learners to develop the ability and confidence to think numerically and spatially in order to interpret and critically analyse everyday situations and to solve problems." (South Africa: DoE, 2003: p.9)

There were some responses that showed that learners do have some idea of what they were told about what Mathematical Literacy is. Some of the responses, for example, included:

"It is about things we know." (B3)

"It is mathematics that opens up minds and involves calculating about things in our real-life situation, calculating measurements on school grounds." (C1)

"In Maths Literacy we solve real-life problems."(C1)

From the responses it is evident that some learners do not yet clearly know what the exact definition of Mathematical Literacy is, as it is stated in the Mathematical Literacy NCS guidelines. However, some have a slight idea or understanding of the definition as they mentioned that it teaches things about real-life situations.

It also emerged that Mathematical Literacy was also perceived negatively by some learners not doing Mathematical Literacy by using negative words such as "inferior maths" or "low maths." This could have a negative impact and a low turn-over in the subject since learners would not like to choose it as nobody would want to be associated with some "low" graded subject. Previous research by Graven and Venkatakrishnan (2006) showed that teachers also had the perception that Mathematical Literacy is meant for those learners who failed mathematics.

In relation to the question "What do you know about Maths Literacy (question 4), there was a positive response:

"I know that it is a learning area having maths ("ifikeleleka nakubani," meaning anyone can be able to do it, unlike pure maths) - boys and girls can do it." (A2)

This showed that unlike pure Mathematics, Mathematical Literacy can be performed better by both males and females. Previous studies (Shaffield, 1999) showed the perception that in pure maths boys performed better than girls. Generally, research on gender differences has found that males outscore females on visual-spatial ability, maths reasoning and college entrance (Snowman et al, 2009). However, the finding from the study that both boys and girls can perform better in Mathematical Literacy is encouraging.

4.4.2 INTEGRATION OF MATHEMATICAL LITERACY WITH OTHER SUBJECTS

Learners developed an understanding of linking Mathematical Literacy with other subjects. They identified a relationship between what they do and learn in Mathematical Literacy with what they learn in other learning areas like Geography, Accounting, Business Studies and English.

"It helps to understand other learning areas like Geography because in Maths Literacy we also learn about maps" (A3).

"Mathematical Literacy is too much English" (A3).

"I have learnt a lot of English vocabulary terms that are used in Mathematical Literacy that I have never heard before" (A1).

"It also helps to understand and relate to the commercial subjects we do here at school" (C1).

The curriculum stresses that integration is important: integration is *should be* achieved within and across subjects and fields of teaching (DoE, 2003). The integration of knowledge and skills across subjects and terrains of practice is crucial for achieving applied competence. Pellegrini and Blatchford (2000) mentioned that

competence begins with repeated experiences in individual settings and expands by interacting with different people and different materials. They further mentioned that teachers must understand the competence that learners come to school with if they are to learn Mathematics. The learner needs to understand concepts and link the topic to a context that the leaner knows so as to remember and not forget the concept and also have a mental picture by making connections between facts and skills. The design for curricula should create space for integration. Steen (2001) and Madison (2004) suggest that Quantitative Literacy is a competency to be achieved through contextual teaching of mathematics in an integrated manner not as a separate subject. Also Schoenfeld (1990) says, in the best of all possible worlds, instruction in all subject matter should touch on Quantitative Literacy whenever possible.

4.4.3. COMPARISON BETWEEN PURE MATHEMATICS AND MATHEMATICAL LITERACY

In response to different types of questions that learners were asked they always go back to comparing Mathematical Literacy to pure maths. This is indicated by the different responses below:

"It is Mathematics that is different to pure Mathematics and it can help."(A1)

Another response was:

"It is Mathematics that is interesting and important because it is about things we know and see." (B3)

"It is a subject about maths that needs attention; other people say it is weaker than maths." (C3)

"It is better understandable than pure Maths."

Learners are of the view that that Mathematical Literacy should be taught because in Mathematical Literacy they are able to grasp and understand something based on what they experience in life. They are able to do most of the tasks like the exercises given to them as homework and class-work without the help of their teachers.

They take Mathematical Literacy as an alternate learning area especially for those who failed pure mathematics. They supported the fact that it was being introduced and felt good that once a learner fails pure maths, that learner is still able to do some calculating in Mathematical Literacy or some kind of mathematics.

"Those who fail mathematics are able to do mathematical literacy."(A3)

There was also a response that the learners' parents were not aware of the two choices between Mathematical Literacy and pure maths, unlike learners who knew that there is a choice from Grade 9, that in Grade 10 one must choose either Maths or Mathematical Literacy. Some parents were not aware of the difference between the two.

4.4.4 REASONS FOR DOING MATHS LITERACY

In question 8 where respondents were asked about whether they like Mathematical Literacy or not, a learner responded by saying that ***"No, I don't like it; I was forced to do it. I wanted to take Geography; the class for Geography is the same class for Maths Literacy." (B2)***

The learner wanted to take Geography but was forced to choose Mathematical Literacy because the only class that offered Geography was the Mathematical Literacy class. The learner had no choice even if the learner wanted to combine Geography with pure Maths.

Although their friends' comments about their perceptions of mathematical literacy were negative as mentioned earlier, learners were not demotivated to do Mathematical Literacy. They had a positive self-concept and were intrinsically motivated. According to Bandura (1996), self-concept, self-esteem and self-efficacy are all types of self-perception.

In response to the question on the importance of Mathematical Literacy, learners saw Mathematical Literacy as important because it is based on things that they do every day, such as technology and cell phone tariffs, and it will help them to become an entrepreneur, a teller, or a carpenter, etc. On the positive note some learners responded by saying that it is going to help them make decisions on how to borrow and invest and how to manage money. The DoE (2003) suggests that Mathematical Literacy should enable the learner to become a self-managing person, a contributing worker and a participating citizen in a developing democracy. Learners also responded to liking Mathematical Literacy because it has opened up their minds.

4.4.4.1 Teacher involvement

Thirty percent of the learners in the sample said teachers were supportive. The teacher was able to see which learners struggled or experienced difficulty with pure Mathematics and tried to motivate the learner(s) to choose Mathematical literacy instead. The teachers involved learners by allowing them to do exercises and

activities that they enjoyed. They also involved the learners by encouraging them to bring everyday related examples that involve Mathematical Literacy like bank slips, cash slips and newspaper articles. Also a learner responded that because of obtaining high marks in the previous grade in Mathematical literacy, the teacher motivated the leaner to continue learning Mathematical Literacy.

Learner (B1) responded and described the teacher as being very understanding and very patient by allowing learners to work at own pace in order to be able to understand. They said the teacher also allowed group work and this helped learners to understand maths concepts better when working as groups. They got to learn through interaction with other learners. This increased learners' confidence and learners felt competent to do mathematical [illegible].

Previous studies have shown a similar view and the pace and involvement of the teacher played an important role to access mathematical thinking and success. Graven and Venkatakrishnan (2006) suggest that success at mathematical literacy by learners resulted from the slower pace which allows for more discussions of contexts and concepts with peers and with teachers.

Vygotsky's theory (1987) stresses that the development takes place through social relationships, i.e. via the zone of proximal development where the learner cannot understand something on his/her own, but has the potential to do so through interaction with another person who does have the capacity. In Vygotsky's view through support or scaffolding, the child is enabled to reach new levels of competence which she or he could have not attained alone. Another learner

responded by saying that the teacher was always available, encouraging, supportive and motivating.

"... the teacher in grade 10 was very supportive if we did not understand." (A2)

Feedback was given and also constructive criticism. Teachers always ask if learners understood in order to clarify difficult concepts in a language that learners would be able to understand.

"Teacher always asked if we understand a concept and try to explain in a simple way." (A3)

Suh (2007) says "having a chance to make sense of their understanding individually helps students to feel confident about their understanding if they share their ideas with a partner in class."

Learners' perceptions can be deduced from the way they relate their everyday context to maths literacy. These are examples of contexts (context of Mathematical about sport, Mathematical Literacy when playing games) that is used in Mathematical Literacy as mentioned by (Mthethwa, 2007).

Ford (2006) mentions that in order to develop confidence, as mentioned in the DoE (2003) and Steen (2001) in mathematics, is to provide opportunity to use mathematics in a real life context. Kilpatrick (2001) supports this by mentioning that when students have acquired conceptual understanding, they see the connection among concepts and procedures and gain confidence, which then provides a base from which they can move on to another level of understanding.

4.4.4.2 Parental involvement

Most of the learners' parents did their secondary education when Maths Literacy was not yet introduced; the subject or the curriculum is totally new to them. This could impact on the success of the performance of their children especially when they have to assist them with their homework. Another factor could be that other parents are illiterate and could struggle to understand the new subject.

Referring to one response, a learner indicated that parents did not want the learner to choose maths literacy. (job related problem):

"My parents did not want me to choose maths literacy because they said I will have a problem at tertiary, saying that most courses that give job quickly need one to have maths not maths literacy." (A1)

Parents have fears of the unknown. When something new is introduced, people tend to have fears of the unknown during the implementation through a lack of information.

Some parents supported its implementation:

"My parents were supportive and encouraged me .. ."(A2)

"... My parents had not problem." (B1)

"They motivated me to choose whatever I am comfortable in."(B3)

Motivation came from other learners after enquiring about how Mathematical Literacy is. Motivation came from the fact that the learner wanted to be an entrepreneur and is doing commercial subjects. The other learner was motivated when he saw

Mathematical Literacy from Maths Literacy books and ended up developing an interest in choosing it.

4.5 THEMES

4.5.1 LANGUAGE OF MATHEMATICAL LITERACY

Responding to the question,

"What can you say about learning Mathematical Literacy in English?" Learners' responses indicated that when they are taught Mathematical literacy they also learn about language, that is, English.

"I learn more English vocabulary..."(A1)

"English helped me to learn new words."....(A3)

"I get more information in English." (B2)

Whereas in response to the question where they were asked to give their own definition of Mathematical literacy, one learner responded by saying:

"It is maths in language, most of the time it allows one to gain an understanding of English." (B2)

It is clear that learners also are learning new vocabulary not only mathematical literacy. When asked about their understanding of Mathematical Literacy, there were different perceptions on Mathematical Literacy in relation to English.

Some learners perceive Mathematical Literacy, as a learning area that allows them to gain English. "It is maths in English, most of the time it allows one to gain an understanding of English. Whereas based on the question where learners were asked how their friends perceive Mathematical Literacy, there was a response that

friends perceive Mathematical Literacy. as a learning area that has too much English so they learn English whilst they also learn Mathematical Literacy.

When learning Mathematical Literacy, the learners also mentioned that they are able to translate word problems into numbers.

"In Mathematical Literacy we are engaged in calculating and solving problems in that we read paragraphs and try to write what we read in a form of numbers."(A3)

Although in another response the learner agreed that Mathematical Literacy is one of the interesting and important subjects to learn as they learn English, the learner also finds some difficulty in learning other concepts that are sometimes difficult to understand. This sometimes resulted in learners to have alternative meanings of certain Mathematical Literacy words before any Mathematical Literacy teaching takes place.

Learners misinterpreted some questions because of their background and their poor proficiency in English. Learners also gave the same answer to different types of questions, e.g. there were questions (refer to the Appendix) that were not as well answered as I expected.

One response to the question "What is Mathematical Literacy and give your own definition of it" was :

"It is maths in language"(B3)

To the question, "What do you know about Mathematical Literacy?" one learner responded:

"I know a lot ... but also English in maths.

Responses were very similar to different questions. It could happen that the misinterpretation was caused by the fact that the learners' mother tongue is Xhosa and they only speak English within the school surroundings, especially inside the classroom. At home, learners rarely speak English because some of their parents are illiterate.

For some questions, therefore, I had to ask more than once. At times I had to translate questions into simpler language or use code-switching (explains by using Xhosa words to explain the meaning of English words), so that learners could clearly understand what I asked. In other questions, they gave similar or the same answer to a question.

In answering the question "What can you say about learning Mathematical Literacy in English?",there were contrasting answers. Some participants felt that learning Mathematical Literacy in English is better, although they have the challenge of learning new concepts because English is their second language as they all learn Xhosa as their mother tongue language.

"Sometimes I experience problems in understanding the words then I have to guess what the question is."

In learning Mathematical Literacy in English learners realised that to know Mathematical Literacy one needs to be able to learn and know some English

vocabulary. They got to know more information although they do experience some problems and confusion. The teacher then translates into simpler English or even did code-switching, but they would still rather be taught Mathematical Literacy in English than in their mother tongue language.

Learners perceived the Mathematical Literacy examination as manageable. They commented that when writing paper one, they did not experience difficulty as they say the language used is understandable and the questions are familiar as long as one is doing practice, whereas they say that in paper two the language used is tricky and, unlike in paper one, the questions there are always something new or unfamiliar. Furthermore, in paper one formulae are always given and simple.

Mathematics depends on verbal skills and context items that have linguistic, cognitive and contextual dimensions (Madison, 2006). It is also stated in the DoE (2003, p.9) that without well-developed reading and language skills, learners will not be able to "develop mathematical thinking skills such as generalizing, explaining, describing, observing, specialising, creating, representing and predicting." Literature also showed that, (Ellerton, Clarkson and Clement, 2000) poorly developed language skills undermine maths performance. Language influences students' thought by moulding perception and stimulating ideas (Cooper as cited in Mavugara-Shava , 2005).

4.5.2 Mathematics in context

Learners felt that learning Mathematical Literacy is learning mathematics in context because they indicated that Maths Literacy involves calculations which they do in

their everyday life-situations. This is also mentioned in the DoE (2003) that learners should be taught and should learn Mathematical Literacy that is based on contexts in real life situations. Steen (1997) says that to be Mathematically Literate, individuals need all competencies, namely, Mathematical thinking and reasoning and mathematical knowledge.

Learners indicated that, by learning Mathematical Literacy, they no longer struggle to calculate interest (simple and compound). They are able to assist their parents and are able to save. They find themselves more interested in budgeting, especially at the end of the tax year. They also read and listened to the budget speech for the financial year.

For the learner to understand the concept of the topic to be taught, the learner needs to link the topic to a context that the learner knows so that he can be able to remember and not forget the concept again, and also have a mental picture and make connections between facts and skills.

In response to the question, "What are the advantages of learning Mathematical Literacy?", learners mentioned that they learn about budgeting, to deal with numbers, make financial decisions, gain skills on how to measure, painting, building and entrepreneurial skills.

4.6 Enjoyment

When learners were asked whether they like Mathematical Literacy or not, there were responses that were positive as learners indicated enjoying Mathematical

Literacy more. They associated it with things that they do and see (like bank slips, shops, being able to manage their money and calculate discounts). The fact that they are also able to assist their parents when doing banking boosted their morale too. They felt involved in helping their parents financially when doing calculations in the bank.

In response to the question which asked if learners would choose maths literacy even if there was an option not to do it, the majority of learners felt that they would choose to do Mathematical Literacy as they have developed a liking for it and enjoying it.

"I would choose Mathematical Literacy, I wouldn't be happy not to do any maths."(B2)

"I would choose Mathematical Literacy because it is about things we do and use daily."(C2)

In contrast to liking Mathematical Literacy, a learner responded :

"No, I don't like it, I was forced to do it. I wanted to take Geography, the class for Geography is the same class for Mathematical Literacy."

The learner wanted to take Geography but had no choice even if the learner was not satisfied with the combination. This could result in the learner having an attitude towards Mathematical Literacy which could also result in negative performance.

Some learners expressed the fact that they were told to choose Mathematical Literacy not that they wanted to. Graven and Venkatakrishan (2006) state that Mathematical Literacy is not offered as an open choice to learners. Weak and failing Mathematics learners at the end of the General Education and Training (GET) band are strongly advised to take Mathematical Literacy, whilst those passing Mathematics are advised to take pure Mathematics.

On the basis of learners who could not do well in pure Mathematics, the DoE (2003) states that learners who could not do well mathematically in the General Education and Training band usually stopped studying Mathematics, thus contributing to the perpetuation of a high level of innumeracy.

A sense of enjoyment as well as interesting comments relating to liking, loving Mathematical Literacy in contrast with prior experiences in Mathematics confirmed by respondents who stated that they enjoyed Maths Literacy 'mostly' or all the time in comparison with the level of enjoyment in grade 9 Mathematics. Other words in relation to the enjoyment of ML were being 'easy.' ML is about thing we see, that is visible things, more related to real-life or everyday situations.

4.7 LABELLING/STIGMATIZING

During the investigation more than 50% of the respondents indicated that they 'enjoy' Maths Literacy and the fact that those who do not do ML and stigmatize did not affect their performance but instead boosted their morale of even performing better in the subject. More than 50% of the respondents indicated ML as having boosted their self- esteem, especially those earning high marks as they mentioned it is

related to real life contexts. This will help those who did not know about the subject to know more of ML.

4.8 CONFIDENCE AND SELF-ESTEEM

Confidence and self-esteem were seen as the greatest benefit of mathematical literacy by the participants. Encouraging children to be creative their thoughts are different from others. More than 50% of the participants reported being focused, happy and confident about their perceptions of Mathematical Literacy.

Respondents indicated that the introduction of ML has allowed them the chance to be numerate and has boosted their self-esteem. Numeracy is more than the ability to do basic arithmetic. It also involves developing confidence and competence with numbers and measures (Murray, 1995). To gain confidence the learner must have the will to understand and remember methods learned and relate them in appropriate ways so as to gain confidence (Kilpatrick, 2001).

Majority of respondents mentioned that their roles in relation to their families changed with the introduction of Maths Literacy. They became more involved in finance.

More than 30% of the respondents mentioned that their inability sometimes to understand content and context was because of the lack of understanding language. Respondents highlighted having shared ideas which helped understand ML and boosted their self-confidence. To develop confidence in Mathematics is to provide ML in a real context (Renga and Dalla 1993) reported that learners base their

confidence in themselves on the way that teachers perceive them and they try to find the various experiences and the feedback that they get to suit this perception.

4.9 HELPFUL MATHEMATICS

Mathematical Literacy was perceived as helpful by respondents because they mentioned that it helps to solve real-life problems that learners experience. Learners are able to understand numbers based on practical things. It helps them to assist their families and parents when banking and also helps in budgeting. It was perceived as helpful as it is integrated to what they learn in other learning areas related to business like Accounting, Economics and Business Studies, and this is connected or linked to what they do and know in real life situations. Positive experiences of ML related to experiences of spaces opened up for learning through enhanced opportunities for communication, participation and understanding, both inside and outside the school.

4.10 ADDITIONAL COMMENTS

Interviewer: Do you have any additional information about the above discussion?

a) Mathematical literacy as job related subject

Learners perceived Mathematical Literacy as a job related and useful subject in that everybody is able to "do some kind of maths" and it helped them to know or manage their finances (banking, building).

They also had fears about access to tertiary level education whether maths literacy is going to be useful with regard to maths related subjects at this level if one has chosen Mathematical Literacy at high school.

On the positive side, learners saw Mathematical Literacy as being useful for their future as they will be able to be entrepreneurs and will be able to get good jobs. Learners see Mathematical Literacy as a learning area that will open up doors for them as they felt that by being taught and learning about space, shape and measurement in real-life contexts they will be able to be self-employed. This, therefore, showed that Mathematical Literacy is talking about everyday Mathematics. Mathematical Literacy is maths that is used everyday about things that surround us.

Referring to learners' fear of career opportunities, one of the Critical and Developmental Outcomes of Mathematical Literacy (DoE, 2003) is to enable learners to explore the importance of Mathematical Literacy for career opportunities and to realise that Mathematical Literacy contributes to entrepreneurial success. It is therefore the teachers' responsibility to help learners to have confidence in mathematical literacy and develop the skill and ability to see the need that Mathematical Literacy will bring in the future career opportunities.

The majority of learners doing Maths Literacy did not have the mathematical pre-knowledge required by the Grade 10 Mathematical Literacy curriculum. The majority of learners taking Mathematical Literacy either failed Maths in grade 9 or they were placed in the class as new learners with a history of very low attainment in maths. This results in the learners struggling with the mathematical knowledge content.

b) Lack of resources was cited as a challenge

One of the challenges mentioned with regard to instructional material was the choice of textbooks that were not predetermined, which was a result of shortage of sample copies sent by the various publishers. The shortage of textbooks can result in the learners spending a lot of time copying exercises and questions from the textbooks rather than using the time to engage with their teacher in the requirements of the day's lesson.

For students to be able to compete in today's and tomorrow's economy, they need to be able to adapt the knowledge they are acquiring, learn new concepts and skills, and view mathematics as a useful tool that must be constantly sharpened. That is, they need to be mathematically proficient (Kilpatrick, Swafford and Findell, 2001).

4.11 **DOCUMENT ANALYSIS**

In analysing documents Sanghera (1999) posited that, for interpretivists, documents (minutes, news, school reports) are representatives of practical requirements and constructed for that purpose, that is, as a source of information. According to Sanghera (1999), in this contexts, documents are seen as 'accomplishments' that construct what happened, based on a form of practical reasoning that renders the social order accountable and comprehensive, and is also open to negotiation and manipulation. In documents that were analysed, that is, their books where they write class-works, home-works and evaluation tests, I found that what they perceived as Mathematical Literacy being an "easy" subject was not reflected in their books. In some of their written work there were wrong answers and achievement of marks below 50%. (see Appendix D sample of written test)

Learners were able to say that Mathematical Literacy is "easy" maths but for some who indicated "ilula"(meaning easy), that was not reflected in their books when I analysed their books as part of doing document analysis, trying to compare what they were saying to what they have obtained in their evaluation tasks. Inclusion of context makes Mathematical Literacy to be easy to understand as it relates to everyday life situations. In general, learners had positive perceptions about Mathematical Literacy as a subject and perceived it to be easy.

What I observed in learners' books in their responses to the different activities, is that learners' competency in English is at very low levels. The fact that these learners come from disadvantaged communities and that they seldom or hardly use the English language in their homes, might be a contributing factor.

When looking at the books that learners use as resource material (textbooks), I found that in all three schools, learners use different books as their textbooks. In school B and C, because of the shortage of these textbooks, they copy some activities for homework from the board. For class work activities, they share books.

Activities are done on a daily basis and are marked. What I noticed was that their performance in their evaluation tasks were not according to what they responded as they mentioned Mathematical Literacy to be an "easy" maths. The content of learning was followed as per the National Curriculum Statement (NCS) document. During evaluation Learning Outcomes (LO's) and Assessment Standards (AS's) were followed. Activities were also taken from a range of sources like newspapers, electricity bills, bank deposit slips and withdrawal slips and other life related

activities. At times the learners themselves had to mark their activities because of large numbers.

4.12 Implications of the learners' perceptions of Mathematical Literacy

i) Understanding of Mathematical Literacy

Learners had different views about understanding of Mathematical Literacy. They said they understand that it is about mathematics in words. They voiced that by learning Mathematical Literacy, they have also gained and understanding of English and are also able to integrate Mathematical Literacy with other learning areas, like Geography, Economic and Accounting.

ii) Perceptions of Mathematical Literacy

They perceive Mathematical Literacy as mathematics in context as they related it to real life situations. They perceived it as a helpful subject something that improved and boosted their self confidence. Some of the points for understanding Mathematical Literacy were related to how they perceived it.

iii) Advantages and challenges

A sense of enjoyment as well as interesting comments relating to liking, loving Mathematical Literacy in contrast to prior experiences in mathematics was mentioned. Mathematical Literacy has developed confidence and competence as a result it has boosted their self-esteem as they are able to gain more marks than mathematics. One of the challenges was that when learning Mathematical Literacy, they, misinterpreted some questions because of their background and their poor proficiency in English. Paper 2 was perceived as difficult than paper 1 especially the formula on future value. Some learners were experiencing difficulty

in substituting the values. There was also a challenge of being forced to do Mathematical Language because of underperforming in maths.

4.13 CONCLUSION

This chapter presented the findings of the research study about learners' perceptions of Mathematical Literacy. These findings are categorised according to themes related to the research questions. These findings are used to develop recommendations and strategies that will be helpful in the teaching and learning of Mathematical Literacy. The next chapter deals with the conclusions and recommendations.

CHAPTER 5

SUMMARY, RECOMMENDATIONS AND CONCLUSION

5.1 INTRODUCTION

This chapter presents the summary of the findings about the conclusions and the recommendations. The findings of this study are based on the research questions that were asked and stated in chapter 1.

5.2 SUMMARY OF THE RESEARCH FINDINGS

The aim of the study was to explore learners' perceptions of Mathematical Literacy based on the research questions mentioned in chapter 1. The results of the study indicate that learners share different perceptions of Mathematical Literacy. More than 50% of the participants did not clearly know and understand what the definition of Mathematical Literacy is as it is presented as practically as possibly by including the context in their real life situations.

According to the DoE (2003) Mathematical Literacy is defined as "a subject driven by life-related applications of Mathematics. It enables learners to develop the ability and confidence to think numerically and spatially in order to interpret and critically analyse everyday situations and to solve problems."

Although learners had no clear definition of Mathematical Literacy the study has revealed positive and negative perceptions of Mathematical Literacy. The learners noted that by learning Mathematical Literacy they are able to be critical, confident and take an independent stance about issues which affect them, which is precisely

the kind of thinking that the Mathematical Literacy curriculum seeks to develop. The NCS for Grade (10-12) policy document (DoE, 2003, p.2-4) encourages a "learner-centred and activity based approach to education," and the development of "high knowledge and skills", requires the "empowerment of those sections of the population who are previously disempowered by a lack of knowledge and skills" and it "seeks to create a life-long learner who is confident and independent with the ability to participate in society as a critical and active citizen.

The learners felt that Mathematical Literacy was going to provide them with the opportunities to be entrepreneurs of tomorrow and be able to make decisions like helping parents make financially sound decisions. Learners perceived Mathematical Literacy as helping them make financially s[illegible]choices, giving them skills that help them even beyond the classroom, something that has boosted their self-confidence and self-esteem. A need was emphasised for the integration of Mathematical Literacy with other learning areas that they are doing.

Learners have the perception that Mathematical Literacy should be taught as they felt that now they have the opportunity of being involved in some kind of Mathematics. They perceive Mathematical Literacy as both being a skill, a competence and a subject of study.

From the learners' perceptions there is a need to change the negative attitude and perceptions of those (learners, teachers and parents) that see Mathematical Literacy as an inferior subject. This would be done by involving all those involved in educating them to stress the importance of Mathematical Literacy in the future

careers of learners. The Department of Education should advocate and intervene by changing the negative perceptions about Mathematical Literacy, and especially discourage teachers not to show their negative attitudes to Mathematical Literacy as they are the ones who can be influential on those learners who have doubts about the subject.

Learners expressed a strong feeling that appraisals by the teachers motivated and boosted the learners' self-confidence. As a result, those who had low self-esteem when doing pure Mathematics perceived Mathematical Literacy to be a learning area that boosted their self-esteem. Bandura (1986) maintains that self-efficacy beliefs provide the foundation for human motivation, well-being and personal accomplishment.

Feedback by teachers was perceived by learners as something that can be used to improve and boost their self-confidence. It is in line with one of the recommendations pointed out by Julie and Mbekwa (2005, p.1) that the teacher's feedback is vital to help build up homework, class test and controlled monthly tests. Julie and Mbekwa (2005,p.1) further mention that an essential tool that can be used to improve learners' Mathematical skills is for educators to use effective feedback to elicit learners' understanding and expectations of teacher assessment feedback. Background knowledge of and a good foundation in Mathematics are and still remain pre-requisites for the acquisition of Mathematical Literacy.

It seems that, although previous studies (Snowman *et al.*, 2009) showed that in pure Mathematics boys performed better than girls, this study showed that with

Mathematical Literacy the performance of both boys and girls is the same. Both male and female participants showed an enjoyment and liking of doing Mathematical Literacy. According to Bandura (1986), self-efficacy beliefs provide the foundation for human motivation, well-being and personal accomplishment. The NCTM Principle (2000) states "Excellent Mathematic education requires equity, high expectations and strong support for all students."

From this study, it is found that learners developed an understanding that Mathematical Literacy is linked to different learning areas that they do at school as they were able to identify this relationship with different learning areas, Geography, Business Studies, Economics and Accounting were mentioned during the interviews and integration is emphasised within and across subjects and fields of teaching (DoE,2003). It is mentioned (DoE 2003) that the integration of knowledge and skills across subjects and terrains of practice is crucial for achieving applied competence.

Language remains the barrier to understanding Mathematical learning and teaching. More than 50% of the participants did indicate gaining and learning new vocabulary and about 30% agreed that they experienced some difficulty in understanding some of the concepts used in Mathematical Literacy, as a result of which they sometimes gave or had alternative meanings for certain Mathematical Literacy words. This is reflected in literature by Mbekwa (2006) and Osborn *et. al.* who claim that language is an important tool for exchanging ideas and concepts and it is used to communicate to understand Mathematical facts, concepts and principles, and for problem solving. They understand Mathematical Literacy better when it is used in everyday real life situations that they know.

Teachers and parents played a role in motivating learners to choose Mathematical Literacy as their subject, especially those who were achieving poorly in pure Mathematics. They described their teachers as being patient and understanding during the tuition process and they helped them to work in groups and this boosted their confidence when calculations were done as they obtained better marks in Mathematical Literacy.

Although more than 50% of their parents knew nothing about Mathematical Literacy, they motivated learners to take the subject of their choice. Learners showed a high level of enjoyment of Mathematical Literacy because it is about real life situations and the things they know and also it played a role in boosting their confidence, self-efficacy and self-esteem.

5.3 IMPLICATIONS FOR TEACHING MATHEMATICAL LITERACY

In this section I present a reflective analysis of the implications of my findings on learners' perceptions of Mathematical Literacy.

a) Learners

As seen from the summary of the findings, there were negative and positive views among the learners about the newly introduced subject. The positive feelings augur well for the subject and all stakeholders involved in the teaching and learning of Mathematical Literacy should try to address the concerns raised by the learners.

The learners are of the view that Mathematical Literacy is an easy subject compared to mathematics. It also gives them a feeling that they are able to attempt and solve

mathematical problems affecting their daily lives. This, according to the learners, has boosted their self- concept and confidence level.

b) Teachers

Teachers should try to sustain this positive feeling among the learners so that the students will perform better in the subjects to have better success rate in the subject. Teachers can do this as suggested by Probst (1984) by making sure that the teaching atmosphere in the classroom is in a non-threatening mode, conducive, non-competitive and thought provoking, thus allowing learners to enjoy the lesson that is going on. Rawnley and Fisher (1998) also suggest that the learning environment created by the teacher can make learning Mathematics/ Mathematical Literacy (*my addition*) enjoyable and make learners feel valued if it is an encouraging one. The fact that the learners acknowledged the support given by their teachers in making them understand concepts and solve problems in Mathematical Literacy should be encouraging to teachers to continue with further support. Mathematical Literacy teachers should continually structure it and support the learners through linking its teaching with real-life contexts as suggested by the Department of Education (2003). The challenge for the Mathematical Literacy teachers, as suggested by the DoE (2006) is to use situations or contexts to reveal the underlying mathematics while simultaneously using the mathematics to make sense of situations or contexts, and in so doing develop in their learners the habits or attributes of a Mathematically Literate person (DoE, 2006).

To best prepare learners to be mathematically proficient for the highly quantitative real world of business, teachers need help in creating authentic, complex problems that integrate Mathematics, research, technology and communication skills.

Kilpatrick *et.al.* (2001) assert that to help learners acquire Mathematical proficiency, there is a need for institutional programmes that will address all the five strands as mentioned in the previous chapters. They further claim that proficiency in Mathematics should enable learners to cope with the mathematical challenges of daily life and to continue the study of Mathematics in high school and beyond. Thus, in general, this conception of mathematical proficiency seems to emphasise and express the claim that valuing of Mathematics should be a precondition for the development of Mathematical Literacy.

c) Documents

Students need interesting and practical examples to make it abundantly clear that mathematics skills are applicable in the real world. Textbooks should include fun mathematical activities that motivate learners to enjoy Mathematical Literacy and promote this by integrating Mathematical concepts and skills with other subjects. Children will learn more mathematics when it is made as enjoyable as possible. This occurs, generally, when children work with objects, play games, complete projects, and relate mathematics to real-life situations (Schminke, Maertens and Arnold, 1978)

In many instances, students who have traditionally struggled in Mathematics have been "labelled" and are not challenged to meet high standards. Teachers must maintain high expectations for these students and provide encouragement to augment alternative teaching strategies that should be employed. Similarly, gifted students must be provided with enrichment so that they are actively engaged and challenged mathematically (NCTM, 2000). Learners must be exposed to both content and context in real life, as suggested by the DoE (2003), to facilitate learning and understanding of mathematical concepts. Teachers should, therefore, ensure

that context is used in association with content. Graven and Venkatakrisnan (2006) showed that teachers had the perception that Mathematical Literacy was meant for those learners who failed Mathematics. In helping learners understand and promote confidence to know Mathematical Literacy, teachers need to undergo on-going professional support that will help them to experience for themselves how teaching for the development of Mathematical Literacy is like.

In a previous research study, Madongo (2007) mentions that most of the participating teachers complained about not having been adequately trained for the teaching of Mathematical Literacy, and thus they did not have ideas on how to deliver it in the context of the FET classroom. Training would also help teachers to be confident to teach Mathematical Literacy as some of them are teaching Mathematical Literacy without having training or the qualifications to do so. Few teachers were trained when the subject was newly introduced. Now as a result of the increasing number of learners doing ML, untrained teachers have to teach ML. This implies that Government needs to reconsider its position for further development of Mathematical Literacy teachers. The Department of Education in conjunction with Higher Education Institutions should do advocacy by offering more programmes to help teachers embark on Mathematical Literacy learning as there is still a shortage of qualified teachers in the subject and more learners registering for this subject. They should also consider the issue of the learning material to be provided for learners as one of the issues raised by the learners was the shortage of resources such as textbooks.

Parents and teachers were not aware of ML and were not informed of it before it was introduced to get their own perceptions about it. Parents also need to be enlightened about the implications of a learner choosing Mathematical Literacy as more than 50% of participants indicated that their parents do not yet clearly know what Mathematical Literacy is, so as to let go of their fears of the unknown which is mainly due to lack of information. Posamentier and Jaye (2006) believe that parents exert a more powerful and more direct effect than teachers on children's attitude towards Mathematics. It suggests that parents would play a role in changing their children's attitude in choosing Mathematical Literacy. Teachers' perceptions that Mathematical Literacy is a low grade, inferior subject could be changed by conducting workshops for them. Learners should make their own choices so that being forced to make a choice should not lead to negative performance in Mathematical Literacy. The negative perceptions about Mathematical Literacy where it is labelled by using words like "inferior, "low grade", and "easy" mathematics imply that other people will not be interested to do it. There is, therefore, a need to change the negative perceptions about Mathematical Literacy by creating awareness of it and by stressing its importance by organizing advocacy campaigns for parents, teachers and even learners.

Language was also mentioned as a challenge when learning ML. This implies that there is also a challenge regarding language literacy and needs to be taken into account. Writers of textbooks and other learning materials should consider using simple and appropriate levels of language to explain the everyday life phenomena related to mathematical concepts in order to motivate learners to understand better. A lot of confidence and morale boosting needs to take place in Mathematical Literacy

classes where Mathematical Literacy is labelled negatively by some learners due to their poor language skills. This might help students to overcome notions that they are mathematically stupid and that Mathematical Literacy is inferior and low maths. When looking through the learners' documents, that is, their books, I noticed that what the learners were saying about their performance in Mathematical Literacy was, it was not the same in their documents. This implies that something needs to be taken note of to help them with their performance.

5.4 LIMITATIONS OF THE STUDY

This study was a qualitative case study in which the researcher investigated learners' perceptions of Mathematical Literacy with a small group of grade 10, 11 and 12 learners in three selected high schools in the East London District of Mdantsane. The findings of this study cannot be generalized as it was conducted with a very small group. As a Mathematical Literacy teacher my personal views also might have influenced my interpretation of the learners' responses, even though I tried my utmost to be as objective and neutral as possible.

5.5 RECOMMENDATIONS FOR FURTHER STUDIES

This study, as stated earlier, used a small population and therefore should not be generalized on all the learners doing Mathematical Literacy. The research was conducted only from high schools which are close to each other in one township. This, therefore, suggests the need for further research on a large scale across the province or the country. Further research could be conducted on the performance of learners in Mathematical Literacy recruited from different schools in Mdantsane or on gender differences amongst learners in Mathematical Literacy. Parents' views on

Mathematical Literacy could be another area for research as the learners indicated that their parents were not clear about what the subject is about.

5.6 CONCLUSION

Learners' responses were that Mathematical Literacy was easy but when I observed their documents they did not reflect what they were saying. Strategies need to be developed to assist learners in the learning of Mathematical Literacy especially those with their poor proficiency in English. The integration of ML with other learning areas should be emphasised so that learners are familiar with the ML concepts used in other learning areas. Essential tools should be used to improve mathematical skills and educators to use effective feedback to elicit learners' understanding and teacher expectations of teacher assessment feedback. Background knowledge of anda good foundation in Mathematics are and still remain a pre-requisite. It must be the choice of learners to do ML to change the negative attitude of those learners who see ML as an inferior subject.

I can conclude by reporting that the research questions used in the study helped me to identify the perceptions of learners about Mathematical Literacy. It gave me an opportunity to understand the learners' views about the subject and the challenges as well as the advantages of learning it. It is my sincere hope that the report will ignite a little fire in the readers to carry out further research in Mathematical Literacy.

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APPENDICES

APPENDIX A : INTERVIEW SCHEDULE:SEMI-STRUCTURED

SECTION A

Date of interview: .....

Time: .....

Venue: ....

Interviewer: Mbatsha Z.

Interviewee: Learner

Age: .....

Gender: .....

Grade: .....

SECTION B

A. PERCEPTIONS OF MATHEMATICAL LITERACY.

1. What do you think is Mathematical Literacy? Give your own definition?

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2. Why do you think Mathematical Literacy should be taught and learnt?

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3. How do your friends perceive Mathematical Literacy?

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B. UNDERSTANDING OF MATHEMATICAL LITERACY

4. What do you know about Mathematical Literacy?

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5. What are the advantages of learning Mathematical Literacy?

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6. What are your views/opinions about what you learn in Mathematical Literacy?

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7. Do you think Mathematical Literacy is important for you? Why?

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C. LIKING/DISLIKING MATHEMATICAL LITERACY

8. Do you like Mathematical Literacy? Why or why not?

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9. What motivated/influenced you to choose Mathematical Literacy as one of your learning areas?

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10. Tell me what your teachers do to motivate you to learn Mathematical Literacy.

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11. What were your parents' reactions about your choosing of Mathematical Literacy?

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12. What can you say about learning Mathematical Literacy in English?

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13. Suppose you have an option not to do Mathematical Literacy, will you still do it? Why or why not?

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14. Do you think Mathematical Literacy teaching and learning should be continued? Why or why not?

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.....15. What challenges do you experience in Mathematical Literacy?

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SECTION C

Do you have any additional information about the above discussion?

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THANK YOU FOR YOUR PARTICIPATION!

University of Fort Hare
Together in Excellence

Appendix B: Letter of Access

P.O.Box 12738
AMALINDA
5252
30 May 2011

The Principal

Dear Sir/Madam

Re: Access for Ms Z. Mbatsha to conduct research in your school

I, Ms Zonke Mbatsha , am registered as an M.Ed student at the University of Fort Hare for the M.Ed programme. Your school has been chosen as one of the schools where my research has to be conducted.

Kindly therefore grant me permission to enable me to conduct research in your school. I would also appreciate if I can be granted permission for the learners to be participants as part of this research as the research is based on learners.

Yours sincerely

Z. Mbatsha

Faculty of Education, SITE

School of Initial Teacher Education
Corner of Fleet and Cambridge Street, East London, 5200
P.O. Box 7426, East London, 5200

University of Fort Hare
Together in Excellence

PABX 7216/7178| Fax: 043- 704 7117 |
Email:chthomas@ufh.ac.za. |

25 May 2011

The District Director
East London District
Eastern Cape Department of Education

PERMISSION TO CONDUCT RESEARCH

Dear Sir/ Madam

Ms. Mbatsha is a registered M. Ed student at Faculty of [redacted]ation, University of Fort Hare. As part of the M. Ed programme she has to submit a research thesis. She intends to research on Learners' Perceptions of Mathematical Literacy. She wants to interview a teacher each from Grades 10, 11 and 12 in three schools in the East London district. The faculty requests you to grant her necessary permission and support to conduct her research in your district. I further request you, as her supervisor, to write letters to the principals and teachers of her chosen schools to allow her to conduct the research and also to support her.

I hope that my request will be granted.

Thank you.

Yours in education

C. Thomas (Supervisor)
Acting Director
School for Initial Teacher Education.
Faculty of Education
University of Fort Hare
East London
043 704 7178

Province of the
EASTERN CAPE
DEPARTMENT OF EDUCATION
EAST LONDON DISTRICT

Dr. WB Rubusana Building * NU 1 Mdantsane* Private Bag X9007 * East London * 5200 * REPUBLIC OF SOUTH AFRICA * Tel: +27 (0)43 708 6208 Fax: +27 (0)43 760 0545 *Website: ecprov.gov.za

Date: 02 June 2011 **ENQUIRIES:** MRS A C ESBEN

The Acting Director
School for Initial Teacher Education
Faculty of Education
University of Fort Hare
EAST LONDON
5201

Dear Sir/Madam

PERMISSION TO CONDUCT RESEARCH IN SOME SCHOOLS IN THE EAST LONDON DISTRICT

Your letter in connection with the abovementioned matter, received on 01 June 2011 has reference.

Permission is hereby granted for **Ms Z Mbatsha** to conduct research in some schools of her choice in the East London District as part of the M.Ed Programme and in order for her to submit a research thesis on Learners' Perception of Mathematical Literacy.

This permission is granted on condition that tuition time is not disrupted and that you obtain the necessary permission from the school principals as well.

We wish you well in your endeavours.

Yours faithfully

W M NGWANYA
DISTRICT DIRECTOR

Appendix C: **CONSENT FORM FOR MS MBATSHA'S RESPONDENTS**

I

.....

..... fully agree that I will be the respondent of Ms Mbatsha's research study. I promise that I will provide her with the necessary information which will be of help to her study. I am fully aware that I will be bound by the ethics of this research exercising confidentiality as required by this study.

Signed at .....on

this.....day

of 2011

Signature of Respondent

.....Date.....

Signature of the researcher

.....Date .....

APPENDIX D: SAMPLE OF RESPONSES

RESEARCH FINDINGS QUESTIONS

The research questions and related objectives are developed and described in chapter 1.
The aim of the study was to investigate the learners' perceptions of the Mathematical Literacy curriculum in three selected high schools in the East London District in Mdantsane. Respondents were selected to have one from each grade in the three selected high schools.
Section A was about the characteristics of respondents according to age, gender and grade. The biographical or characteristics of respondents only served to give information about the respondents that helped to give the nature of learners. The three selected high schools were coded as School A, School B and School C.

SECTION B QUESTIONS

A. PERCEPTIONS OF MATHEMATICAL LITERACY

Question 1

Interviewer: What do you think is mathematical literacy? Can you give your own definition.

A1: It is Mathematics that is different to pure mathematics and it can help.

A2: It is Mathematics that is easy to understand. "yimathselula" (easy maths)

A3: Maths that involves talking, you don't only use numbers but also language.

B1: It is mathematics that teaches a lot about when to buy something, you do not spend a lot on unnecessary things and you are able to save.

B2: it is maths in language, most of the time it allows one to gain an understanding of English.

B3:It is Maths that is easy to understand unlike pure Maths.

C1: It is mathematics that opens mind and involves calculating about things in our real-life situation, we also calculate measurements on school grounds.

C2: It is Mathematics about calculations of interest and budgeting, things that we know.

C3: Subject about maths that needs attention, other people say it is light, **weaker than maths**.

Question 2

Interviewer: Why do you think Mathematical Literacy should be taught and learned?

A1: It helps learners who have difficulty in understanding pure mathematics.

A2: It is better understandable than pure Maths.

A3: Those **who fail** pure maths are able to do mathematical literacy.

B1: It teaches us about mathematics in our daily life situation because we are able to bank, calculate interest, learn about travelling tariffs, use our cell phones whether to have prepaid or contract phones.

B2: It helps people on how to handle money and save for future purposes.

B3: It will help those who are unable to do Maths.

C1: It should be taught because we [illegible] how to measure things like doing plans for houses, building housing, how to paint them, it is going to help us to be entrepreneurs to start our own businesses or get jobs.

C2: When maths literacy is taught we do not only learn about maths but also learn language.

C3:Just like in pure maths in maths literacy we are taught the formula when we calculate areas, volume, etc. but unlike pure maths in maths literacy we are given the formula when we write test. If you don't practice the formula you struggle to apply values.

QUESTION 3

Interviewer: How do your friends perceive mathematical literacy?

A1: They say it's easy maths. They undermine it saying it is like Maths in grade 3. "Bayithathelaphantsi, sibala ama-apile"

Interviewer: Why do you think they say "yeyama-apile"?

A1: May be it is because most of the time when they come upon maths literacy exercises apples and oranges are used.

A2: They see us as "stupid", but if I give them the maths literacy question paper they are unable to calculate to solve the questions. They encounter some difficulties because Maths Literacy is not "easy maths" like they say.

A3: Mathematical Literacy is too much English.

B1: They say those who choose Maths Literacy will not get jobs "ayityisi." (meaning that it will not allow one to have something to "eat" food on the table or work)

They say those who choose Maths Literacy will experience some difficulty to choose courses at university.

B2: They say it's "inferior maths."

B3: They say it's "low maths."

C1: They say careers for those who choose Maths Literacy are scarce.

C2: They say Maths Literacy is mathematics that talks using numbers.

C3: They say it is waste of time, "ilula"(easy maths).

Theme: Easy Maths

Question 4

Interviewer: What do you know about Mathematical Literacy?

A1: I know a lot of things about Mathematical Literacy, not only calculation but also English in maths.

A2: I know that it is a learning area having maths "ifikeleleka kuye wonke umntu." (trying to say anybody can be able to do it).

A3: In Mathematical Literacy we are engaged in calculating and solving problems in that we read paragraphs and try to write what we read in a form of numbers.

B1: Mathematical Literacy is about numbers and language about maths.

B2: It is easy mathematics.

B3: It is what we did in pure mathematics but is more talking than Mathematics we used to do.

C1:Mathematical Literacy is mathematics with too much English other words we know others are difficult to understand.

C2: It is mathematics that I enjoy and like because it is about things I know and see.

C3:It is maths that is better to understand than pure mathematics, we do things that are real in other subjects.

Question 5

Interviewer: What are the advantages of learning Mathematical Literacy?

A2: I am able to learn a lot of things like what is meant by budgeting for the financial tax year.

A1: I have learnt a lot of English vocabulary terms that are used in mathematical literacy that I have never heard before.

A3: Maths Literacy will help to be able to deal with numbers in future when we work.

B1: It helps when one needs to borrow loan or invest money to be able to calculate interest.

B2: I have learnt to make financial decisions and how to save money. It saves from hiring people to do simple calculations or jobs.

B3: It teaches about how to borrow money

C1: It helps to manage things

C2: It gives one skills, to be able to measure and do tiling, painting, building and other types of work.

C3: It helps to know how to measure and build a house.

Interviewer: Do you think Mathematical Literacy is important for you? Why?

A1: Yes, very much important, it is not only about how to calculate, it is also about learning English vocabulary. 'I also learn about conversions, maps, distance, speed, grid things that we also do in Geography.

A2: In Mathematical Literacy we learn what we do in other subjects like Accounting, Business Studies.

A3: Yes, it is important it is going to help me be an entrepreneur.

B1: It is based on the things we do everyday. Things that we hear from the media, budgeting, tax, exchange rates.

B2: Mathematical literacy is important because I am able to be confident about my calculations unlike mathematics I was doing.

B3:It is important it is about thing we do everyday and we are able to help our families with calculating other things and doing budgeting.

C1: It is important because it is going to help me when I want to do business and want to borrow capital at the bank.

C2: It is helpful and it is going to help us in the future as our teacher told us when we chose it.

C3:It is important especially if we will be able to do it at tertiary with other courses.

B. LIKING/DISLIKING MATHEMATICAL LITERACY

Question 8

Interviewer A: Do you like Mathematical Literacy? Or not? Why?

A1: I like it because there is not **trigonometry** that is boring like in pure mathematics.

AI: like it because I always pass it , it is not so tricky like mathematics.

A2: I like it because it is a subject that does not take long to understand as long as I practice it daily.

A3: I like it because you don't solve a lot of x's and y's.

B1: I like it because I perform good, always score high marks.

B3: Yes, I like it because it is about mathematics that we do everyday.

C1: I like it because there are **no difficult formulas** like in pure maths and formulas are always given as long as you understand them you don't waste time thinking of the formula, you just apply numbers.

C2: No. I don't like it because I was **forced** to do it. I came from another school and wanted to take Geography. The class for Geography is the same class for Mathematical Literacy. I wanted to take pure mathematics.

C3: It is not complicated like maths.

Question 9

Interviewer: What motivated/influenced you to choose Mathematical Literacy as one of your learning areas?

B3:It was my own decision.

C3. I saw it from the other learners who did it and wanted to know about it and I saw that it is going to be perfect for me.

B1: I wanted to do pure maths but I failed it and was taken to a class of Mathematical Literacy.

A1: Since I am doing commerce subjects, I realised that it will be the right maths for me to do as I also want to be an entrepreneur and start my own business.

A2: From what I saw in Maths Literacy books I developed a liking for it.

A3: My teacher and my friends motivated me when I asked them about it.

B2: I was motivated by what I saw from my sister's book that now they obtain high marks in mathematical literacy unlike pure mathematics.

C2: My parents motivated me to take it saying that maybe I will be able to perform better.

C3: Nobody motivated me I just thought I would choose something different from pure mathematics.

Question 10

Interviewer: **Tell me what your teachers do to motivate you to learn mathematical literacy.**

A1: I wanted to do History because I like it and if you do Geography you have to do maths literacy – there is only one class for Geography and Maths Literacy.

A2: Although I wanted to change to pure maths as one of my learning areas in grade 11, the teacher in grade 10 in maths lit. was very supportive if we did

not understand. He tried to use other ways to make us know, giving several activities related to everyday experiences.

B1: My teacher saw that I experienced difficulty in pure mathematics and convinced me to take maths literacy.

C1: My teacher at the school I attended in Cape Town has an influence in my choice because of my performance in the previous grade I got high marks in Mathematical Literacy.

Other learners: Teacher had no influence, it was my own choice.

Question 11

Interviewer: What were your parents' reactions about your choosing of Mathematical Literacy?

A1: My parents did not react badly. They only asked if it was not going to be difficult. I told them I had no choice it is either pure maths or maths literacy.

A2: My parents were supportive encouraged me to study, do more practice.

A3: My parents did not want me to choose Maths Literacy because they said I will have a problem at tertiary, saying that most courses that give job quickly need one to have maths not Maths Literacy.

B1: I made my own decision. My parents had no problem since they do not know Mathematical Literacy.

B2: My parents motivated and encouraged me saying that it is going to help me in the long run.

B3: They motivated me to choose whatever I am comfortable.

C1: My parent was not happy, saying that it's a subject for lazy people.

C2: Parents said it's ok as long as it is something I like and will pass but did not know anything about Maths Literacy.

C3: They were not aware of the difference between the two choices, that maths and Maths Literacy.

Question 12

Interviewer: What can you say about learning Mathematical Literacy in English?

A1: I do not have a problem, I understand it as it is taught in English.

A2: I learn more English vocabulary. It would be difficult if not taught in English because I saw maths words in Xhosa when I was doing grade 9 and they were difficult to understand.

A3: English helped me to learn new words. In pure maths there are less word and mostly numbers.

B1: Sometimes I experience problems in understanding the words then I have to guess what the question asks. Sometimes I just look at the numbers then calculate.

B2: I get more knowledge and more information in English.

B3: I realise that most of the time to understand Maths Literacy one must be able to understand English

C1: Sometimes I do experience some problems in understanding certain terms and assume that the question ... on what I think.

C2: Teacher always explain in class thinking I understand the question but struggle when doing questions on my own.

C3: It becomes difficult to understand question at times and I tend to confuse what is asked.

QUESTION 13

Interviewer: Suppose you have an option not to do Mathematical Literacy, will you still do it? Why or why not?

A1: I would choose to do it, because I like it better than pure Maths and I get better marks than I used to get in pure Maths.

A2: I would do Maths Literacy as it is about practical and real issues.

A3: I would choose Maths Literacy. It helps me to understand other learning areas more, like in Geography we do maps and grids like in Maths Literacy.

B1: I would go for Maths Literacy, almost everything involves maths like the maths in Mathematical Literacy.

B2: Maths Literacy because it's about important things, it opens up my mind, how to choose to invest, use of cell phones, etc.

B3: Yes I would choose it, it's good to learn it as it teaches about the real life things, now I don't have problem choosing how to invest in the bank.

B3: I would do Maths Literacy, it's a nice subject I enjoy learning something dealing with real issues.

C1: Maths Literacy, it also helps to learn more English because it is more of talking maths.

C2: I would go for Maths Literacy because it helps to have an alternative option of doing maths.

C3: Yes I would do Maths Literacy as it helps in decision making in real life situation.

14. Do you think Mathematical Literacy teaching should be continued or not? Why or why not?

Responses to question 14 were similar with those in 13, all responses were for the continuation of Mathematical Literacy reasons given were the same as in question 13.

Question 15.

Interviewer: What challenges do you experience in Mathematical Literacy?

A1: Language is a challenge if one is experiencing difficulty in English because Maths Literacy has more English words than pure Maths.

A2: Paper 2 is always a challenge, it is too tricky.

A3: Taxation in paper 2, how to calculate future value, that formula on future value.

B1: People take it for granted, it is not easy it needs time.

B2: Learning shapes, areas and volumes, a little bit confusing, there are those difficult questions, especially in paper 2.

B3: In paper 2, taxation is a little bit confusing.

C1: Some formulas in volume and area at times they look similar.

C2: Paper 2 is always a problem, I get less marks than in paper 1, they ask difficult questions.

C3: The part in calculating future value is the problem, it is not easy to follow, it needs more practice.

Additional Information;
Learners asked questions on careers and job related.
Learners also asked the way Mathematical Literacy is taught if it is going to help choose a career or help at tertiary, especially for those who want to do Bachelor of Commerce.

TABLE : Percentage of learner perceptions on different aspects of ML

Enjoying Mathematical Literacy	**6 learners/More than 50%**
Happy and confident, help to learn new language.	**6 learners/More than 50%**
Inability to understand content and context(language) Experience difficulty in understanding some concepts	**3 learners/30%**
Did not know the definition of what Mathematical literacy is	**6 learners/More than 50%**
Gaining new vocabulary and new language	**7 learners/50%**
Parents new nothing about Mathematical Literacy	**6 learners/50%**