EXPLORING TEACHERS' INTERPRETATIONS AND IMPLEMENTATIONS OF THE INTENDED MATHEMATICAL LITERACY CURRICULUM

THEMBA M MTHETHWA
0617649w

A thesis submitted to the School of Science Education in the Faculty of Humanities, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Doctor of Philosophy.

Johannesburg, September 2013
Supervisor: Prof. Mellony Graven

DECLARATION

I declare that this thesis is my own unaided work. It is being submitted to the University of the Witwatersrand, Johannesburg, for the degree of Doctor of Philosophy. It has not been previously submitted to any other institution for any degree or examination.

Themba M Mthethwa

14 March 2014

ABSTRACT

This study aims at investigating the question: How do Mathematical Literacy (ML) teachers interpret, experience and implement the intended Mathematical Literacy curriculum in Grades 10 – 12? The study draws from a socio-cultural perspective to analyse the ML Curriculum and teachers' interpretations of the ML curriculum. It draws largely from Basil Bernstein's (1975; 1982; 1996) framework of knowledge system and the Third International Mathematics and Science Study (TIMSS) (1996) framework of curriculum analysis.

The study consists of three phases: The first phase involved 60 teachers across schools in the East London (Eastern Cape) district of South Africa. The teachers' views and experiences of Mathematical Literacy, as expressed in questionnaires, were analysed, using the Statistical Package for Social Sciences (SPSS) programme. In the second phase, seven teachers were purposefully selected for interviews from the sixty teachers who had participated in the first phase. The third phase involved consecutive lesson observations with two teachers selected from the seven teachers who had participated in the second phase.

Results show that teachers have different views and understandings of the Mathematical Literacy curriculum, and also have different ways of implementing the subject. Teachers' mathematical backgrounds were found to have a great influence on how teachers implement Mathematical Literacy. The study illuminates connections and disconnections between the intended curriculum and the implemented curriculum, and furthermore shows that teachers' interpretations and recontextualisations of the intended curriculum in classroom contexts are key to the nature of the curriculum that is implemented. The study explores five important areas which relate to how teachers interpret, experience and implement Mathematical Literacy. These areas are: (i) Teacher Knowledge; (ii) Teaching and Learning of Mathematical Literacy; (iii) Recontextualising and reproducing the curriculum; (iv) Mathematisation in Mathematical Literacy and (v) Content and contexts of Mathematical Literacy. The study concludes with recommendations for classroom practice and for further research.

DEDICATION

To

I dedicate this to my wife Sonto, my mother Daisy Mthethwa, my brothers
Nkosinathi and Josef
and my sisters Sibongile and Nonhlanhla

ACKNOWLEDGEMENTS

I acknowledge the very kind assistance and support of:

My Supervisor, Prof. Mellony Graven. Many thanks for your patience and professional guidance during all stages of the study and NRF funding.

The schools at which the research was conducted; where the educators and learners were willing participants.

My family Nomasonto, Josef Mthembu, Sphiwe Vumase, Nathi Mthethwa, Sbongile, Nonhlanhla and Daisy for their encouragement.

My friends, Sir Eckson D Khambule, Mbongiseni Gumede, Themba Dlamini, Khaya Mhlongo, Fanele Ndwandwe, Mthibi Phosa, and Nkanyiso Sibiya for their positive input.

Finally, I thank God who has given me the power and wisdom to do it all.

TABLE OF CONTENTS

APPENDICES

EXCERPTS

FIGURES

TABLES

ACRONYMS

ACE	Advanced Certificate in Education
AS	Assessment Standards
B ED	Bachelor of Education
B Sc	Bachelor of Science
CAPS	Curriculum Assessment Policy Statement
DBE	Department of Basic Education
DOE	Department of Education
FET	Further Education and Training
GET	General Education and Training
HG	Higher Grade
KZN	KwaZulu-Natal
LO	Learning Outcome
LPG	Learning Programme Guideline
ML	Mathematical Literacy
MLMMS	Mathematical Literacy, Mathematics and Mathematical Sciences
NATED	National Education Department
NCS	National Curriculum Statement
NPDE	National Professional Diploma in Education
NSE	Norms and Standard for Educators
OBE	Outcomes Based Education
OECD	Organisation for Economic Co-operation and Development
PhD	Doctor of Philosophy
PISA	Programme for International Student Assessment
RSA	Republic of South Africa
SG	Standard Grade
SPSS	Statistical Package for Social Sciences
STD	Secondary Teachers' Diploma
TIMSS	Third International Mathematics and Science Study

CHAPTER 1

INTRODUCTION TO THE STUDY

This study deals with teachers' interpretations and implementations of the South African Mathematical Literacy curriculum in Grades 10 – 12 (general). In this chapter, I present the statement of the research problem, its purpose and critical questions. The motivation for, and significance of the study, and the definition of key words used in the study, are also discussed. I conclude this chapter with an outline of the chapters for the thesis as a whole.

Statement of the problem

The National Department of Education introduced a new curriculum in the Further Education and Training (FET[1] Band) in 2006. This curriculum is called the National Curriculum Statement (NCS) Grades 10 – 12 (general). Mathematical Literacy is one of the new subjects in the South African FET curriculum. In my experience and involvement in teacher training for Mathematical Literacy, I have observed that teachers who are teaching Mathematical Literacy have varied mathematical histories. Some have a background in Mathematics (i.e. they have studied it post matric in their teaching qualification) and others have no FET or post matric mathematics background (they did not study it in their teaching qualification) but they were re-skilled[2] in order to teach Mathematical Literacy. Both the teachers with a mathematics background and those from re-skilling programmes need to interpret and put into practice this new curriculum. There is much literature that suggests that differences occur between the intended curriculum and the implemented curriculum in South Africa (see: Kelly, 1999; Jansen, 1999a; Potenza and Monyokolo, 1999; Taylor, Muller and Vinjevold, 2003; Aldous, 2004; Vanderyar and Killen, 2007). Notably, little is known about the implementation of the new curriculum in the FET

[1] Grades 10-12

[2] Through departmental workshops (normally one to three weeks) and/or through an Advanced Certificate in Education (ACE in (Mathematics Literacy)) offered by universities (two year course part-time) or Post Graduate Certificate in Education (PGCE) (two year course part-time)

band. The purpose of this study is therefore, to investigate and examine the relationship between the implemented and the intended Mathematical Literacy curriculum. This was envisaged to address the gap in research in relation to this curriculum innovation. The overarching question driving this research was: How do teachers of Mathematical Literacy interpret and implement the intended Mathematical Literacy curriculum?

Critical questions

This study aims to investigate the following critical questions:

(i) What are teachers' interpretations of the intended Mathematical Literacy curriculum?

(ii) What are teachers' experiences of teaching Mathematical Literacy, and how do these experiences influence their practice and interpretation of the Mathematical Literacy curriculum?

(iii) How do teachers' interpretations and implementations of the curriculum depart from, or adhere to, the intended Mathematical Literacy curriculum?

While I explore in this study indications of adherence to and departure from various aspects of the curriculum documentation this should not imply that I consider these as either-or or dichotomous. The view of curriculum as contextualised social process (Cornbleth, 1990) and curriculum documentation as a product of competing forces (Chisholm, 2005) means that the curriculum itself has a range of different messages which often compete but yet exist side by side. Similarly teacher utterances and practices can adhere to one aspect in one respect and depart from it in another. Teacher adherence or departure from aspects of the curriculum, in terms of their view of mathematical literacy will also be influenced by the context in which they are making the utterance or the context in which they are practicing.

In order to engage with these critical questions, I first analysed 'the intended curriculum' as laid down in the official curriculum documents[3] (with specific reference

[3] When the new curriculum was introduced in 2006, the Department of Education developed policy documents for all subjects, called National Curriculum Statements. In addition to the policy statement

to the National Curriculum Statement Mathematical Literacy: the Teacher Guide (2006), the Assessment Guideline document (2008) and the Learning Programme Guideline (LPG) (2005) document). While this was a key contribution to the study, it was not a critical question as such, but it provided the background analysis against which the above critical questions could be addressed. The documents provided a critical contribution in relation to the analysis of the Mathematical Literacy curriculum. The details of this document analysis are presented in Part 2 of Chapter 3.

Motivation for the study

Mathematical Literacy was introduced as a new subject in Grade 10 in 2006, in Grade 11, in 2007 and in Grade 12 in 2008. According to the DoE (2003) the purpose of the inclusion of Mathematical Literacy as a compulsory alternative to Mathematics, as a subject in the FET curriculum, is that it will ensure that South African citizens of the future become highly numerate users of mathematical skills. This purpose of Mathematical Literacy is indeed noteworthy. A question that follows then is: how is the Mathematical Literacy curriculum designed and presented to meet this envisaged purpose? An investigation into the intended and implemented Mathematical Literacy curriculum in this respect is important. It is also important to explore how teachers experience this new subject, and to examine teachers' experiences of its introduction, as both these aspects influence their implementation and influence future implementation. At present, there is little known about the implementation of Mathematical Literacy.

Teachers are at the core of successful implementation of curriculum ideas (Potenza and Monyokolo, 1999; Todd and Mason, 2005). The role played by teachers in curriculum development and implementation is important. The Norms and Standards for Educators in schooling (NSE) policy (DoE, 2000) describes seven roles of educators. One of these roles describes teachers as interpreters and designers of

---

document, supporting documents on topics such as assessment policy, teacher guidance and Learning Programme guidelines were produced.

learning programmes and materials. Teachers are, therefore, acknowledged as curriculum interpreters and agents (Lubisi, Parker and Wedekind, 1998; and Taylor and Vinjevold, 1999). Lubisi et al. (1998) argue that teachers are agents, not just machines that implement instructions that come from above. Lubisi et al. further assert that teachers develop their own understanding of the curriculum as they interpret it in their own way, and do so both consciously and subconsciously.

Substantial evidence from research has shown that teachers have diverse interpretations and understanding of the curriculum (see: Lubisi et al., 1998; Jansen, 1999; Review committee, 2000; Handal and Herrington, 2003; Mthethwa, 2007; Vandeyar and Killen, 2007) and this has both positive and negative effects on teaching and learning (Lubisi et al., 1998). It is therefore at the core of the matter to find out how teachers interpret Mathematical Literacy and to determine the extent to which their interpretations and practices adhere to, or depart from, the intended official curriculum, and to investigate reasons for compliance and departures.

Just as the review of C2005 had a major influence that brought changes to the curriculum (Review Committee, 2000), hopefully this investigation will contribute to reviews of the Mathematical Literacy curriculum, and provide insights for teacher development programmes in Mathematical Literacy.

My role in supporting the implementation of Mathematical Literacy

From my experience and my role as a provincial facilitator (2005) for NCS in KwaZulu-Natal (KZN), I have had interactions with a number of teachers in KZN. Some of these teachers were very passionate about Mathematical Literacy, but some had a lot of misconceptions about Mathematical Literacy. From 2008 to 2010 I was involved in Mathematical Literacy In-service programmes at Fort Hare University. My role as a teacher educator was to teach ACE[4] students (teachers)

Mathematics and Mathematical Literacy courses. My interaction with my Mathematical Literacy student teachers strengthened my resolve to investigate more about teachers' interpretations and understanding of Mathematical Literacy. These teachers had different views and understanding of Mathematical Literacy. Some viewed the role of the Mathematical Literacy curriculum as a blueprint[5] while others viewed it as a document that outlines a learning environment (Lubisi et al., 1998). All these views have inspired me to conduct this study that focuses on teachers' interpretations and implementation of the intended curriculum.

Significance of the study

During this critical period in South Africa, when the education system is undergoing transformation from the old system to the new system, little is known about the success and the future of the newly implemented FET curriculum. In particular, Mathematical Literacy is a radically new subject with no predecessor subject (discussed in the next section). Research plays a considerable role in informing curriculum designers and all those involved: teachers, learners, parents and the public, about the challenges and successes of the intended and implemented curriculum. This study attempted to investigate the implementation and the nature of the way in which the intended Mathematical Literacy curriculum is implemented through investigating teachers' interpretations and experiences. The findings thus provide insights into the strengths and weakness, successes and failures, opportunities, constraints and challenges of the Mathematical Literacy curriculum in FET. The findings from this study also suggest implications for teacher classroom practice, teacher education and further research. The participants in this research

[5] According to Lubisi et al., the 'blueprint' view of the teacher's role is to implement the curriculum the planners' design without questioning it; while the view of the curriculum as a learning environment includes the teacher's role in interpreting the curriculum reflectively, and constructing a suitable learning environment.

project have had the opportunity to reflect on their practice, and to reflect on ways to enhance their practice and understanding of Mathematical Literacy.
Additionally I will:

(i) Hold a voluntary workshop that engages with the findings of this study for participants and non-participating Mathematical Literacy teachers in the broader East London area.

(ii) Offer to share insights with institutions of higher education for teacher education and the National Department of Education. If they wish, they may use the findings and recommendations from this study to help improve and develop their in-service training programmes, so as to meet the challenges faced by teachers in classroom practice.

It is hoped that this study will raise issues that will point to a need for further research, and that the findings of this study will be used as a basis for discussion and argument related to Mathematical Literacy particularly on the role of context and content in Mathematical Literacy.

Definitions of the key terms

To support the reader, the key words used in the title are defined as follows:

Teacher interpretation

Interpretation means teachers' understanding and explanations of the Mathematical Literacy curriculum.

Teacher implementation

Implementation means the way in which teachers say they teach Mathematical Literacy, and the actual way in which teachers teach Mathematical Literacy.

Intended curriculum

Intended curriculum means the official Mathematical Literacy curriculum for Grades 10-12, as prescribed in the Departmental documents.

Mathematical Literacy curriculum

Mathematical Literacy curriculum is the school subject ‘Mathematical Literacy’ taught in Grades 10-12 in senior secondary schools in South Africa.

Outline of chapters

This study consists of nine (9) chapters. These are outlined below as follows:

CHAPTER 1

In Chapter 1 the research problem, purpose statement and critical questions are presented. The motivation for and significance of the study, and definition of key terms, as well as the outline of chapters are presented.

CHAPTER 2

Chapter 2 presents the theoretical framework for the study and the tools for data analysis.

CHAPTER 3

In Chapter 3 a comprehensive literature and curriculum documents review is presented. This chapter is presented in two parts. The first part is a review of studies in Mathematical Literacy, both nationally and internationally. The second part of this chapter presents an analysis of Mathematical Literacy curriculum policy documents.

CHAPTER 4

Chapter 4 describes the research design of this study (Part 1) and the research process (Part 2). The different stages of the research project from 2008 to 2013 are presented. Research methods for data collection are introduced. The relationship between the research questions and the research methods used to address the specific questions is discussed.

CHAPTER 5

In Chapter 5 the first of the three phases of data analysis derived from questionnaires is presented in two parts. These parts deal with quantitative data and qualitative data respectively. Analyses of the interviews and classroom observation are presented in Chapters 6 and 7.

CHAPTER 6

In Chapter 6, data analysis of the interviews of the seven participants is presented, followed by typological and inductive analyses of the interviews.

CHAPTER 7

Chapter 7 presents analyses of the lessons observed, of the two Mathematical Literacy teachers. The chapter ends with a summary of the three phases of data analysis.

CHAPTER 8

Chapter 8 presents the results and discussion of the findings. The chapter has two parts. Part 1 presents the key findings of the study from all three data sources discussed in the three previous chapters (questionnaires, interviews and lesson observations). Part 1 also relates directly to the research questions, and Part 2 raises five key areas for further discussion.

CHAPTER 9

Chapter 9 concludes the study by presenting conclusions and recommendations for classroom practice, Mathematical Literacy teacher education, and further research avenues. Contributions to the study of mathematics education are also presented.

CHAPTER 2

THEORETICAL FRAMEWORK

We don't see things as they are; we see them as we are ~ Anaïs Nin[6]

Introduction

In the previous chapter I presented the introduction to the study. In this chapter the theoretical perspectives underpinning this study and the tools for data analysis are presented.

Theoretical framework

In this study curriculum is viewed as contextualised social process (Cornbleth, 1990). Curriculum documentation provides insight to what is intended. The curriculum is itself a social construction - the product of competing perspectives. As Chisholm (2005:193) points out, since different lobbies, voices and interests construct and interpret the curriculum 'a neat translation between interests and curriculum outcomes is not possible'. Since in this study I explore the complex relationship between the intended and the implemented curriculum – with a specific focus on the way in which the promotion of real life contexts in the curriculum are interpreted and implemented by teachers- I found it useful to draw on Taylor's (1999; 2003) outline of the curriculum process as an adaptation of the framework of the Intended; Implemented, and Attained curriculum. (This is adapted from Schmidt et al.'s (1997) use of the framework in their cross-national investigation of curriculum intentions in school mathematics). Similar to Taylor (1999) I work from the assumption that even ‘while school level actors, and teachers in particular, always reinterpret policy, effectively remaking it a curriculum framework and its related documents (set) the agenda from the main business of the schooling system: teaching and learning'

[6] French born American Author of novels and short stories, 1903-1977

(p.107).

As such I will begin my research with a thorough documentary analysis of various curriculum documents and through this will highlight various competing perspectives and possible coherence and contradictions between various aspects which almost inevitably arise from the social context of diverse (often competing) interests from which they emerge. This coheres with the interpretevist perspective I take in the research and in the interpretation of teacher data of their interpretations and implementation of the curriculum.

For the theoretical framework I have drawn on a socio-cultural perspective to analyse the Mathematical Literacy curriculum and the teachers' interpretations of this curriculum, with special reference to the intended and implemented curriculum. I have largely drawn from Bernstein (1971; 1975; 1982; 1996) and the Third International Mathematics and Science Study (TIMSS) (1996) framework[7] of curriculum analysis. Firstly, I present key concepts in the TIMSS framework and Bernstein's framework. Secondly, I elaborate on the connection between the TIMSS framework and Bernstein's framework. Thirdly, I justify the relevance of these two frameworks in the present study. Finally, I explore the mathematics orientations as identified by Graven (2002) and four pedagogic agendas for Mathematical Literacy, as identified by Graven and Venkat (2007) and argue why these provide useful analytical tools for this study.

An interpretive perspective is taken in relation to investigating teacher interpretations and implementaion of the newly introduced subject Mathematical Literacy. Since the implementation of this subject was new for teachers in this study, the curriculum (as a contextualised social process that includes the production of curriculum documents and support materials) form a critical part of the social context that in which the teachers actively make sense of the curriculum and make decsisions about how to teach the subject in their classrooms. For this reason beginning with an analysis of the curriculum is essential.

[7] Adapted from Schmidt, W. H., McKnight, Curtis, C., Valverde, R., Gilbert, A., Houang, R.T. & Wiley, D A. (1997); Valverde, Bianchi, Wolfe, Schmidt and Houang (2002).

The TIMSS framework for curriculum analysis

The TIMSS framework for curriculum analysis has been used to analyse both curricula in South Africa (see: Taylor and Vinjevold, 1999; Taylor et al., 2003) and internationally (Robitaille, Schmidt, McKnight, Valverde, Houang and Wiley, 1997; Valverde, Bianchi, Wolfe, Schmidt and Houang, 2002; and Johansson, 2005). The TIMSS framework is based on a model of curriculum that has three components: the intended curriculum, the implemented curriculum and the attained/achieved curriculum. For the purpose of this study the third component (attained curriculum) will not be explored in great detail, as it is not within the scope of this study. These key components are summarised in the following figure as detailed below:

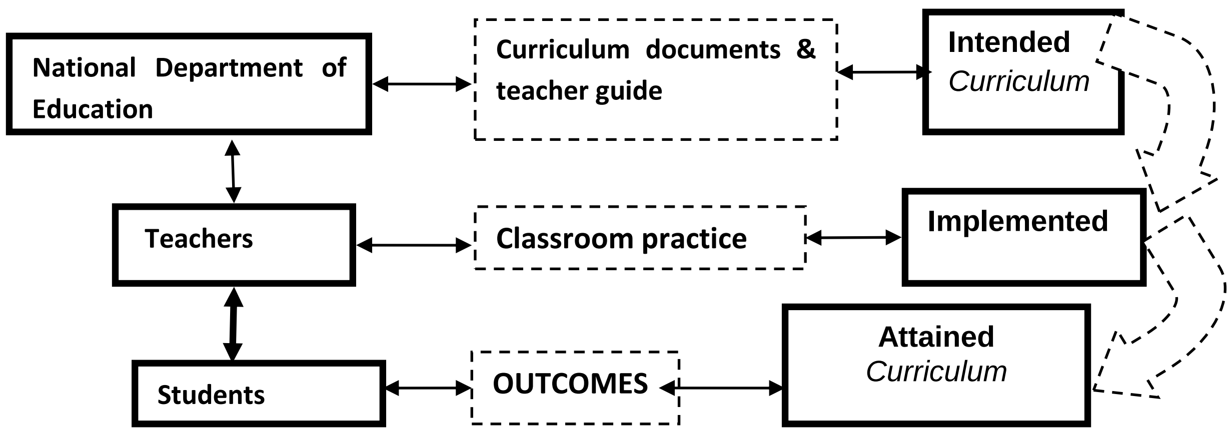


Figure 1: TIMSS Framework

The intended curriculum

According to TIMSS the intended curriculum consists of the mathematics and science that society intends students to learn, and the education system that society believes is best designed to facilitate such learning. Cuban (1995) refers to the intended curriculum as the official curriculum, and describes it as what state and district officials set forth in curricular frameworks and courses of study. According to Kelly (1999) the intended curriculum refers to the official or planned curriculum. Kelly (1999) defines the planned curriculum as “what is laid down in syllabuses, prospectuses and so on” (p.5). Taylor et al. (2003) maintain that the dominant ideals of any society are reflected in the intended curriculum (p.71). In the South African education system the intended curriculum is designed by the National Department of Education and, after necessary consultations with all stakeholders, it is approved and adopted in parliament as a policy (for example NCS Mathematical Literacy Grades 10 – 12 (general)). Similarly, Howson and Wilson (1986) simply define the intended curriculum as the one prescribed by policy makers. The implemented curriculum is the one that is actually carried out by teachers in their classrooms, and the attained curriculum is the one learnt by students. This framework, with particular focus on the intended and implemented curricula is pertinent in this study and resonates with the first critical question (see critical questions).

The implemented curriculum

According to TIMSS the implemented curriculum is made up of what is actually taught in the classroom, who teaches the curriculum, and how it is taught. Robitaille et al. (1997) contends that intentions and objectives at the level of teacher and classroom activity are considered as the implemented curriculum. Taylor et al. (2003) point to schooling as one of the principal institutions through which a society transmits its ideals to the next generation. They, however, note that much can go wrong in the process of transmission, and they write:

> Because of the relative autonomy of the schooling system from the legislature, and of schools from the educational bureaucracy, and teachers within the school, there are a number of points of potential slippage between intentions of the curriculum and their realisation in the acquisition of social and cognitive competences by children in schools and classrooms. This slippage may occur because of opposition to the original intentions by transmitters or acquirers, because of inabilities or inefficiencies of transmission/acquisition, or because of differences of interpretation on the part of transmitters or acquirers (p.74).

Kelly (1999) adds that differences between the intended curriculum and the implemented curriculum “may be conscious or unconscious, the cause of any mismatch being either a deliberate attempt by teachers or others to make what they offer appear more attractive than it really is” (p.11). Coles and Gale Grant (1985) refer to the intended curriculum as the curriculum on paper (that is, the statement of purpose, aims, content, experiences, materials etc.) and the implemented curriculum as the curriculum in action (the way in which the curriculum on paper is put into practice). The relationship between these components of the TIMSS framework is key to this study which seeks to understand both the coherence in, and the inconsistencies between the intended and implemented curricula.

Attained curriculum

The attained curriculum is at the student level, and according to the TIMSS includes what students have learned, and their attitudes towards mathematics and science. While recognizing this element as one of the three important facets of the TIMSS framework, it will not be used in framing the present study because this study focuses on the teachers' interpretation and implementation of the Mathematical Literacy curriculum. This component would be more pertinent if the focus of the proposed study was on teachers and learners (implemented and attained curricula).

Why Bernstein's framework?

Bernstein's work is noted world-wide as a useful tool for curriculum analysis (Davies, 1995; Singh, 1997; Kress, Jewitt and Tsatsarelis, 2000). In South Africa, recent studies on the post-apartheid curriculum have adopted Bernstein's framework (see Graven, 2002; Taylor and Vinjevold, 1999; Taylor et al., 2003; Haley and Parker, 1999; Parker, 2006a, 2006b; Hoadley, 2006, 2007; Graven and Venkat, 2007). This work led me to explore Bernstein's relevance to this study of teachers' interpretations of the intended and implemented Mathematical Literacy curricula.

Indeed, I found that Bernstein's framework serves as a useful tool to analyse the NCS Mathematical Literacy official documents and teachers' interpretations of the intended curriculum. Bernstein (1971) contends that there are three message systems through which the formal education knowledge can be recognised, that is, the curriculum (defines what counts as valid knowledge), pedagogy (defines what counts as a valid transmission of knowledge) and evaluation (defines what counts as valid realisation of this knowledge on the part of the taught). The official curriculum documents engage with Bernstein's three message systems (curriculum, pedagogy and evaluation). Bernstein (1971; 1975; 1982; 1996) provides useful models which are relevant in this study. The following Bernsteinian concepts will be used as tools for analysis: Classification (C) and Framing (F); curriculum types (collection type and integrated type); pedagogic models (performance and competence models), pedagogic discourse (instructional discourse and regulative discourse) and recognition and realisation rules.

Bernstein contends that strong classification results in strong boundaries and strong insulation between subjects and contents, while weak classification is characterised by weaker boundaries and reduced insulation between categories. Framing is about who controls what (Bernstein, 1996). Bernstein (1971) defines framing as the degree of control teachers and pupils' possess over the selection, sequencing and pacing of contents.

In the section that follows, I use Bernstein's framework to describe the Mathematics Literacy (ML) curriculum as it is presented in policy documents.

Curriculum types: Where is Mathematical Literacy positioned?

Bernstein (1971; 1975) describes two broad types of curriculum, namely, the collection type and the integrated type. These types are related to what Cornbleth (1990) calls a technocratic curriculum and a critical curriculum respectively. According to Bernstein (1975) a collection type "exists if the contents are clearly bounded and insulated from each other". (p.87). Collection type is characterised by strong classification and strong framing. He contends that in this type of curriculum the learner has to collect a group of favoured contents in order to satisfy some criteria of evaluation. Taylor et al. (2003) maintain that in the collection code, school knowledge is organised according to strong insulated subject hierarchies. An integrated curriculum exists where the various contents do not go their own separate ways, but where the contents stand in an open relation to each other. An integrated curriculum is characterised by weak classification and weak framing. Taylor et al. (2003) point out that schools in which the integrated code dominates are characterised by weaker subject boundaries, providing teachers with greater discretion and possibilities for experimentation. In ML, mathematics is presented in real life contexts to ensure that "the subject is rooted in the lives of the learners" (DoE, 2003: 42). According to the DoE (2003:6) "subject boundaries are blurred". These weak boundaries suggest that ML aligns well with an integrated curriculum type.

Pedagogic models: Which model is foregrounded in Mathematical Literacy?

Bernstein (1996) describes two models and three modes within each model. These models are competence models (liberal/progressive, populist and radical modes) and performance models (singular, regional and generic). Competence models are linked to learner-centred modes of instruction. Competence models are directed towards what the learner knows and can do at the end of learning (Taylor and Vinjevold, 1999). According to Bernstein (1996), in competence models acquirers have more control over selection, sequence, pace, and the pedagogic practices, which inhere in personalised forms. Performance models focus on specific learning content and texts. Bernstein posits that performance models serve primarily as economic goals and are hence considered instrumental. According to Bernstein (1996), in performance models, acquirers have less control over selection, sequence, pace, and the pedagogic practices, which inhere in personalised forms. These models are useful in the analysis of the ML curriculum documents.

Within what Bernstein considers a valid transmission of knowledge, he further provides the notion of pedagogic discourse. According to Bernstein (1996), pedagogic discourse is an ensemble of rules or procedures for the production and circulation of knowledge within pedagogic interactions. He identifies two rules which are embedded in pedagogic discourse. These are, instructional discourse (the discourse which creates specialised skills and their relationship to each other) and regulative discourse (the discourse which creates order, relations and identity). Bernstein contends that instructional discourse (ID) is embedded in the regulative discourse (RD), hence RD is the dominant discourse in classrooms. He argues that regulative discourse 'produces the order in the instructional discourse' (p.48). According to Bernstein pedagogical discourse is linked to recontextualising fields. He identifies two important fields which create the fundamental autonomy of education. He labels these fields as the pedagogic the recontextualising field (PRF) and the official recontextualising field (ORF). ORF is created and dominated by the state (in the case of this study, the ML policy documents mentioned above are examples) and its selected agents and ministries, while PRF consists of pedagogues in schools and colleges, departments of education, specialised journals and private research foundations. These concepts of recontextualising fields have been used in the analysis of curriculum documents to establish a theoretical framework (see Chapters 5, 6 and 7).

Combining Bernstein and TIMSS frameworks

Bernstein's work links well with the TIMSS framework. His message systems (curriculum, pedagogy and evaluation) link with three key components of the TIMSS framework (see Figure 2 below). The TIMSS framework provides different levels (such as the national level and the school level) in which the three components of the message systems operate, and Bernstein provides a language of description of each component. Several researchers have used both Bernstein and the TIMSS framework to analyse Curriculum 2005 - also commonly referred to as the Outcomes Based Education curriculum (OBE). For example, Taylor et al. (2003) and Taylor and Vinjevold (1999). For the purposes of this study, and following on from the way I have drawn on literature to define the intended, implemented and attained curriculum, I summarise the primary connections between TIMSS and Bernstein in the following diagram:

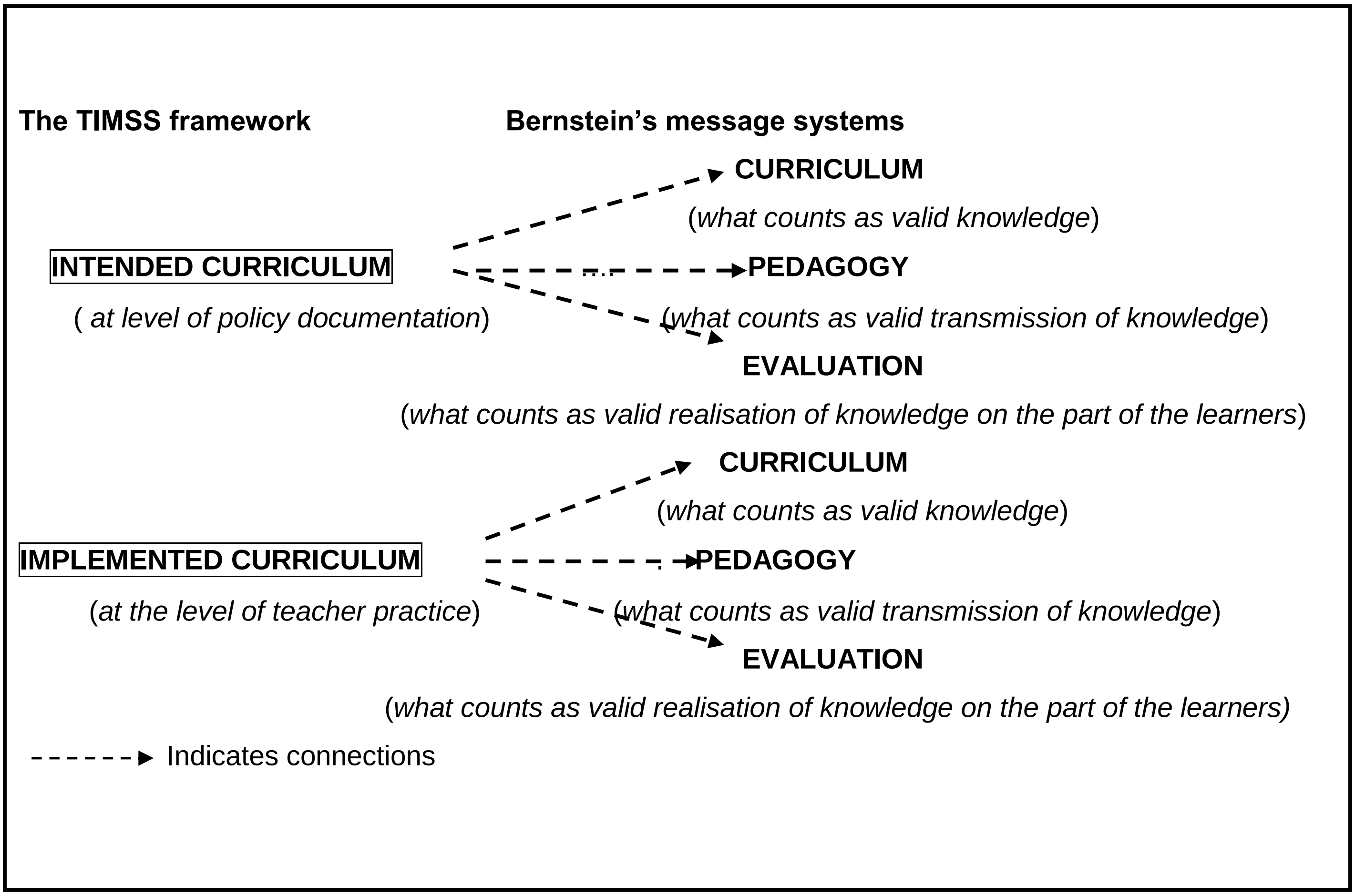


Figure 2: TIMSS framework and Bernstein's framework

Bernstein's framework also provides some lenses for interpreting teachers' pedagogic practices in the classroom situation. These lenses pay attention to power relations, classification and framing, and pedagogic discourses and models. The theoretical framework presented below summarises the links between Bernstein's framework and the intended and implemented curriculum of the TIMSS framework, and also indicates how the tools for analysis are linked to the proposed theoretical frameworks.

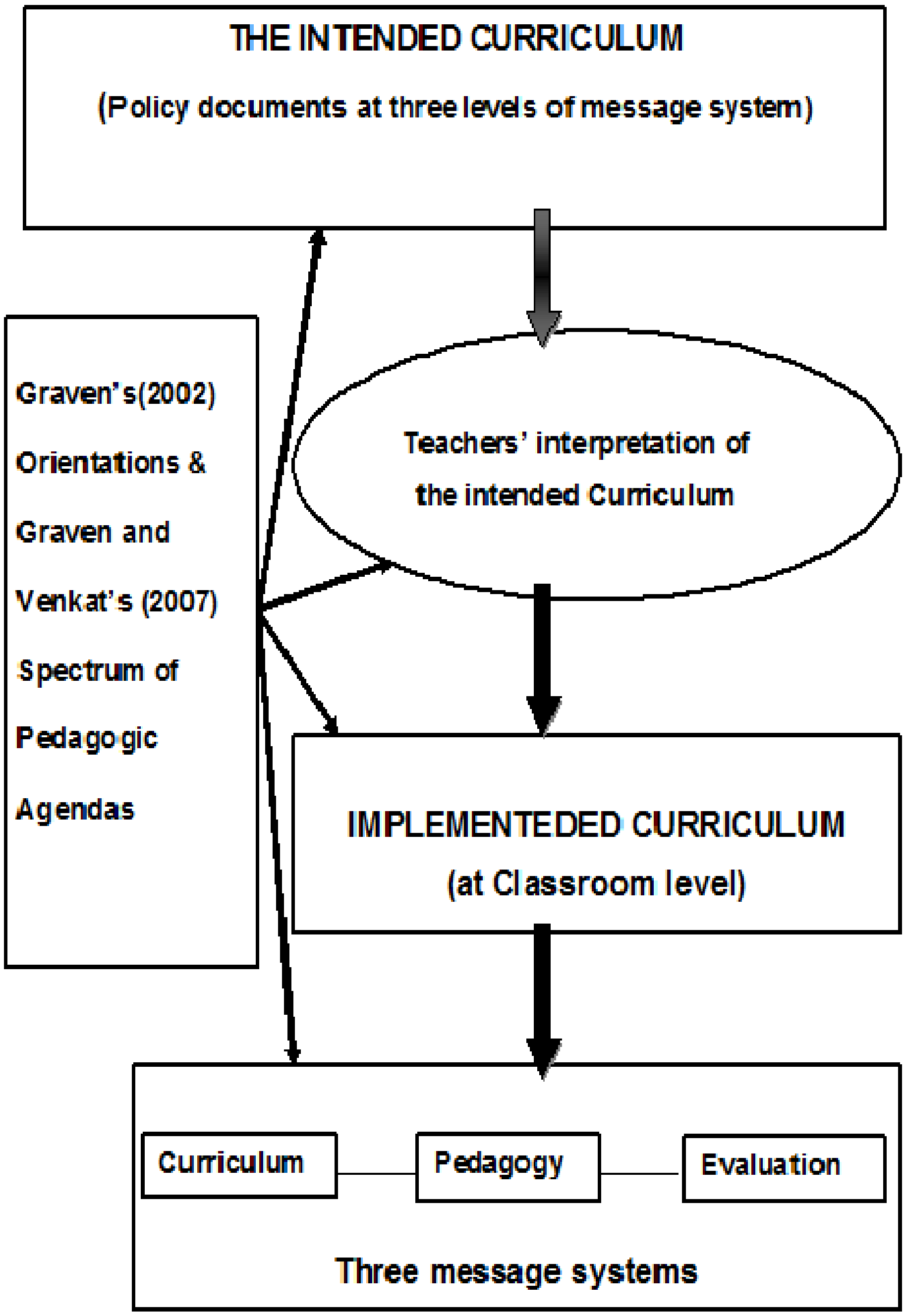


Figure 3: Theoretical framework

Tools for analysis

To analyse the official curriculum documents and the teachers' responses in interviews I draw on Graven's (2002) orientations to mathematical knowledge evident within the curriculum. These orientations are:

(i) mathematics for critical democratic citizenship, allowing learners to critique mathematical applications in various social, political and economic contexts

(ii) mathematics as relevant and applicable to aspects of everyday life and local contexts

(iii) mathematics for inducting learners into what it means to be a mathematician, to think mathematically and view the world through a mathematical lens

(iv) that mathematics involves conventions, skills and algorithms to master in order to gain access to further studies.

These orientations are useful in analysing curriculum statements and have been used locally to analyse Post apartheid curriculum (see: Graven, 2002; Parker, 2006b; Graven and Venkat, 2007).

Similar to Parker (2006b) who used these orientations to analyse assessment standards of the Mathematics and Mathematical Literacy FET curriculum, I will use these as tools for analysis. These orientations will also be used to analyse the teachers' interpretations and implementation of the intended Mathematical Literacy curriculum.

To analyse the teachers' classroom pedagogic practice I draw from Graven and Venkat's (2007) spectrum of Pedagogic Agendas (as elaborated in the literature review section). In their spectrum (discussed further in the literature revie) they pay special attention to the way contexts are interpreted used by teachers in the teaching of mathematical literacy. In the case studies of teacher lessons that I include in this study I will particularly focus on their use of contexts in their teaching. Thus while further research could usefully focus on how key mathematical concepts are taught/

developed by teachers here I will focus on their use of contexts in their teaching.

The spectrum of pedagogic agendas is relevant and appropriate in the analysis since they were developed specifically for the Mathematical Literacy.

Conclusion

In this chapter I have presented the theoretical frameworks and tools for data analysis. In the next chapter I present literature and document reviews. For the document review I will draw on the above framework for analysing the intended curriculum as inscribed in policy.

CHAPTER 3

LITERATURE REVIEW AND DOCUMENT REVIEW

A capacity and taste for reading gives access to whatever has already been discovered by others ~ Abraham Lincoln[8]

Introduction

In the previous chapter I presented the theoretical framework of the study and now in this chapter I present a literature review and document review. This chapter is presented into two parts. The first part of this chapter entails review of literature relating to Mathematical Literacy. The literature review will focus on (i) how the South African Department of Education defines and presents Mathematical Literacy, (ii) links between South Africa's perspective and International perspectives on Mathematical Literacy, (iii) local reviews of South Africa's Mathematical Literacy curriculum, (e.g. *Pythagoras* special issue (2006)), and (iv) ongoing research into the implementation of Mathematical Literacy in South Africa.

The second part presents analysis of official Mathematical Literacy curriculum documents. The key policy[9] documents of Mathematical Literacy that I analyse are: the National Curriculum Statement Grades (10 – 12) Mathematical Literacy Policy document (2003), Learning Programmes Guidelines (LPG) (2005), a Teacher Guide (2006) and the Assessment Guideline document (2008). I draw from Bernstein's (1971; 1975; 1996) theoretical framework, Graven's (2002) orientations to mathematical knowledge and Graven and Venkat's (2007) spectrum of pedagogic agendas as tools to analyse these policy documents.

---

[8] September 30, 1859 - Lincoln's Address before the Wisconsin State Agricultural Society

[9] These are policy documents produced by the Department of Education that contain all the details on the National Curriculum Statements for the Mathematical Literacy curriculum.

PART 1: REVIEW OF THE LITERATURE RELATING TO MATHEMATICAL LITERACY

The introduction of Mathematical Literacy in SA: Background and curriculum context

A new curriculum called the National Curriculum Statement (NCS) was introduced in 1998 to replace the National Education Department Report 550 Curriculum (known as NATED 550). The NCS[10] is founded on nine principles[11] of which one dominant principle is Outcomes Based Education (OBE) (DoE, 2003a). The initial plan for the implementation of NCS in all Grades was to be completed by 2005 (i.e. Curriculum 2005/C2005) though things did not go according to plan. When the NCS was implemented in the General Education and Training Phase[12] (GET Phase) there were many problems and difficulties with implementation (see Jansen and Christie, 1999). This resulted into the appointment of a Review Committee that reviewed the NCS in the GET Phase. The Review Committee (2000) was assigned to provide recommendations on:

(i) Key success factors and strategies for a strengthened implementation of the new curriculum
(ii) The structure of the new curriculum
(iii) The level of understanding of outcomes-based education (p.4)

One of the recommended changes when the NCS in the GET Phase was reviewed was that the learning area Mathematical Literacy, Mathematics, and Mathematical Sciences (MLMMS) should be changed to Mathematics as was the case in the previous curriculum. When MLMMS was changed to Mathematics there were many implications associated with it. One had to do with the classification of knowledge and the other one had to do with progression. MLMMS was weakly classified and more integrated than its predecessor Mathematics (Graven, 2002), but when it was

[10] NCS: I am referring to both GET NCS, which was for a time called the RNCS, and to the FET NCS.
[11] Nine principles: social transformation; Outcomes-based Education; high knowledge and high skills; integration and applied competence; progression; articulation and portability; human rights, inclusivity, environmental and social justice; valuing indigenous knowledge systems; and credibility, quality and efficiency.
[12] Schooling system in South Africa has two bands GET (Grade R-9) and Further Education and Training (FET) Grades 10 – 12).

changed to Mathematics classification was strengthened and integration reduced. Boundaries between MLMMS and other learning areas were intentionally blurred and a high level of integration was encouraged. The second implication, and of particular relevance to this study, relates to the progression from the GET band to the FET band. MLMMS had both Mathematics and Mathematical Literacy combined into one subject thus in MLMMS learners learnt both Mathematics and Mathematical Literacy. Such a background was important to the first cohorts of learners in Grade 10 where they were required to choose either Mathematics or Mathematical Literacy for their studies in the FET band. While there are components of Mathematical Literacy still present in the RNCS, it is more backgrounded while disciplinary mathematical concerns and concerns for mathematical progression are foregrounded.

It is important to note that in the NATED 550 curriculum Mathematics was compulsory from Grade R up to Grade 9. From Grade 10 – 12 learners were required to choose to do or not to do mathematics. Those learners who chose Mathematics (in Grades 10 – 12) also had a choice to take Mathematics at Standard Grade (Mathematics SG) or Higher Grade (Mathematics HG) level. In most cases there were very few students who were doing Mathematics HG (see examiners' reports (DoE, 2002; 2003)). Drawing from my experience[13] there were some problems associated with how learners chose the level of study (SG or HG). In some instances learners (in some schools) were encouraged by teachers to take Mathematics on SG level. This was motivated by the fact that Mathematics SG was less challenging than HG hence some schools took advantage of the situation in order to produce better Grade 12 results and to boost their pass rate. It is also within the interest of this study to explore whether there was any deliberate push of the learners by the teachers or schools to do either Mathematics or Mathematical Literacy and to determine Mathematical Literacy teachers' views on this matter (dealt with in Chapters 5-7).

[13] I was teaching mathematics at High School (FET Phase) for more than ten years. I was also serving in the School Management Team (SMT) as Head of Department for Mathematics (for four years) and Science; and as a Deputy Principal for three years.

Mathematical Literacy: A question of what, how and why?

Many subjects that are offered in the in the NCS-FET were also offered in the old curriculum NATED 550, for example, Mathematics, Physical Science, Life Sciences (Biology and Human Physiology) etc. These subjects have a direct link to the learning areas offered in the GET phase, for example, RNCS-Mathematics links to NCS-Mathematics; RNCS-Natural Science (NS) links NCS-Physical Science. Mathematical Literacy on the other hand has no direct link to either learning areas offered in the GET or subjects which were offered in the NATED 550. I have pointed out earlier that when MLMMS was changed to Mathematics this resulted in a new learning area that was more directly linked to FET Mathematics than to Mathematical Literacy. Hence I see Mathematical Literacy in the FET as a new subject. Interesting questions can be asked about Mathematical Literacy: What is it? How did it come into being? And why it was introduced? In the next section I attempt to answer these questions by presenting a literature review on Mathematical Literacy.

What is Mathematical Literacy?

It is important to understand what Mathematical Literacy is. According to Christiansen (2006:6) Mathematical Literacy "refers to the competence of individuals". In the South African context Mathematical Literacy refers both to a school subject and to the competency of individuals. The Department of Education DoE (2003) defines Mathematical Literacy as:

> Mathematical Literacy provides learners with an awareness and understanding of the role that mathematics plays in the modern world. Mathematical Literacy is 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 (p.9).

It seems that this definition does not explicitly define what Mathematical Literacy is; rather, it explains what Mathematical Literacy does and what it as a subject is driven by. Notably, three important key elements or components can be derived from this definition. These are mathematical content, real-life contexts and competencies (see:

Bowie and Frith, 2006). Similarly, these three components are also identified by the OECD Programme for International Student Assessment (PISA). The PISA (2003) definition of Mathematical Literacy is similar to the way it is defined in the South African context. PISA (2003) defines Mathematical Literacy as follows:

> Mathematical Literacy is an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgments 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 (p.23).

PISA (2003) distinguishes and describes three components of Mathematical Literacy that are similar to the ones noted by Bowie and Frith (2006). These are:

(i) The *situations or contexts* in which the problems are located

(ii) The *mathematical content* that has to be used to solve the problems organized by certain overarching ideas, and, most importantly

(iii) The *competencies* that have to be activated in order to connect the real world, in which the problems are generated, with mathematics, and thus to solve the problems (p.30).

It is evident that there is a close link between Mathematical Literacy in the South African context and in PISA. Most importantly, PISA provides detailed information on these three components (PISA, 2003). This similarity is to be expected as the curriculum team worked with PISA documentation (DoE, 2008:8). In Chapter 8, I draw from PISA to discuss mathematisation in Mathematical Literacy as a key issue in the implementation of the intended Mathematical Literacy curriculum in South Africa.

Pugalee (1999) model of Mathematical Literacy

Pugalee (1999) provides a basic model of Mathematical Literacy. In an attempt to define Mathematical Literacy, Pugalee first describes a basic model of Mathematical Literacy. He contends that the Mathematical Literacy model must meet three important aspects, namely, (i) embody the *five processes* through which the students obtain and use their mathematical knowledge; (ii) demonstrate the *intricate* *interrelationships* between the various processes that are essential in the development of Mathematical Literacy; and (iii) specify enablers that facilitate development of the five processes (p.19). He then defines Mathematical Literary as a complex interaction of five processes (p.20). These five processes (also captured in the South African Department of Education documents) are: (i) valuing mathematics; (ii) becoming confident in one's ability to do mathematics; (iii) becoming a problem solver; (iv) communicating mathematically; and (v) reasoning mathematically. These five processes resonate with Graven's (2002) orientations of mathematics which are used in the analysis in Chapter 5.

Pugalee uses two concentric circles to develop a model which depicts the components of Mathematical Literacy, as shown in Figure 4 below:

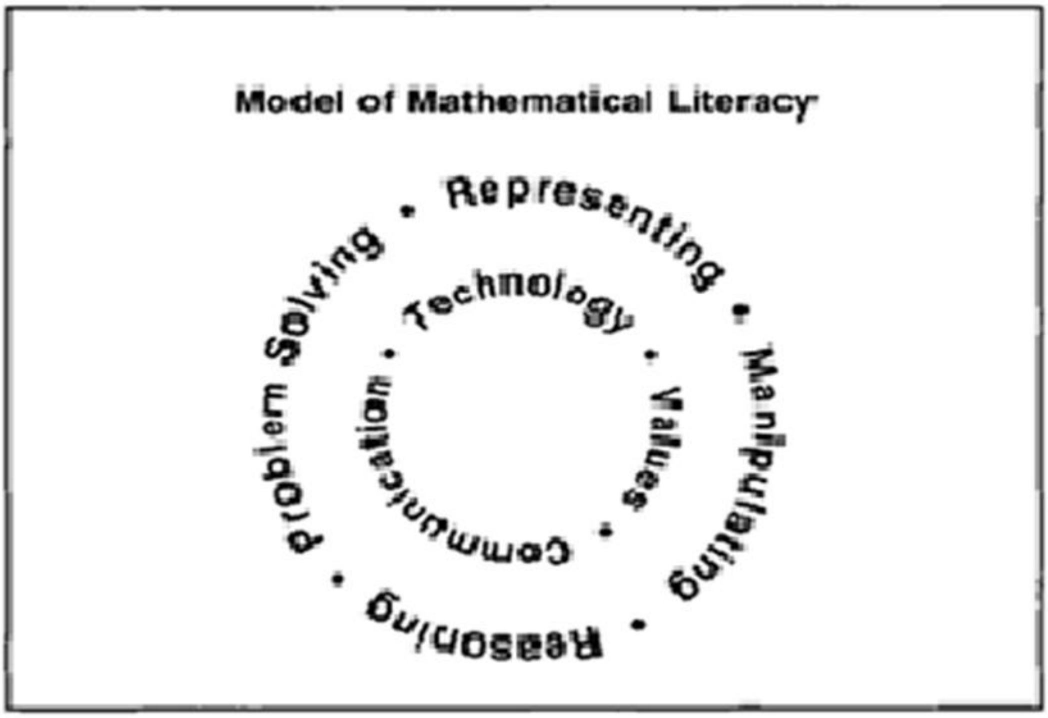


Figure 4: Model of Mathematical Literacy adapted from Pugalee (1999)

According to Pugalee the larger circle shows processes (reasoning, problem solving, representing and manipulating) that are critical in doing mathematics and the inner circle shows three enablers (communication, technology and values) that facilitate the doing of mathematics. Pugalee argues that these processes and enablers mentioned above form the basis of the model for Mathematical Literacy. He further adds:

> These two concentric circles depict the interrelatedness of the enablers and processes in the evolution of Mathematical Literacy (p.20)

Indeed, this is particularly true as these enablers and processes facilitate the doing of mathematics, for example[14]:

> On a particular day it took 5 hours to cut the grass. Suppose the workers started at 08:00 and took two 15-minute tea breaks and a half-hour lunch break. At what time would the workers finish cutting the grass?

To solve this problem one has to reason first, trying to trim the context and represent the problem mathematically, then manipulate it by following appropriate procedures.
Once the solution has been found, it is presented in relation to the problem. In Chapter 6, I present specific steps involved in solving a Mathematical Literacy problem. This model and other tools are used in the analysis of teachers' interpretations of Mathematical Literacy and teachers' classroom practices. That is to say, I will use this model to examine the extent to which teacher practices promote the development of these five processes.

Mathematical Literacy and mathematisation

Mathematisation is the fundamental process learners use to solve real life problems (OECD, 2003). The process of Mathematisation involves five steps, as shown below:

[14] Feb/March 2010 National Examinations: Mathematical Literacy question 1.6.3

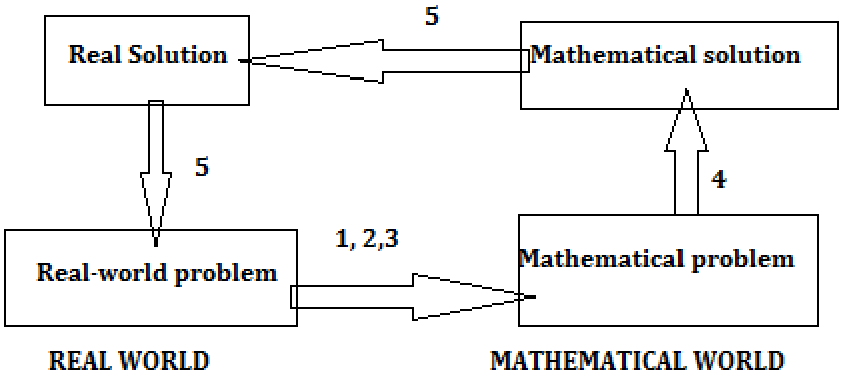


Figure 5: The Mathematisation cycle (adapted from OECD; 2003:38)

1. Start with a problem situated in reality
2. Organise it according to mathematical concepts and identify the relevant mathematics
3. Gradually trim away the reality through processes, such as making assumptions , generalising and formalising, which promote the mathematical features of the situation and transform the real-world problem into a mathematical problem that faithfully represents the situation
4. Solve the mathematical problem
5. Make sense of the mathematical solution in terms of the real situation, including identifying the limitations of the solution. (OECD, 2003:38)

The Mathematisation cycle presented above provides guidelines to the process of solving real life problems. The four important aspects of this process of Mathematisation are representation, manipulation, reasoning and problem-solving. These four key elements of Mathematisation are well discussed by Pugalee (1999). Mathematical Literacy teachers are required, or expected, to develop their learners to be able to mathematise accordingly. In chapter 8 I discuss mathematisation as critical issue in Mathematical Literacy.

Who is Mathematical Literacy for?

Since Mathematical Literacy is new in the curriculum there are possibly misconceptions about the subject and about who it is intended for. According to DoE (2003) Mathematical Literacy is for learners who do not perceive themselves studying disciplines which are mathematically based, like engineering and natural sciences.

In the NATED 550 curriculum there were two grades of Mathematics: Standard Grade (SG) and Higher Grade (HG). It is likely that many people associate Mathematical Literacy and Mathematics with either SG or HG. Others view learners who are doing Mathematical Literacy as those who cannot do Mathematics. In other words, Mathematical Literacy is for the learners who are not clever (see some of these misconceptions in Graven and Venkatakrishnan, 2006b).

How and why has Mathematical Literacy come into being as a subject in SA?

As I indicated earlier, in the past only Mathematics was an option from Grade 10. In the newer curricula things are quite different; every learner now must choose either Mathematics or Mathematical Literacy. While there could be many reasons for introducing Mathematical Literacy in the FET, the following reasons deserve attention. According to DoE (2003) the inclusion of Mathematical Literacy as a compulsory subject in the FET curriculum will ensure that future South African citizens are highly numerate users of mathematics. Christiansen (2007) points to two main reasons for the introduction of Mathematical Literacy as a school subject in South Africa. According to Christiansen (2007) these reasons were: (i) to reach the 200 000 learners leaving Grade 12 yearly without any mathematics; as well as the 200 000 learners who fail Mathematics in Grade 12 every year; and (ii) to teach learners competencies and knowledge which would be in line with the overall intentions of the NCS. Bowie and Frith (2006) maintain that Mathematical Literacy has 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 (p.29). These reasons are supported by Venkatakrishnan and Graven (2006) who contend that the introduction of Mathematical Literacy in the FET was aimed at increasing the number of learners taking mathematical courses at all levels. There is little known yet about whether this aim has been met.

Brombacher (2006) similarly identifies two major forces that led to the introduction of Mathematical Literacy. These forces are: (i) the democratisation of mathematics, that is, to provide greater access to mathematical skills for more people and (ii) mathematics for democracy, that is, it is imperative that more people be able/ equipped to use mathematics in order to participate in the modern world of technology. This poses a critical question, which is subject to debate, as to whether all who gain access to mathematics through Mathematical Literacy will, in fact, use mathematics effectively and efficiently to participate in the new world of technology.

The Department of Education goes on to make a list of important abilities that Mathematical Literacy aims to develop. The DoE (2005a: 8) specifies the following:

(i) The ability to use basic mathematics to solve problems encountered in everyday life, and in work situations.
(ii) The ability to understand information presented in mathematical ways.
(iii) The ability to engage critically with mathematically based arguments encountered in daily life.
(iv) The ability to communicate mathematically.

These abilities are significant in the teaching and learning of Mathematical Literacy. Teachers must be aware of these abilities and be able to develop teaching strategies that will enhance the development of these abilities. In the analysis of the teachers' classroom practices (chapter 7) one of the key themes is related to the extent to which these abilities are promoted by the teacher. This will help to answer critical question (iii).

I have attempted to answer the question about what Mathematical Literacy is and what it is for. In the next section I present literature on some current studies on

Mathematical Literacy, with special reference to teachers' understanding and implementation of the Mathematical Literacy curriculum. I will also discuss the findings from current studies on Mathematical Literacy in South African context.

Research on the implementation of the Mathematical Literacy curriculum in SA

Since 2006, when Mathematical Literacy was introduced in the FET, much has been reported (see: Julie and Mbekwa, 2005; Vithal and Bishop, 2006; Christiansen, 2006; Mbekwa, 2006; Bowie and Frith, 2006; Frith and Prince, 2006; Brown and Schäfer, 2006; Vithal, 2006; Julie, 2006; Venkatakrishnan and Graven, 2006; and Graven and Venkat, 2007).

Mbekwa (2006) studied teachers' views on Mathematical Literacy and on their experiences as students of the course. This study reveals two important findings on teachers' views: (i) the view which regards Mathematical Literacy as that type of mathematics that finds application in people's lives; (ii) the view that Mathematical Literacy is a simplified or easier version of the Mathematics that learners do at school (p. 29). The study also reveals that there is common agreement amongst teachers that Mathematical Literacy has to do with real life application of mathematics.

Another study that focuses on Mathematical Literacy teachers was done by Julie (2006a). Julie (2006a) studied teachers' preferred contexts of Mathematical Literacy in order to find out what teachers prefer learners to deal with in Mathematical Literacy. The results showed that teachers consider situations from the background of learners, and those that will not conflict with teachers' personal pedagogical ideologies, as important and useful contexts to be used in Mathematical Literacy. Both Mbekwa and Julie provide important findings on teachers' understanding of Mathematical Literacy. However, it is evident that these studies do not make any attempts to explore the relationship between the teachers' responses and the classroom practice.

Christiansen (2006; 2007) presents a critical analysis of Mathematical Literacy as a school subject. Christiansen (2006) interrogates two ways in which the Mathematical Literacy curriculum justifies itself. Firstly, through claims of utility, and secondly through claims that it will provide learners with awareness and understanding of the role that mathematics plays in the modern world (p. 6). She further distinguishes different perspectives of Mathematical Literacy, namely, with respect to its proclaimed goals and on its context relatedness or situatedness (Christiansen, 2007:91). She argues that the goals of Mathematical Literacy are theoretical rather than practical. Christiansen (2007) uses concepts developed by Paul Dowling; domains to analyse assessment standards of Mathematical Literacy. She makes the following claim:

> The curriculum is saturated by the myth of mathematics' utility to everyday practices, while the curriculum is largely organised around mathematics - mathematics which is often not utility in everyday practices. Yet many of the contexts invoked are too simple to get insight into complex phenomena or to handle complex problems (p.91).

Christiansen (2006) argues that, although contexts are foregrounded in Mathematical Literacy, Mathematical Literacy content is distinctly mathematical (p.10). With regard to the successful implementation of Mathematical Literacy, she contends that teachers of Mathematical Literacy must possess enough mathematical knowledge for them to cope with the demands of teaching Mathematical Literacy.

Christiansen (2007) asserts that:

> A teacher of Mathematical Literacy would have to know enough mathematics and enough about applications of mathematics, misuses of mathematics, and effects of using mathematics to further learners' awareness and understanding of the role that mathematics plays in the modern world, help them develop the ability and confidence to interpret and critically analyse social, political and practical situations using mathematical skills transferred from one context to another (p.101).

The above concern is also noted by Vithal (2006) who contends that a particular challenge in the teaching and learning of contextualised mathematics is that the teacher has to ensure that neither the learner's understanding of the mathematics, nor that of the context, gets compromised (pp. 40 – 41).This is a major dilemma (Julie, 2006). Similarly Bowie and Frith (2006) argue that Mathematical Literacy teachers will face many challenges to teach Mathematical Literacy as they are required to understand more than the mathematical content. They also need to understand the various contexts used in Mathematical Literacy, such as HIV/AIDS, financial issues, mortgages, voting systems etc. If these challenges exist, how do Mathematical Literacy teachers cope with teaching Mathematical Literacy successfully, especially those who do not have a considerable Mathematics background? How do Mathematical Literacy teachers incorporate these contexts when they might not themselves understand the various contexts presented in Mathematical Literacy? All these questions necessitate the need for research on teachers' experiences of interpreting and of teaching Mathematical Literacy.

The literature suggests that the Mathematical Literacy teacher is likely to have his or her own driving agenda or contradicting agendas, when he or she implements the curriculum (see: Julie, 2006; Venkatakrishnan and Graven, 2006; and Graven and Venkatakrishnan 2006, 2007). These agendas may to a large extent be informed by the teacher's Mathematics background. Below I present some of these agendas as discussed in the literature.

A spectrum of agendas in Mathematical Literacy

Mathematical Literacy is a hot topic (Vithal and Bishop, 2006) as people try to understand whether it is a new literacy or a new mathematics. There are a number of driving agendas in Mathematical Literacy. Some of these agendas have received special attention from some researchers. Venkat (2007) explores mathematics versus literacy; and Christiansen (2007) explores mathematical gaze versus livelihood gaze; and Graven and Venkat (2007) discuss pedagogic agendas. There are some agendas in Mathematical Literacy, included in PISA and in SA's curriculum, which have not yet received attention from South African researchers, for example, the technological agenda (Skovsmose, 1994) and the political agenda.

Venkat (2007) observed two teachers teaching Mathematical Literacy in different classrooms. Although the two teachers were teaching the same subject in the same Grade, their driving agendas were different. Venkat found that one teacher was foregrounding a more mathematical agenda while the other was foregrounding a more literacy-focused agenda (p.78). Venkat argues that these agendas were not incompatible. A similar observation was made by Sethole (2004). Sethole in his case study describes the experiences of two teachers, Bulelwa and Kevin, who attempted to take on board the notion of incorporating 'the everyday' into mathematics. Sethole found that both teachers attempted to incorporate the everyday into the mathematics teaching. However, Bulelwa used AIDS as a context, and foregrounded the social concerns over mathematics while Kevin foregrounded mathematics skills over social concerns.

Graven and Venkat (2007) explore Pedagogic Agendas. Drawing from the analysis of Mathematical Literacy documents and from empirical data, they identify a spectrum of pedagogic agendas, which are presented in the following table.

Table 1: Spectrum of agendas adapted from Graven and Venkat (2007)

Agenda	**Description of pedagogic agenda**
1. Context driven	To explore context that learners need to interact and engage with in their lives and to use mathematics to achieve this.
2. Content and context driven	To explore a context so as to deepen mathematics understanding and to learn mathematics and to deepen understanding of that context.
3. Mainly content driven	To learn mathematics and then to apply it to various contexts.
4. Content driven	To give learners a second chance to learn the basics of mathematics in GET band.

It is important to note that, according to Graven and Venkat (2007), these four (distinct) categories are not strictly applied. They also point to an issue arising within these agendas, namely, contextual authenticity versus mathematical progression. These agendas are particularly important in this study as they serve as a tool for analysis discussed in the next section).

Literature on the role of contexts in Mathematical Literacy

There are many views on the role of context/s in mathematics and science education. Some teachers believe that contexts play a major role in the teaching and learning of Mathematical Literacy. In the analysis of teachers' responses (in Chapter 5), it came out very strongly that the context in Mathematical Literacy is important. I shall now present arguments on the positive contributions of contexts in Mathematical Literacy. Researchers argue that contexts in Mathematics play a major role in making Mathematics accessible (see: Blinko, 2004; Boeler,1993; Mudaly,2004; Van Den Heuvel-Panhuizen, 2005; Yosh et al., 1997; Nicol and Crespo, 2005; Sethole, 2004; Zavenbergen, Sullivan and Mousley , 2002; Du Fue, 2001). Similarly, in Mathematical Literacy contexts play a similar role of making the mathematics accessible, particularly for those who could not do pure Mathematics. I now refer to some key arguments on the positive contribution of contexts in Mathematical Literacy. At the same time I will relate these arguments to the findings of the study.

The inclusion of contexts in Mathematical Literacy can be seen as one way of crossing the boundaries between mathematical and non-mathematical discourses; thus extending more opportunities to everyone to access mathematics. This can be explained, in terms of Bernstein (1996), as weak classification. Mathematical Literacy is considered to be weakly classified (see Chapter 3). There is substantial evidence in the literature, and from the findings of this study, that the manner in which Mathematical Literacy curriculum is designed and presented attempts to: (i) draw the interest of the learners to do Mathematical Literacy without any fear of the mathematics content attached to it; (ii) to access mathematics; and (iii) to understand mathematics in real life situations.

The influence of context in arousing interest in learners has been strongly argued in literature (see: Gerdes, 1985; Boaler, 1993; Bowman, 1997; Mudaly, 2004; Blinko, 2004; Nicol and Crespo, 2005). The results in this study show that most teachers and their learners find Mathematical Literacy interesting since it relates to everyday life. Mudaly (2004) argues that, besides the ideal of showing learners how mathematics is related to the real world, contexts also serve to increase interest in the subject matter. Drawing from his experience, Browman (1997) asserts that after allowing his students to work with real-world problems in his class, the level of student interest increased to the extent that they were especially excited about being able to solve a mathematics problem that even the so-called mathematics geniuses in calculus could not solve. This confirms that the real world context has a potential to increase the interest of the learners. Blinko (2004) maintains that "putting [mathematics] questions into a context can go a long way in making abstract ideas more meaningful" (p.3.). According to Blinko (2004) contexts make mathematics meaningful to the learners. Boaler (1993) adds that using real world, local community, and even individualised examples which students may analyse and interpret, is thought to present mathematics as a means with which to understand reality.

Similarly, Nicol and Crespo (2005) emphasise that "The contexts in which mathematics is studied play an important role in helping students understand not only how, when, and why particular concepts, procedures, and skills are used, but also what makes them significant and worth knowing" (p.240). Zevenbergen et al. (2002) reflect on their experiences regarding the role of contexts in mathematics, and they suggest that the use of contexts in mathematics education can enhance learning for the learners (p.1).

As much as contexts are central to the development of Mathematical Literacy it is important to note that a balance between context and content is essential. The Department of Education (DoE, 2005b) states that:

> Learners must be exposed to both mathematical content and real-life contexts to develop competencies (p.7).

It is evident that, according to the Education Department's perspective, content should go together with context. Although there are no statistical figures that indicate the proportions (percentages) for each component (context and content), it is observed that context and content must be central to any given task in Mathematical Literacy. The Department further advises Mathematical Literacy teachers:

> To use situations or contexts to reveal the underlying mathematics, while simultaneously using the mathematics to make sense of the situations or contexts, and in so doing develop in students habits or attributes of a mathematically literate person (DoE, 2005b:4).

Apart from the positive impact of the contexts in Mathematical Literacy, it is argued in the literature that context can sometimes affect understanding. This was confirmed by the teachers during their interviews (see for example, Jabu in Chapter 6). Some of the negative experiences reported by teachers in this study relate to the language of learning and teaching (see Susan's interview). The argument from the teachers is that Mathematical Literacy has a lot of contexts which demand language proficiency or competence from the learners. Teachers contend that most of the learners have a problem understanding English and hence find it difficult to interpret Mathematical Literacy problems because of the language issue. This argument is supported by the qualitative study that was conducted in Korea (Whang, 1999), and which revealed that children have difficulties in solving mathematics word problems written in English. Similarly, a study of Mathematics Literacy of final year students (Howie and Pietsern, 2001) showed that students performed particularly poorly in questions requiring written answers:

> Students showed a lack of understanding of mathematics literacy questions, and an inability to communicate their answers in instances where they did understand the question (p.19).

Murray (2003) argues that for a child to understand and respond to a problem posed, the language and grammatical constructions used when the word problem is formulated are obviously crucially important (p.39).

Apart from linguistic demands that contexts bring into the teaching and learning of Mathematical Literacy, research has shown that contextualising mathematics can sometimes produce undesirable results (see: Cooper and Dunne, 1999; Chacko, 2004; Naidoo and Parker, 2005; Murray, 2003; Greer, 1993; Verschafel and De Corte, 1997). Below I refer to a few examples from literature and from the findings of this study.

The study by Cooper and Dunne (1999) has revealed how contextualising mathematics creates some difficulties for working-class students, such that they perform significantly more poorly than their middle-class peers on contextualised tasks, while their performance on decontextualised tasks is equivalent. The study on the implications of mathematics teachers' and officials' identities to mathematics discourses for democratic access to mathematics (Naidoo and Parker, 2005) involved seven Grade 9 teachers. All seven teachers expressed negative orientation towards contextual mathematics. Some of the teachers maintained that:

> Teaching and assessing mathematics from situations denies pupils adequate subject content and knowledge (p.63).

Murray (2003) argues that inclusion of context in mathematics does not necessarily produce good results all the time. Murray asserts that learners experience real life very differently from adults, and are familiar with very different aspects of real life. She stipulates four ways in which the context can act as a barrier to understanding mathematics:

(i) Learners are not familiar with the context
(ii) The context has unpleasant connotations
(iii) The context is limited.
(iv) The problem has to be transformed or modelled by the learner before he/she can solve it (p.40).

Van Den Heuvel-Panhuizen (2005) also suggests four important points about context as a barrier to teaching and learning mathematics:

(i) Context can hinder finding an answer
(ii) Students' unwillingness to take into account the context

(iii) Context problems do not allow one to take the context into account

(iv) Taking the context into account is not evenly distributed among students.

The above points are supported by Mair (1991), who suggests that some of the contextualised problems have little in common with those faced in real life; hence learners are sometimes not familiar with the context used. It is possible that a context used in the problem might be irrelevant to a student's life or interest and this may have a negative impact on the learning of mathematics.

Conclusion

In this section I have presented a review of related literature from local and international perspectives, on-going research into curriculum implementation, and agendas in Mathematical Literacy. From the literature there is abundant evidence to suggest that there is still a huge gap between what is known about teachers' experiences and understanding of the intended Mathematical Literacy curriculum and how their understanding and experiences influence implementation. This study therefore attempts to narrow the gap between what is known and what is not yet known, thus contributing to the body of knowledge.

In the next section I present a review of curriculum documents for NCS Mathematical Literacy Grades 10 – 12.

PART 2: DOCUMENT REVIEW

An analysis of Mathematical Literacy curriculum documents

Introduction

The South African Department of Education introduced the National Curriculum Statement (NCS) in the Further Education and Training (FET) (Grades 10 – 12) in 2006. Twenty-nine (29) subjects were introduced, including Mathematical Literacy (ML). Key documents to Mathematical Literacy were published by the Department of Education and made available to all schools prior to the implementation of the curriculum (in 2004 and 2005). These documents include the: Overview document; NCS Subject document (policy document); Learning Programme Guideline (LPG) and Assessment Guideline document. In addition to these documents, Life Orientation and Mathematical Literacy have a Teacher Guide document. These two subjects, Life Orientation and Mathematical Literacy, received special treatment because they were new in the system and had not been offered in the previous curriculum (NATED 550).

As I indicated in Chapter 1, in order to engage in the critical questions, I first analysed '*the intended curriculum'* as laid down in official curriculum documents. This review of curriculum documents is important in the following ways:

(i) The first critical question explores the teachers' interpretations of the intended Mathematical Literacy curriculum. It is therefore necessary to unpack the intended curriculum and thus create the basis for the analysis of teachers' interpretations of the intended curriculum. This assists in understanding the teachers' interpretations of the curriculum.

(ii) Similarly, critical question 2 relates to understanding how the teachers' interpretation and implementation of the curriculum depart from or adhere to the intended Mathematical Literacy curriculum. This critical question cannot be answered only by interviewing and observing Mathematical Literacy teachers. It is necessary to develop terms of reference which will form the basis for an argument that suggests the extent to which teachers' interpretations and implementation depart or adhere to the intended curriculum.

Based on the reasons given above, the review of the policy documents was conducted. The section below therefore presents the analysis of the National Curriculum Statement for Mathematical Literacy (Grades 10 – 12) official curriculum documents. Basil Bernstein's (1982; 1996) notion of message systems (curriculum, pedagogy and evaluation) was used as a theoretical framework in analysing the ML curriculum documents. Both Graven's (2000) mathematics orientations and Graven and Venkat's (2007) spectrum of agendas were used as tools for analysis.

Structure of analysis

The purpose of the analysis was to meet the two conditions described above; hence the structure of analysis was designed along those lines. The following key aspects of the curriculum documents were considered, namely, (i) a general review of all NCS Mathematical Literacy documents and an analysis of the general aim and purpose of Mathematical Literacy in terms of Graven's (2002) orientations; (ii) Mathematical Literacy in terms of Bernstein (1982; 1996). I further attempt to explore curriculum design in relation to Bernstein's message systems as presented in Chapter 2.

General review

As indicated in the introduction, there are four (4) Mathematical Literacy official documents, and it is important to note that these four documents were published in different years, between the years 2003 to 2008. These four documents are presented and described below:

Table 2: Overview of Mathematical Literacy policy documents

	MATHEMATICAL LITERACY DOCUMENTS	**Pages**	**Description**	**Comments in relation to framework**
1	NCS Grades 10 – 1 2 (general) Policy – 2003	74pp	A subject Statement document which has four chapters. The first chapter describes the principles and the design features of the National Curriculum Statement. The second chapter describes the definition, purpose, scope, career links and Learning Outcomes of the subject. The third chapter contains the Assessment Standards for each Learning Outcome (LO), as well as content and contexts for the subject. The chapter further entails the proposed content and contexts to teach, learn and attain. The last chapter deals with the generic approach to assessment as suggested by the National Curriculum Statement.	This document presents what counts as valid Mathematical Literacy knowledge, i.e. message system “curriculum”.
2	Learning Programme Guidelines (LPG) – 2005	21pp	LPG focuses on designing learning programmes for ML. This includes the subject framework, work schedule and lesson plans.	This document concerns itself more with what counts as valid transmission of knowledge, i.e. the message system “pedagogy”.
	Teacher Guide	69pp	The Teacher guide document	This document also

3	(TG) – 2006		provides information to teachers of ML on how to develop ML; this includes resources needed to teach ML,, and learning units and assessments in ML. It is important to note that a Teacher Guide document has Grade 10 work only.	concerns itself more with what counts as valid transmission of knowledge, i.e. the message system "pedagogy".
4	Subject Assessment Guidelines (SAG) – 2008	42pp	SAG has three sections It provides detailed guidelines for assessment in the NCS; this includes continuous and summative assessment, examination paper marks allocation and different taxonomy levels.	This document is concerned more with what counts as valid realisation of knowledge on the part of the learners.

The aims and purpose of Mathematical Literacy as described in the policy documents:

The Department of Education DoE (2003) defines Mathematical Literacy as:

> Mathematical Literacy provides learners with an awareness and understanding of the role that mathematics plays in the modern world. Mathematical Literacy is 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 (p.9)

Graven's (2002) orientations of mathematics listed below are used to analyse the DoE's definition of Mathematical Literacy.

Table 3: Graven (2002) orientations of mathematics

Orientation 1. Mathematics for critical democratic citizenship. It empowers learners to critique mathematical applications in various social, political and economic contexts.
Orientation 2. Mathematics is relevant and practical. It has utilitarian values and can be applied to many aspects of everyday life.
Orientation 3. Mathematics as induction into what it means to be a mathematician, to think mathematically and to view the world through a mathematical lens.
Orientation 4. Mathematics as a set of conventions, skills and algorithms that must be learnt. Many will not be used in everyday life but are important for further studies.

The table below analyses key elements of the DoE's definition of Mathematical Literacy in relation to the Graven orientations 1 - 4 above.

Table 4: Mathematical Literacy as defined by the Department of Education

Mathematical Literacy aspect	**Orientation emphasised**
Mathematical Literacy is driven by the life related application of mathematics.	Primarily Orientation 2 with some relationship to Orientation 1
Mathematical Literacy provides learners with an awareness and understanding of the role played by mathematics in the modern world.	Primarily Orientation 2 with some relationship to Orientation 1
Mathematical Literacy enables learners to develop the ability and confidence to think numerically and spatially.	Primarily Orientation 2 with some relation to Orientation 4 in relation to maths skills
Mathematical Literacy enables learners to critically analyse and interpret everyday situations.	Primarily Orientation 1 with some relationship to Orientation 2
Mathematical Literacy enables learners to solve problems in real life situations.	Primarily Orientation 2 with some relationship to Orientation 1

This analysis of the Mathematical Literacy definition shows that the definition, as presented in the official curriculum document, corresponds with Orientations 1 and 2.

Orientations 3 and 4 seem to be less covered by this definition. This suggests that ML has more of a focus and emphasis on real life application of mathematics in real world contexts than the development of mathematical concepts for servicing further mathematical studies.

Below, I further analyse Mathematical Literacy in terms of Basil Bernstein (1982; 1996) models.

Mathematical Literacy in terms of Bernstein (1975; 1982; 1996)

In Chapter 2 I introduced the study's theoretical framework and also described Mathematical Literacy in terms of the message systems. I have already described the pedagogic models and the curriculum type that resonate with Mathematical Literacy. At this stage I present a summary of Mathematical Literacy in terms of Bernstein's (1982; 1996) model. This summary is presented in the table below:

Table 5: Mathematical Literacy in Basil Bernstein's terms

Bernstein (1982; 1996) notion	**Mathematical Literacy considered as...**
Curriculum type Two types of curriculum, the *collection type* (exists if the contents are clearly bounded and insulated from each other) and the *integrated curriculum type* exists where the contents stand in an open relation to each other (Taylor et al. (2003)).	***Integrated curriculum type*** According to the DoE (2003:6) "subject boundaries are blurred". Mathematical Literacy is designed so that it integrates various contexts of all types. See list of contexts below.
Pedagogic model Bernstein (1996) describes two models: competence model and performance model. Competence models are linked	***Competence models*** According to the DoE (2003:3) "Outcomes-based education (OBE) forms the foundation for the curriculum in SA. It strives to enable all

to the learner-centred, and are directed towards what the learner knows and can do at the end of learning (Taylor, 1999). Performance models focus on specific learning content and texts.	learners to reach their maximum learning potential by setting the Learning Outcomes to be achieved by the end of the education process. OBE encourages a learner-centred and activity-based approach to education".
Classification Classification is expressed as being *strong* (where boundaries are explicit and categories are insulated from one another), or *weak* (where there is integration or where the boundary is weak or blurred).	***Weak classification*** Since Mathematical Literacy has been described as a curriculum driven by life related application, it is an integrated curriculum and is weakly classified.
Framing Framing is about who controls what (Bernstein, 1996). Bernstein (1971) defines framing as referring to the degree of control teachers and pupils possess over the selection, sequencing and pacing.	***Weak framing*** In Mathematical Literacy there is much emphasis on real life contexts of the leaner which enable him/her to have more control over learning. "Contexts are central to the development of Mathematical Literacy in learners. It by its very nature requires that the subject be rooted in the lives of the learners" (DoE, 2003:42). Since the curriculum encourages a learner-centred approach to education, Mathematical Literacy is therefore considered weakly framed.

In the review of policy documents I further considered key aspects of Mathematical Literacy which, I contend, form the basis for analysing the extent to which teachers' interpretations of the intended curriculum adhere to, or depart from, the official curriculum. These aspects are: curriculum design, content and contexts, progression, and finally teaching and learning in Mathematical Literacy. The information presented is derived from the four official curriculum documents for Mathematical Literacy.

Curriculum design

While the rhetoric of the definition, rationale and purposes of Mathematical Literacy indicate a weakly classified curriculum, this is not fully consistent through other parts of the curriculum, such as in the Learning Outcomes (LOs) and Assessment Standards (ASs). Mathematical Literacy curriculum for Grades 10 – 12 has been designed and structured into four Learning Outcomes (LO), namely: LO 1 Number and operations in context; LO 2 Functional Relationships; LO 3 Space, Shape and measurement; LO4 Data handling.

These Learning Outcomes are very similar to those of the NCS Mathematics for Grades 10 – 12. I argue that the way in which ML curriculum has been designed leads many people to compare ML with the subject Mathematics (or a watered down version of it). Previous studies on ML (see: Christiansen, 2007) confirm that assessment standards are too mathematical. In the policy document DoE (2003) a six-point scale of achievement is adopted (ranging from code 1 – inadequate, to code 6 - outstanding). Contrary to these codes, in the Assessment Guideline document (DoE, 2008:9) there are seven codes-slightly different from the six. This could create confusion for the teacher.

It is stipulated in the policy document that ML is for learners who intend to study disciplines which are not mathematically based. DoE (2003) states:

> Mathematical Literacy should not be taken by those learners who intend to study disciplines which are mathematically based, such as the natural sciences or engineering (p.11).

This statement can be interpreted in many ways by both teachers and learners. A learner who intends to pursue a career in commerce, for example, Bachelor of Commerce degree (B Com), is likely to be confused as to whether he/she should take ML or not. While such programmes (like B Com) usually require a mathematics background, recent studies have shown that ML can be recognised for the entry requirements into a B Com. Degree (see: Walton, 2008).

Content and context

Contexts

In Mathematical Literacy, contexts are considered to be "central to the development of Mathematical Literacy in learners" (DoE, 2003:42). Analysis shows that various contexts are used in Mathematical Literacy to attain the Learning Outcomes (LO's) and Assessment Standards (AS) of ML. These contexts are related to the principle of the National Curriculum Statement (NCS), such as issues arising in health (e.g. HIV/AIDS), human rights, inclusivity, environmental and socio-economic justice (DoE, 2003). Specific contexts that are used in Mathematical Literacy have been identified in the Teacher Guide document for ML (DoE, 2006) (see Table 6 below). Most of these contexts match with those that were identified by the mathematics educators in South Africa, Zimbabwe, Uganda, Eritrea and Norway (see: Julie and Mbekwa, 2005:33).

Table 6: Examples of contexts that are used in Mathematical Literacy

Clusters of contexts	**Examples**
Health	Contexts that deal with HIV/AIDS issues and Body Mass Index (BMI).
Finances	Contexts that deal with banking related issues, such as accounts (e.g. Mzansi), investment, loans, interest (simple and compound) and ATMs. Contexts that deal with marketing related issues, such as income and expenditure, selling price, profit, and breaking even. Contexts that deal with budgeting.
Municipal tariffs	Contexts that deal with water, electricity etc. (monthly costs).
Transport and	Contexts that deal with Telkom telephone cards, charges and cell

communication	phones Contexts that deal with mailing (ordinary and fast mail), envelope sizes and postcards etc. Contexts that deal with travelling e.g. a trip with Shosholoza Meyl.
Sports	Contexts that deal with Soccer World Cup (soccer stadiums and tickets) and athletics.
Mathematics	Contexts that deal with mathematics content, like linear equations and algebraic graphs.
General	Contexts that deal with baking and cooking Contexts that deal with bicycle gear and other objects.

These different types of contexts (and others not mentioned) should be used in Mathematical Literacy lessons. Bowie and Frith (2006) argue that Mathematical Literacy teachers will face many challenges in teaching Mathematical Literacy, as they are required to understand more than mathematics (content) but also various contexts used in Mathematical Literacy. I argue that both competence and performance models are foregrounded in Mathematical Literacy because, as seen above in Tables 5 and 6, competence models are explicit. Additionally, below in Table 7, the mathematics content knowledge presented suggests that the learner should learn "specific content and context". In Chapter 8, I further discuss the issue of context and content in Mathematical Literacy.

Content

In the table below I present mathematics content stipulated in the Mathematical Literacy Curriculum. Christiansen (2006) argues that although contexts are foregrounded in the rhetoric of Mathematical Literacy, much Mathematical Literacy content is "distinctly mathematical" (p.10).Thus; some of the topics dealt with in Mathematical Literacy are strongly classified as mathematical. For example, trigonometry, linear programming, quadratic equations etc. (See in particular these topics in the Grades 11 and 12 columns of LO2 and LO3 in the table below).

Table 7: Mathematics content in Mathematical Literacy

LO's	Grade10	Grade11	Grade12
LO 1	1. Fractions, decimals, percentages 2. Positive exponents and roots 3. The associative, commutative and distributive laws 4. Rate 5. Ratio 6. Direct proportion 7. Inverse proportion 8. Simple formulae 9. Simple and compound growth 10. Scientific notation.	1. Content involved in Grade10 work but applied to more complex situations 2. Square roots and cube roots 3. Ratio and proportion 4. Complex formulae 5. Cost price and selling price 6. Profit margins.	1. Content Grade 10 and 11 but applied to more complex situations 2. Taxation 3. Currency fluctuations 4. Financial and other indices.
LO 2	1. Tables of values 2. Formulae depicting relationships between variables 3. Cartesian co-ordinate system 4. Linear functions 5. Inverse proportion 6. Compound growth 7. Graphs depicting relationships between variables 8. Maximum and minimum points 9. Rate of change (speed, distance, time).	1. Content involved in Grade10 work but applied to more complex situations 2. Simple quadratic functions 3. Solutions to linear, quadratic and simple exponential equations 4. Solutions to two simultaneous linear equations.	1. Content Grade10 and 11 work but applied to more complex situations 2. Simple linear programming (design and planning problems) 3. Graphs showing the fluctuations of indices over time.
LO 3	1.Measurement of length, distance, volume, area, perimeter 2.Measurement of time (international time zones) 3.Polygons commonly encountered(triangles, squares, rectangles that are not squares, parallelograms, trapeziums, regular	1.Grade 10 content but applied to more complex situations 2.Measurement in 3D (Angles included, $0^0 – 360^0$) 3. Surface Area and volumes of right prisms and right circular cylinders 4.Conversion of measurements between different scales and systems 5. Compass directions	1. Content Grade 10 and 11 but applied to more complex situations 2. Surface areas and volumes of prisms of right pyramids and right circular cones and spheres 3. Scale models 4. Sine rule, cosine

	hexagons) 4. Circles 5. Angles (00 3600) 6. Theorem of Pythagoras 7. Conversion of units within the metric system 8. Scale drawings 9. Floor plans 10. Views 11. Basic transformation geometry, symmetry and tessellations.	6. Properties of plane figures and solids in natural and cultural forms 7. Location and position on grids 8. Trigonometric ratios: sin x, cos x, tan x.	rule and area rule.
LO 4	1.Construction of questionnaires 2.Populations 3. Selection of samples 4. Tables recording data 5.Tally and frequency tables 6. Single and compound bar graphs 7. Pie charts 8. Histograms. 9. Line and broken-line graphs. 10. Mean, median, mode. 11. Range. 12. Relative frequency 13. Probability.	1. The content of Grade 10 but applied to more situations 2. Selection of samples and bias 3. Cumulative frequency 4. Ogives (cumulative frequency graphs) 5.Variance (interpretation only) 6.Standard deviation (interpretation only) 7.Quartiles 8. Compound events 9. Contingency tables 10 Tree diagrams.	1. Content Grade 10 and 11 but applied to more complex situations. 2. Bivariate data 3. Scatter plots 4. Intuitively-placed lines of best fit 5. Percentiles.

With such topics presented in the above table, one would expect that teachers need to have a good mathematics background in order to teach Mathematical Literacy confidently.

Progression

Progression is one of the key principles of the NCS (DoE, 2003). The analysis of the curriculum reveals that progression is evident in mathematical content (see Table 7 above) and in the complexity of contexts. Progression in these two indicators necessitates progression in problem solving skills, from applying routine procedures to reasoning and reflecting levels. According to the DoE (2003), in Mathematical

Literacy, “the Assessment Standards do indicate progression from Grade to Grade” (p.38). The analysis, however, shows that this is not true with some Assessment Standards (see example LO1 AS 2 in Table 8 below) (DoE, 2008: 18).

Table 8: Example of Assessment Standards with no articulated progression

10.1.2 Relate calculated answers correctly and appropriately to the problem situation by: Interpreting answers in terms of the context; Reworking a problem if the initial is not sensible, or if the conditions change; Interpreting calculated answers logically in relation to the problem, and communicating processes and results.	**11.1.2** Relate calculated answers correctly and appropriately to the problem situation by: Interpreting answers in terms of the context; Reworking a problem if the initial is not sensible, or if the conditions change; Interpreting calculated answers logically in relation to the problem, and communicating processes and results.	**12.1.2** Relate calculated answers correctly and appropriately to the problem situation by: Interpreting answers in terms of the context; Reworking a problem if the initial is not sensible, or if the conditions change; Interpreting calculated answers logically in relation to the problem, and communicating processes and results.

The above Assessment Standards show no progression from Grade 10 to Grade 12. The DoE (2003), however, acknowledges that the progression “is not markedly evident in some of the Assessment Standards” (p.38). The DoE suggests that progression should be ensured in mathematical knowledge and complex situations. However, there is no example given to show how this progression might unfold. Curriculum documents seem to be unclear in this regard. The Teacher Guide document largely presents ideas and examples relating to the stipulated Grade 10 AS. North (2008) similarly notes that some of the Assessment Standards in ML are identical across the grades, and he provides examples in which progression could be achieved.

Teaching and learning strategies

Similar to mathematics, the teaching and learning of Mathematical Literacy is faced with many challenges. Vithal (2006) notes that “the teacher has to ensure that neither the learner’s understanding of the mathematics nor that of the context gets compromised” (pp. 40-41). The Policy document for ML (DoE, 2003) suggests the approach that needs to be adopted in developing Mathematical Literacy; it is to “engage with contexts rather than applying mathematics already learned, to context” (p. 42). This view is contrary to the Teacher Guide document’s proposition (DoE, 2006) where there are twenty-six learning units, each unit being expected to take between five and ten days of classroom time. Four of these learning units (units 4, 8, 15 and19) are labelled “direct content teaching”. Some of the examples given are purely mathematics content based, with no real life context, example (DoE, 2006: 43):

Solve for “a”

a) $2\ X\ a - 5 = 19$

b) $2\ X\ (a + 5) = 18$

c) $6 + 2\ X\ a = 21$

d) $(a + 4) \div 2 = 24$

It appears that the approaches to teaching these units and other units, like trigonometry, are predominantly content based rather than context driven. Similarly, Venkatakrishnan and Graven (2006) observe that documents (for ML) are not clear about the issue of contexts and content. They write:

> It would appear that there are mixed messages within the Department of Education’s documentation for ML. Whether educators will give more emphasis to context-specific problem solving using mathematics, or to the mathematics involved in solving contextual problems remains unclear at this stage (p.20).

In the section below I present some contradictions or ‘mixed messages’ within the Department of Education’s policy documents (Mathematical Literacy Grades 10-12 documents). These aspects identified below provide an important background for teachers' interpretation and implementation of the intended curriculum.

Table 9: Some contradictions in policy documents

Aspect	Comments
Mathematics content Trigonometry, linear programming, quadratic equations	These topics appear in the subject policy document (2003) but do not appear in policy documents (2005, 2006, 2008) (LPG, Teacher Guide and SAG.
Teaching approach There is much emphasis on engaging with contexts in teaching ML.	All policy documents emphasise this approach, but in the Teacher Guide there are units that suggest direct content teaching.
Progression This is one of the essential principles of NCS and is highly emphasised across policy documents of ML.	Analyses show that some assessment standards across all policy documents do not meet with this principle, e.g. 10.1.2, 11.1.2, 12.1.2; see details in Table 7.

Introduction of the Curriculum and Assessment Policy Statement

Two years after data collection for this study was completed (2012), the Department of Basic Education introduced Curriculum and Assessment Policy Statement (CAPS) in the FET phase. The aim of the CAPS is to provide a clearer specification of what is to be taught and learnt on a term by term basis (DBE, 2011).

While I do not provide a thorough anlysis of the CAPS ML document as I have for the NCS ML I briefly discuss some of the changes that have been implemented in

2012 subsequent to my study. Both terminology and structural changes were made from the NCS for ML (DBE, 2011).

Notably the definition, purpose, focus (real life contexts) and principles of Mathematical Literacy remain the same in the CAPS ML to the NCS for ML. However the CAPS for ML is now structured into two sections. Section A: Basic Skills Topics and Section B: Application Topics.

Thus Learning Outcomes (LOs) have been replaced by “Topics” even while the content with the LOs and topics remain quite similar even while reorganised. While in the NCS there were four Learning Outcomes with related Assessment Standards organised as: LO 1 Number and operations in context; LO 2 Functional Relationships; LO 3 Space, Shape and measurement; and LO4 Data handling, with the CAPS there are three basic skills topics (Interpreting and communicating answers and calculations. Numbers and calculations with numbers Patterns, relationships and representations), and five application topics (Finance; Measurement; Maps and plans; Data handling, and Probability).

The Assessment Standards of the NCS which were provided per grade have been removed. Although a Grade by Grade outline remains as shown in the example for measurement, maps and probability given below (DBE, 2011: 15-19):

For Grade 10

Basic Skills topics

- Numbers and calculations with numbers
- Patterns, relationships and representations

Application skills topics

- Finance
- Measurement: Measurements and being able to use Temperature and Time in calculations have been introduced.
- Maps, plans and other representations of the real world: Packaging arrangements explored.

- Probability: Explored through games and weather forecasts.

For Grade 11

Basic Skills topics

- Patterns, relationships and representations

Application skills topics

- Finance
- Measurement: Measurements and being able to use Temperature and Time in calculations have been introduced.
- Maps, plans and other representations of the real world: 3-D models have been introduced.
- Probability: Extended to product claims and tests where results could be inaccurate.

For Grade 12

Basic Skills topics

- None

Application skills topics

- Finance
- Measurement: Measurements and being able to use Temperature and Time in calculations have been introduced.

- Maps, plans and other representations of the real world: 3-D models have been introduced.
- Probability: National lotteries and gambling are introduced as well as risk assessments and articles from newspapers that refer to probabilities.

The complex interplay between mathematical content, skills and real-life contexts is captured in this diagram (DBE, 9):

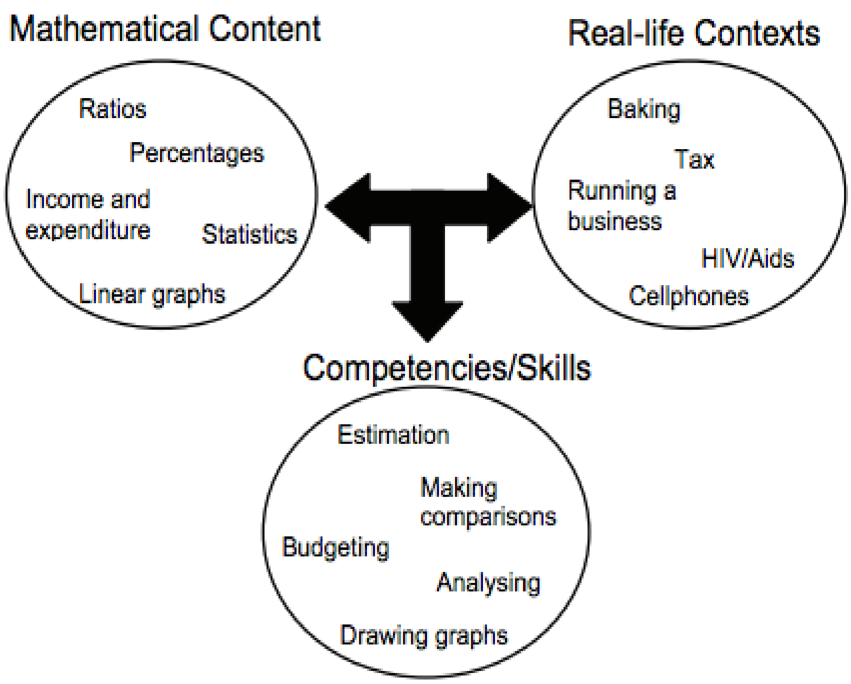


Figure 1: Interplay between content, context and problem-solving skills in Mathematical Literacy

While the ML ASs in the NCS have been criticised for not indicating clear progression from grade 10 – 12 (Christiansen, 2006), one might have expected a clearer explanation for progression in the CAPS. The CAPS however provide an explanation for progression as follows:

> One of the ways in which Mathematical Literacy develops across the grades is in terms of mathematical concepts/skills. E.g. in Grade 10 learners are expected to be able to work with one graph on a set of axes; in Grade 11 two graphs; and in Grade 12 two or more graphs on the same set of axes. This is not the case for all topics, though, and there are some instances where there is no new content in Grade 12 compared to Grades 10 and 11. In such cases progression may occur in relation to contexts and/or problem-solving processes (DBE 2011, p. 11).

The absence of new content in Grade 12 poses question with regard to progression since the DBE (2011) acknowledges that some topics do not have contexts which provide opportunity for progression.

Additionally the CAPS document explains that:

> Progression also occurs in relation to the nature, familiarity and complexity of the context in which problems are encountered. Moving from Grade 10 to Grade 12, the contexts become less familiar and more removed from the experience of the learner and, hence, less accessible and more demanding. There are some topics in which the focus in Grade 10 is on contexts relating to the personal lives of learners and/or household issues (e.g. personal finance → cell-phone accounts; household budget), in Grade11 on contexts relating to the workplace and/or business environment (e.g. business finance → payslips; taxation), and in Grade 12 on contexts relating to scenarios encompassing wider social and political contexts incorporating national and global issues (e.g. exchange rates and inflation). While these broad categories of contexts work well to define progression for certain topics, for other topics, such as measurement, map work and probability, these categories do not provide a useful indication of progression. In such cases progression may occur in relation to content and/or problem-solving processes (DBE, 2011, p. 12).

The above explanation indicates that contexts are presented across grades in a way that enables progression from familiar and personal (close) contexts to more distant broader contexts such as socio political contexts. It is however noted that some topics will not provide opportunity for progression hence content and/or processes should be used to achieve progression. Unpacking what progression means from one grade to the next is thus left for teachers to figure out and is dependent on the topic, content and context. Thus while the ASs no longer appear in the CAPS for ML they have not been replaced by clearer guidelines on progression per topic.

Notably, all topics which were in the NCS document but not for examination purposes such as Trigonometry, quadric equations and linear programming have been removed in the CAPS document. In this study there were mixed views on whether these topics should or should not be removed (discussed in later chapters).

The above said, it is important to emphasise that the curriculum analysis for this study was based on the first South African curriculum for Mathematical Literacy (the NCS Mathematical Literacy) and teacher interpretations and the implementation of this newly introduced subject rather than on the revised CAPS curriculum published in 2011 and introduced for implementation in Grade 10 in 2012.

Conclusion

In this chapter I presented a review of literature and policy documents relating to Mathematical Literacy. In particular I foregrounded some contradictions, both within and across various documents. This contextual background impacts on teacher interpretations and enactment of the curriculum. Teachers draw on, and are influenced by the departmental documents in various ways in their teaching and assessment of ML. In the next chapter I present the research design and the research process of this study.

CHAPTER 4

RESEARCH DESIGN AND PROCESS

Introduction

This chapter presents the research design and process used in this study, in two parts. Part 1 deals with the research design, and Part 2 deals with the research process. The research design part discusses the following: research approach, research strategy, context of the study, sample and sampling procedures, methods of data collection, validity and reliability of the data, methods of data analysis and tools. Part 1 is concluded with an outline of the relationship between the research questions and research methods of data collection. For the research process, the four stages of the research process are presented. These stages deal with the research proposal and ethical clearance, data collection process, data analysis and discussions and finally the reporting stage. Before commencing with the discussion it is important to note that there were three key phases of data collection and these drew on different data gathering techniques:

PHASE 1: Questionnaires

This phase involved a sample of 60 Mathematical Literacy teachers. Data was collected through questionnaires. Each questionnaire had two parts, a quantitative part (with 20 likert scale sub-questions grouped into two categories) and a qualitative part (with two open-ended questions).

PHASE 2: Semi-structured interviews

This phase involved a sample of seven Mathematical Literacy teachers. Semi-structured interviews were conducted.

PHASE 3: Classroom observations

This phase involved a sample of two Mathematical Literacy teachers. A total of eight lessons (four consecutive lessons per teacher) were observed in Grade 11 classes.

PART 1: RESEARCH DESIGN

Research approach

This study sought to explore teachers' interpretation and implementation of Mathematical Literacy. An interpretive qualitative research approach was adopted for its relevance to this study, although some quantitative data was collected from a large group of teachers in the first part of the questionnaire, in phase 1. This quantitative data was used to supplement the more qualitative data gathered.

It is argued that a qualitative approach uses a naturalistic approach that seeks to understand phenomena in context-specific settings (Hoepfl, 1997). Strauss and Corbin (1990) contend that qualitative methods can be used to better understand any phenomenon about which little is known. This is applicable to the present study in which there is little known about teachers' interpretation and implementation of Mathematical Literacy in Grades 10 – 12. Qualitative methods can also be used to gain new perspectives on things about which much is already known, or to gain more in-depth information that may be difficult to convey quantitatively (Hoepfl, 1997). Libarkin and Kurdziel (2002) assert that qualitative research is an unconstrained approach to studying phenomena. They further argue that qualitative studies provide a window into a contextual setting, and a logical picture of events within that setting. According to Opie (2004), researchers who seek to obtain softer facts and insights into how individuals create, modify and interpret the world in which they find themselves, employ qualitative techniques. All these attributes of qualitative research resonate well with the nature and purpose of my study which aims at understanding how individual teachers interpret and implement the intended curriculum. The study also aims at understanding teachers' experiences of teaching Mathematical Literacy, and how these experiences influence their practice and interpretation of the Mathematical Literacy curriculum. Qualitative data proved to be more appropriate in providing better opportunities and possibilities to achieve the objectives of this study.

It was on these bases therefore that the qualitative approach was chosen and used in this study.

Research strategy

The research strategy used in this study is in line with the qualitative approach. Creswel (1998) identifies five types of research strategies that can be used in qualitative research. These strategies are: phenomenology, biography, ethnography, case study and grounded theory. For the purpose of this study a case study strategy was adopted as relevant research strategy.

According to De Vos, Strydom, Fouche' and Delport (2002) a case study is the observation of a process, an activity, an event programme or an individual, bound within a specific time and setting. The overarching question the present study attempted to answer is: How do Mathematical Literacy teachers interpret and implement the intended Mathematical Literacy curriculum? A case study involving two Mathematical Literacy teachers was conducted for understanding implementation. Case studies have been increasingly used in Mathematics education (see: Sithole, 2004; Van der Sandt, 2007; Mthethwa, 2007; Kotze, 2007; Adler and Pillay, 2007). Hitchcock and Hughes (1995) observe that the case study approach is a central feature of qualitative research. They further contend that case studies are the preferred strategies when 'how' and 'why' questions are being posed (p.322). This is particularly relevant to this study because the overarching question that this study aims to answer, as already indicated above, is: How do teachers interpret and implement the curriculum?

Context of the study

This study is about teachers' interpretations and implementation of the Mathematical Literacy curriculum. The study involves three parts (see the research process for details). In Part 1, teachers of Mathematical Literacy in the East London District in the Eastern Cape Province were invited to participate in the study. There are approximately ninety secondary schools in the East London District, with almost 100

Mathematical Literacy teachers. The section below explains how these teachers were selected to participate in the second and third parts of the study. It further describes the criteria that were used to select these participants.

Selection of the sample

Purposive and convenient sampling methods (Schumacher and Macmillan, 1993; Cohen, Manion and Morrison, 2000; and Mertens, 2005) were used. Purposive sampling allows the researcher to select subjects on the basis of a particular key feature or characteristic. In the context of this study a key feature explored was the influence of the Mathematics education tertiary background of the participants. Convenient sampling allows the researcher to include the participants who are easy to access. In this context, the East London Education District was convenient for the researcher. The participants were selected on the basis of purpose and convenience.

The sample of teachers consisted of two groups:
Group 1: Mathematical Literacy teachers with a tertiary Mathematics education background who had been teaching Mathematics at FET level before Mathematical Literacy was introduced.
Group 2: Mathematical Literacy teachers without a tertiary Mathematics education background (who had never taught Mathematics, but who had been retrained to teach Mathematical Literacy).

These teachers were chosen on the basis of being representative, or typical, of the population. They reflect variations in the teacher population (Burger and Silima, 2006); and were readily available to participate (Mertens, 2005). To meet these criteria, questionnaires were used to capture relevant information (see Appendix 1).

A list of all the teachers (just under 100) of Mathematical Literacy, and their contact details was requested from the East London Education District office. Initially, I attempted to contact all the teachers (as contactable as possible - see Appendix 5).

Following the teachers' indication of interest to participate, formal letters of request were hand-delivered to the respective teachers and their principals (see Appendices 6 and 7). My sample of 60 teachers is thus from these teachers who were willing to participate and fill in the questionnaires. Details on the questionnaire are provided later in this chapter.

Teachers' responses were useful in providing general information on Mathematical Literacy implementation across the district, and helpful in selecting the participants for the second phase of the study. Initially, ten teachers were invited to participate in the second phase of study, but three did not make themselves available when the interviews were to be conducted. A sample of seven Mathematical Literacy teachers was thus interviewed for the second phase. Four of these teachers had a mathematics background and the other three were from a non-mathematics background. Phase three of the study involved a case study of two teachers who were selected from those teachers who had participated in Phase two of the study. Initially, four teachers were invited, but only two were available and willing to participate in classroom observation. Details of the participants and the data collection are provided below.

Background of the broad sample of teachers

The phase 1 sample consisted of 60 teachers selected from Secondary Schools in the East London Education District, in the Eastern Cape Province of South Africa. The original number of teachers approached was 100 (list received from the District office), and 60 teachers agreed to participate. Their ages ranged between 30 and 50 years. The sample consists of 21 males and 39 females. They had teaching experience from 5 to 25 years. All of them had the minimum teaching qualification, which is a three year teaching diploma, or a Bachelor of Education degree. Some had both mathematics and Mathematical Literacy qualifications as shown in Tables 10 & 11 below.

Table 10 below shows the number of teachers with Mathematical Literacy qualifications, and those who do not have Mathematical Literacy qualifications. The table shows that 25 out of 60 (41.7%) of the Mathematical Literacy teachers had achieved the Advanced Certificate in Education (ACE) specialising in Mathematical Literacy, while 35 out of 60 (58.3%) did not have the ACE qualification.

Table 10: Teacher's qualifications[15]

Qualification	Frequency	%
ACE in Mathematical Literacy	25	41.7
No ACE in Mathematical Literacy	35	58.3
Total	**60**	**100.0**

It is important to note that out of the 25 teachers who did ACE some (13 of them) had had Mathematics qualifications prior to the introduction of Mathematical Literacy and 12 of them did not have any Mathematics qualifications before doing an ACE in Mathematical Literacy.

Table 11 below shows the number of teachers who had tertiary Mathematics backgrounds, and those who did not have Mathematics education background but only underwent Mathematical Literacy training.

Table 11: Teacher's tertiary Mathematics background[16]

Tertiary Background	Frequency	Percent	Cumulative Percent
Mathematics in tertiary qualification	48	80.0	80.0
No Mathematics in tertiary qualification	12	20.0	100.0

[15] In the sample all teachers who did not have Mathematics qualifications did ACE (Mathematical Literacy); some teachers had both Mathematics and Mathematical Literacy qualifications.
[16] These are teachers who have done Mathematics beyond Grade 12 level and taught Mathematics before teaching Mathematical Literacy.

Tertiary Background	Frequency	Percent	Cumulative Percent
Mathematics in tertiary qualification	48	80.0	80.0
No Mathematics in tertiary qualification	12	20.0	100.0
Total	**60**	**100.0**	

Table 11 shows that the majority (80 %) of the Mathematical Literacy teachers had a Mathematics education background. In Chapter 5 I will present the analysis on how these teachers were recruited to teach Mathematical Literacy. Chapter 5 focuses on the 60 teachers who participated in this study. To ensure anonymity they were coded Teacher 1 (T01), Teacher 2 (T02), Teacher 3 (T03)… to Teacher 60 (T60). In Chapter 6, I used pseudonyms for the seven participants who were interviewed, and in Chapter 7 I continued with the same names for the two teachers who were involved in the classroom observation.

Data collection

Sources of evidence used in case studies include documents, archival records, interviews, direct observation, participant-observation, and physical artefacts (Stake, 1995; and Yin, 1994). While all these sources can be important for case studies, in the present study questionnaires; interviews and lesson/classroom observations were used to gather data. As an entry point, questionnaires were used to determine the potential participants, and to determine in general the teachers' interpretation and their articulated implementation of the curriculum across an Education District.

Below, the instruments used for data collection for this study are described. Further details are presented in the research process section.

Data collection for Phase 1 (presented in Chapter 5)

Questionnaires

A questionnaire is one of many ways through which information can be collected from a variety of respondents (McMillan and Schumacher, 2001; Wilkinson and Birmingham, 2003). There were three important reasons for using a questionnaire in this study. The first reason was to determine the potential participants who could provide rich data (from a Mathematics background and from a non-Mathematics background). The second reason was to determine the general view, across ML teachers in East London Education District, of their interpretation and articulated implementation of the curriculum. The third reason was to support methodological triangulation (see below).

Data collection for Phase 2 (presented in Chapter 6)

Interviews

The research interview may be used as the principal means of gathering information which has a direct bearing on the research objectives (Cohen et al., 2000). Interviews are also one of the most important sources for case study information. Bondy and Maunders (1999) identify four forms of research interview in qualitative research, namely, standardised, unstructured, semi-structured and focus group interviews. I considered semi-structured interviews to be the most suitable for this study. Semi-structured interviews fall between structured and unstructured interviews and have more advantages than disadvantages. According to Hitchcock and Hughes (1995) the semi-structured interview is much more flexible than the structured interview (p.157). They further assert that the semi-structured interview allows depth to be achieved by providing the opportunity on the part of the interviewer to probe and expand the respondent’s responses (p.157). Opie (2004) argues that semi-structured interviews are more flexible and thus facilitate more analysis than structured interviews. Similarly, De Vos et al. (2002) are of the view that a semi-structured interview gives the researcher and the participant much more flexibility (p.302). They point to the advantages of using semi-structured interviews, and argue that the researcher is able to follow up specific interesting avenues that emerge in the interview, enabling the participant to give a fuller picture (p.302).

Like any other instruments, a semi-structured interview is not perfect (Wilkinson and Birmingham, 2003); it has some limitations. De Vos et al. (2002) also note that the participant may be unwilling to share information, and the researcher may ask questions that do not evoke the desired responses from the participants (p.302). To minimize these challenges, the suggested useful interviewing techniques and tips to ensure an effective interview - as discussed in Wilkinson and Birmingham (2003) and De Vos et al. (2002) - were used when interviewing Mathematical Literacy teachers (see Appendix 2).

Data collection for Phase 3 (presented in Chapter 7)

Observation

Observational data are attractive as they afford the researcher the opportunity to gather live data from live situations (Cohen et al., 2000). This enables researchers to understand the context of programmes, to be open-ended and inductive, to see things that might otherwise be unconsciously missed, to discover things that participants might not freely talk about in the interview situations, to move beyond perception-based data, and to access personal knowledge (Cohen et al., 2000). Wilkinson and Birmingham (2003) point to the conditions in which observation can be used as a research instrument. These conditions resonate well with the conditions of this study, which are:

(i) when the ways in which people behave and interact with one another in a social setting are important to your research
(ii) when the best way to research what you want to know is to experience it yourself
(iii) when a flexible approach to research is needed (p.118).

An observation schedule was used during the observation (see Appendix 3). Four successive Mathematical Literacy lessons were observed, followed by teacher reflection after each lesson. See details in Chapter 7.

Triangulation

Triangulation may be defined as the use of two or more methods of data collection in the study of some aspect of human behaviour (Cohen and Manion, 1994). According to Cohen et al. (2000) there are different types of triangulation; some of these types are methodological triangulation (using the same method on different occasions or different methods on the same object of study), time triangulation (stability over time) and similarity of data gathered at the same time (synchronic reliability) (p.113). In this study these types of triangulation were used in data collection (data triangulation), in data analysis (using different models) and in drawing on alternative theories. Mouton (1996) asserts that the inclusion of multiple sources of data collection in a research project is likely to increase the reliability of the observations. In this study, the questionnaires, observations and interviews were used to determine (i) what teachers write (questionnaires), (ii) say (interviews) and (iii) do (observations) and thus support methodological triangulation. Table 11 shows the appropriateness of the three instruments that were used to collect data.

Access and ethics

According to Homan (2002), cited in McNamee and Bridges (2002), the principle of informed consent is a standard feature of ethical procedure in social research. Informed consent refers to the procedures in which individuals choose whether or not to participate in an investigation, after being informed of facts that would be likely to influence their decisions (Diener and Crandall, 1978). Gatekeepers[17] should be informed accordingly. In this study access was negotiated with all the gatekeepers, namely: the Department of Education (East London District Manager), High school principals and the participating Mathematical Literacy teachers respectively. Participating teachers were given all the relevant information, including, the purpose of the study, the right to withdraw, the kind of information required and the

[17] Are those who give access to a research field; their role may be allowing investigators into a given physical space, or it may go further in granting permission for research to be conducted in a particular way.

significance of the study. Permission to conduct the research was requested, and was granted by the East London (DoE) District Office (see Appendices 4 and 7). Letters explaining that the consent of the DoE had been given were written to all the Mathematical Literacy teachers who were to participate in this research project. Letters to the school principals of the participants were written to inform them about the research (see Appendix 5). University protocol was followed and ethical clearance was applied for and granted by the Ethics Committee.

Anonymity, privacy and confidentiality

The anonymity and privacy of those who participate in the research process should be respected. Personal information concerning the research participants is kept confidential. The real names of the participating teachers and their schools were not used in the report of this study. Teachers and school principals were assured of anonymity and confidentiality. As Schumacher and Macmillan (1993) write:

> The investigator should inform the subjects of all aspects of the research that might influence willingness to participate, and answer all inquiries of subjects on features that may have adverse effects or consequences (p.193).

All the participants and the schools were happy with this arrangement of privacy and confidentiality.

Methods of data analysis

The data collected through questionnaires, interviews and classroom observation were analysed through various methods. The analysis was informed by the socio-cultural framework as discussed in Chapter 2. Hatch (2002) presents five models of qualitative data analysis, namely; typological, inductive, interpretive, political and polyvocal analysis. For the purpose of this study the inductive and the typological models were used in the data analysis. According to Hatch (2002) the inductive model of data analysis allows the researcher to identify themes that emerge from the data. In an inductive model, themes emerge from the data, and not from predetermined categories. Using this model allowed important issues to emerge and be dealt with accordingly, thus helping me, as the researcher, to discover and discuss more than what I was initially aware of. In the typological model, themes or categories were predetermined. Typological analysis involves dividing the data into categories or groups. Typological data analysis, as viewed by Hatch (2002: 153), “starts by dividing the overall data set into categories or groups based on predetermined typologies.”

This method of analysis helped me to focus on key issues that I wanted to explore. I also used Graven’s (2002) orientations of mathematics knowledge and Graven and Venkatak’s (2007) pedagogic agendas as categories for data analysis. This ensured methodological triangulation. Details are presented in the research process section. Table 12 below connects my research questions with the instruments used to collect data.

Table 12: Relationship between research questions and research instruments

Research question	**Instrument(s) used to collect data**
1. What are the teachers’ interpretations of the intended Mathematical Literacy curriculum?	Semi-structured Interviews Observation Questionnaires
2. What are the teachers’ experiences of teaching Mathematical Literacy, and how do these experiences influence their practice and interpretation of the Mathematical Literacy curriculum?	Semi-structured Interviews Observation Questionnaires
3. How do teachers’ interpretation and implementation of the curriculum depart from, or adhere to, the intended Mathematical Literacy curriculum?	Semi-structured Interviews Observation and Questionnaires

PART 2: RESEARCH PROCESS

Introduction

Having presented the research *design* of the whole study, I now present the research *process* in four stages. The first stage in the process was the research proposal and ethical clearance; the second stage was data collection; stage three was data analysis and discussion; and the final stage involved reporting.

Four stages of the research process

2008-2009: Stage 1: Research proposal and ethical clearance

This was the first stage of a long journey which started in April 2008 and ended in March 2012. During this stage the key things that took place were: the development of a research proposal, requesting permission from the East London Education District, and applying for ethical clearance from the Wits Ethics Committee. The research proposal was accepted, and permission to conduct the research in the East London Education District was granted (see Appendix 9). In July 2009 the ethical clearance certificate was issued. Having received approval to conduct the research, I then proceeded to the second stage of the research process.

2009-2010: Stage 2: Data collection

It is important to mention that the East London District office did not only give me permission to access the schools, but they also provided support in getting teachers' contact details. I got a list of all the schools in the District, with contact details of all the Mathematical Literacy teachers. I contacted as many teachers as I could, requesting them to participate in the research. All the teachers that I managed to contact were willing to participate. I visited all the schools with letters to the Principals and Mathematical Literacy Teachers. It was fortunate that the

Mathematical Literacy teachers had a cluster meeting during that time, hence I was able to reach many teachers.

Firstly, I indicated to the teachers that the research had many phases and I would be inviting them to attend some or all the phases, depending on their availability. The responses were very positive from the majority of the teachers. They requested that I give them extra questionnaires so that they could distribute them to other teachers whom they believed would be interested in participating in the research project. Unfortunately, I could not give them more questionnaires because of the ethical issues that I had to clear before allowing anyone else to participate.

In the first phase of data collection I distributed questionnaires to 80 teachers across the East London Education District. I gave the teachers reasonable time to complete the questionnaire as had been agreed with the individual participants. There were many cases where I had to re-issue a further set of questionnaires because the teacher had misplaced the first one. I thus ended up distributing 98 questionnaires to the 80 teachers.

I personally collected all the questionnaires from the teachers (this process took place between August 2009 and December 2009). I decided to collect the questionnaires myself was because I wanted to code each questionnaire for any possible follow-up questions. Surprisingly, the teachers willingly indicated that they wanted to participate in the second phase of the data collection and to this effect they included their personal details, such as their contact numbers and email addresses. Out of the 80 teachers who received questionnaires, 60 of them returned the questionnaires completed. In one of the biggest schools in the District, the principal would not allow me to conduct the research in his school, and instructed the six Mathematical Literacy teachers not to participate, even though some had indicated their willingness to participate. The other fourteen teachers who were given questionnaires were not available to return them. Many attempts were made to contact them, and I even visited them at their respective schools to collect the questionnaires, but some did not make themselves available, and others claimed to have forgotten the questionnaires at home.

Out of the 60 questionnaires that I got back, 58 teachers indicated that they would like to participate in the second phase of data collection, which involved interviews. I studied the teachers' questionnaires, particularly for information on mathematics education background, and identified ten potential participants for the second phase.

For the second phase of data collection, which took place in February and March 2010, I invited the ten teachers to participate in the interviews. These ten Mathematical Literacy teachers met my criteria for the second phase of data collection (see their details in Chapters 5 – 7). It is relevant to mention that three participants did not avail themselves for interviews; in spite of the commitment and assurance that they had given me that they would participate. There were cases where I made appointments with the teachers and travelled more than 500km to meet them, only to find that they were no longer available, having either taken the day off, or left the school an hour before the appointment time. I thus ended up with seven teachers participating in the interviews. A voice recorder was used to record the interviews, with the permission of the participants. The interviews were semi-structured (see Appendix 2: Interview protocol).

The last phase of data collection, which involved classroom observation, was scheduled for May, August, September and October 2010. I invited four teachers to participate in this last phase. Two of the teachers had a background of mathematics in their tertiary education, and the other two were from a non-Mathematics background (they had not studied mathematics in their tertiary qualification). The June exams in 2010 started earlier to accommodate the 2010 FIFA World Cup, so the May schedule was affected. The third term (from July) was disrupted by strikes of government employees, including teachers. Schooling was affected and I could not access the schools for the whole term. At this stage, only two participants were still willing to participate. I arranged classroom visits with the teachers and schools for the fourth term. All the necessary arrangements and preparations for classroom visits were successful.

The third phase of data collection, as indicated above, involved lesson observations. This process took place at the beginning of the fourth term (October 2010). Two teachers were involved. A total number of eight lessons were observed with the two participating teachers (four consecutive lessons with each teacher). Both teachers were teaching Grade 11 Mathematical Literacy and the combination of subjects that the learners in the two classes were taking, was the same. The observation schedule was used to collect relevant information during the lesson. All lesson observations were followed by the teacher's reflection on the lesson. The key aspects focused in each lesson were: introduction to the lesson, learners' participation, role of contexts and content in the lesson, and the teacher's role in the lesson.

2010-2011: Stage 3: Data analysis and discussions

Data that were collected in the three phases of data collection were analysed and discussed. The three phases of data analysis are presented in Chapters 5 – 7. Chapter 8 captures the discussions that followed data analysis, and the conclusions are presented in Chapter 9.

2011-2013: Stage 4: Reporting

This is the last stage of the research process and it involved the writing of this thesis, from the initial draft to the final report of the study. This process started in October 2011 and continued till September 2013 when the final report was submitted for examination.

A summary of the research process is presented in Table 13 below.

Table 13: Summary of the research process

Stage	Period	Activity
1 Research proposal and Ethical clearance	April 2008 – July 2009	Developing the research proposal and having it submitted to the School of Education. Request permission to conduct research at the East London Education District from the Eastern Cape Provincial Department of Education and District Office.
2 Data collection	July – Dec 2009 Feb – March 2010 Sept. – Oct 2010	Distribution and collection of questionnaires Conducting interviews Conducting classroom/lesson observations.
3 Data analysis	Nov 2010 – Feb 2011 March – Sept 2011	Transcribing data (interviews) Analysis of data and discussions.
4 Reporting	Oct. 2011– Nov 2011 Dec. 201 – Feb 2012 Feb. 2012. – September 2013 March 2014	Draft 1 Draft 2 Final draft Submission for examination. Final submission

Conclusion

In this chapter I have presented the research design and the research process of the whole study. In the research design I presented the research approach, research strategy, context of the study, samples and sampling procedures, methods of data collection, methods of data analysis and tools for analysis. For the research process, I presented four stages of the research process. I have also presented the relationship between the research questions and the research methods of data collection. In the next chapter, details of the data analyses of the questionnaires are presented.

CHAPTER 5

ANALYSIS OF THE QUESTIONNAIRE

Introduction

This study attempts to understand teachers' interpretations and implementation of the Mathematical Literacy curriculum (Grades 10-12). In this chapter I present data collected from the first of three phases of data collection, namely, the questionnaires. Each phase of data analysis attempted to answer the following overarching research question: How do teachers of Mathematical Literacy interpret and implement the intended Mathematical Literacy curriculum? The following *critical questions* were considered:

(i) What are teachers' interpretations of the intended Mathematical Literacy curriculum?

(ii) What are teachers' experiences of teaching Mathematical Literacy, and how do these experiences influence their practice and interpretation of the Mathematical Literacy curriculum?

(iii) How do teachers' interpretations and implementation of the curriculum depart from, or adhere to, the intended Mathematical Literacy curriculum?

In each phase further sub-questions were developed to address the above critical questions.

Data was collected, through questionnaires, from a sample of 60 Mathematical Literacy teachers. Each questionnaire had two sections, a *quantitative section* (with 20 sub-questions grouped into two categories) and a *qualitative section* (with two questions). Qualitative data was analysed through the typological and inductive models of Hatch (2002). Graven's (2002) mathematics orientations and Graven and Venkat's (2007) spectrum of Pedagogic Agendas were used as tools of analysis. Part 1 of this chapter focuses on quantitative data, while Part 2 focuses on qualitative data.

The questionnaire

The first section of the questionnaire has twenty questions which are presented on the Likert scale (see questionnaire Appendix 1). The SPSS[18] was used to analyse the responses from this quantitative section. The 20 questions in the first part of the questionnaire were aimed at getting a general sense of what teachers knew about the curriculum and what they thought about teaching it. However reflecting on some of the questions there is some difficulty with interpreting teacher responses as teachers could have chosen to answer in terms of this is what I know the curriculum says or they might have answered in terms of this is what I think about this subject as a lived and implemented curriculum in my context. In retrospect I would have modified the questionnaire to be clearer so as to ask about teachers interpretations of the curriculum not as merely as a policy document but as 'a contextualised social process' involving their lived experience of it. Teacher answers are however still of interest but the interviews that followed provided a much richer understanding of teacher interpretations of their lived experience and interpretation of the curriculum. The second section has two open-ended questions and responses that were analysed, using models and tools for qualitative data analysis.

The questionnaire was intended to address the following questions in relation to teacher interpretations of ML (*Critical question 1*) and teacher experiences of teaching it (*Critical question 2*).

(i) What is Mathematical Literacy?

(ii) How is Mathematical Literacy taught?

(iii) Why is Mathematical Literacy taught?

(iv) What are teachers' experiences of teaching Mathematical Literacy?

[18] SPSS is an integrated computer programme that enables the user to read data from questionnaire surveys and other sources, to manipulate them in various ways and to produce a wide range of statistical analyses (both descriptive and inferential statistics) and reports, together with documentation. In this study it was used to calculate frequencies and averages.

The quantitative data is presented first, and the qualitative data later. In Part 1, I present the analysis of responses of the 60 teachers to the first two questions presented above, (i) and (ii) respectively. The second section, Part 2, presents an analysis of the responses on the last two questions, (iii) and (iv) respectively.

Each section concludes with summaries of the key findings. Lastly the summary of all the findings of Parts 1and 2 is presented.

PART 1: QUANTITATIVE DATA

Part 1 presents the responses to the first questions: (i) and (ii). These responses are presented separately, and each question has ten sub-questions; the responses are presented in a table form.

(i) What is Mathematical Literacy?

What is Mathematical Literacy? Chapter 3 attempts to answer this important question: from the perspective of the ‘intended’ curriculum was made by drawing from the literature reviewed. Teachers’ responses to this question are now analysed. In an attempt to get a wide range of responses from teachers on their understanding of Mathematical Literacy, ten sub-questions were asked. The teachers were required to respond by indicating whether they: strongly agree, agree, were unsure, disagree or strongly disagree with various statements. In the analysis, three categories of responses were established. The first category was ‘positive response’ (agree and strongly agree), the second category was ‘neutral response’ (unsure) and the third category was ‘negative response’ (disagree and strongly disagree). These ten questions were carefully selected to capture the teachers’ understanding of the intended curriculum. Below are the findings from the analysis of the responses to the *first ten sub-questions.*

Dominant views of the ML teachers on what Mathematical Literacy is

(a) 98.3% of the 60 teachers agree that Mathematical Literacy is driven by real life contexts.

(b) 95% of the 60 teachers agree or strongly agree that Mathematical Literacy is an important subject.

(c) 86% of the 60 teachers agree or strongly agree that both content and context are equally important in the teaching of Mathematical Literacy.

(d) 80% of the 60 teachers agree or strongly agree that learners who are not taking Mathematics must do Mathematical Literacy.

(e) 76.7% of the 60 teachers agree or strongly agree that in Mathematical Literacy contexts are more important than mathematics content knowledge.

(f) 73.4% of the 60 teachers agree that Mathematical Literacy is not similar to Standard Grade (SG) Mathematics.

(g) 66.6% of the 60 teachers agree or strongly agree that people do not understand Mathematical Literacy.

(h) 61.7% of the 60 teachers disagree with the statement that Mathematical Literacy has no clear career links after Grade 12.

Mixed *v*iews of the ML teachers on what Mathematical Literacy is.

For the statements below the views of the 60 teachers were more mixed with almost half agreeing and the other half disagreeing.

a) 53.3% of the 60 teachers disagree that Mathematical Literacy is an easy version of Mathematics.
b) 43% of the 60 teachers agree or strongly agree that learners who are not taking Mathematics must do Mathematical Literacy.

Below, specific table summaries are provided for each of the ten sub-questions or statements based on the first guiding question: *What is Mathematical Literacy?*

The first sub-question was based on real life context and Mathematical Literacy. According to DoE (2003) it is stressed that:

> Contexts are central to the development of Mathematical Literacy in learners. By its very nature it requires that the subject be rooted in the lives of the learners (p.42).

Teachers were to indicate whether they agree or disagree that Mathematical Literacy is driven by real life context. Table 14 below shows responses of the 60 teachers.

Table 14 Mathematical Literacy is driven by real life contexts

Scale	Frequency	Percent	Cumulative Percent
Strongly agree	40	66.7	66.7
Agree	19	31.6	98.3
Unsure	1	1.7	100.0
Total	**60**	**100.0**	

From Table 14, it appears that more than 98% of the teachers agree or strongly agree that Mathematical Literacy is driven by real life contexts. This shows overwhelming coherence with the curriculum definition provided. It is noted, though, that there was only one teacher who was not sure whether Mathematical Literacy is or is not driven by real life context. The issue of the real life contexts is further raised in the next chapter, and is discussed in detail in Chapter 8.

In the second sub-question, teachers were asked whether Mathematical Literacy is an easy version of Mathematics or not. The responses are presented below in Table 15.

Table 15: Mathematical Literacy is an easy version of Mathematics

Frequency	Percent	Cumulative Percent	
Strongly agree	9	15.0	15.0
Agree	8	13.3	28.3
Unsure	11	18.3	46.7
Disagree	24	40	86.7
Strongly disagree	8	13.3	100
Total	**60**	**100**	

Table 15 shows that there are mixed views on whether or not Mathematical Literacy is an easy version of Mathematics. It is noted that just over half of the teachers (53%) disagree with the statement that Mathematical Literacy *is* an easy version of Mathematics, while 28.3% of the teachers agree that it is an easy version of Mathematics. 18.3% of the teachers are unsure whether or not Mathematical Literacy is an easy version of Mathematics. Here we see the mixed messages of the various curriculum documents analysed in earlier chapters playing out in teacher interpretations. While in the rationale of the curriculum it is argued that ML is not a watered down version of Mathematics, our analysis showed that many of the Assessment Standards for ML were a simplified version of Mathematics Assessment Standards.

In the third sub-question, teachers were asked whether the learners who are doing Mathematical Literacy do it because they are not capable of doing Mathematics. According to the DoE (2003) Mathematical Literacy is for learners who do not perceive themselves in the future studying disciplines which are mathematically based, like engineering and natural sciences. Thus, it is not articulated that it is only for learners who do not manage mathematics. Table 16 below shows teachers' responses in this regard.

Table 16: Mathematical Literacy is for learners not capable of doing pure Mathematics

Scale	Frequency	Per cent	Cumulative Percent
Strongly agree	6	10.0	10.0
Agree	20	33.3	43.3
Unsure	12	20.0	63.3
Disagree	19	31.7	95.0
Strongly disagree	3	5.0	100.0
Total	**60**	**100.0**	

Table 16 shows that there are mixed views on whether or not Mathematical Literacy is for those learners not capable of doing mathematics. 43.3% of the responses show that teachers see Mathematical Literacy as being for learners who are not capable of doing Mathematics. On the other hand, 36.7% of the responses disagree with the statement. Notably, there are 11 (18.3%) teachers who are unsure.

The fourth sub-question required teachers to decide whether Mathematical Literacy is similar to Standard Grade (SG) Mathematics[19], or not. The responses are presented below.

Table 17: Mathematical Literacy is similar to SG Mathematics

	Scale	Frequency	Percent	Cumulative Percent
	Strongly agree	2	3.4	3.4
	Agree	5	8.3	11.7
	Unsure	8	13.3	25.4
	Disagree	31	51.7	78.0
	Strongly disagree	13	21.7	98.3
	Total	59	98.3	98.3
Missing	System[20]	1	1.7	100
Total		**60**	**100.0**	

Table 17 shows that 73.4% of the teachers disagree or strongly disagree with a statement that Mathematical Literacy is similar to SG Mathematics. The table shows that 13.3% of the teachers are not sure, while 11.7% of the teachers agree or strongly agree that Mathematical Literacy is similar to SG Mathematics, - a view possibly promoted by several Assessment Standards (which are similar to SG Mathematics), as discussed in Chapter 3. One teacher did not respond to this question and is thus indicated as ‘missing’.

The fifth statement was: Learners who are not taking Mathematics must do Mathematical Literacy. The responses are presented in Table 18 below.

[19] Standard Grade Mathematics was a lower version of the Higher Grade Mathematics syllabus in the NATED 550 curriculum

[20] Means that the respondent did not respond to this question

Table 18: Learners who are not taking Mathematics must do Mathematical Literacy

Scale	Frequency	Percent	Cumulative Percent
strongly agree	26	43.3	43.3
Agree	22	36.7	80.0
Unsure	8	13.3	93.3
Disagree	2	3.3	96.7
strongly disagree	2	3.3	100.0
Total	**60**	**100**	

According to Table 18, the majority of teachers, 48 out of 60 (80%) contends that learners who are not taking Mathematics must do Mathematical Literacy. Indeed this is the enforced policy. However, it might be that these teachers have answered in this way as they agree with the enforced policy. The analysis shows that 13.3% were not sure and 4 of them (6.6%) did not agree that learners who are not doing Mathematics must do Mathematical Literacy. The view expressed by the four teachers, that learners who are not doing Mathematics must not automatically do Mathematical Literacy, does not cohere with the DoE's education policy and ideal of introducing compulsory Mathematics or Mathematical Literacy into the curriculum. Later in this study analysis, some of the negative experiences of Mathematical Literacy teachers in teaching Mathematical Literacy are presented. Those negative experiences are linked with the ideas expressed by some teachers who argue that learners who are not doing Mathematics must not automatically do Mathematical Literacy.

The sixth sub-question or statement was: Mathematical Literacy has no clear career links. Table 19 below shows the responses of the teachers.

Table 19: Mathematical Literacy has no clear career links

Scale	Frequency	Percent	Cumulative Percent
strongly agree	1	1.7	1.7
Agree	4	6.7	8.4
Unsure	18	30.0	38.4
Disagree	24	40.0	78.4
strongly disagree	13	21.6	100.0
Total	**60**	**100.0**	

According to Table 19 above, the majority of the teachers, 37 out of 60 (61%) disagree with the statement that Mathematical Literacy has no career links, while only 5 out of 60 (8.3 %) teachers agree with the statement that Mathematical Literacy has no career links. Notably, 18 out of 60 (30%) of teachers are unsure. While curriculum policy states that ML should be taken by learners who do *not* wish to study careers such as engineering etc., it does not state with which careers it does articulate well. On the other hand, there have been cases where universities accepted good ML results for B Com (e.g. requirements for B Com at Fort Hare and Nelson Mandela Metropolitan University (NMMU)).

In the subsequent chapters, chapter 6 for example, the analysis of interviews shows that teachers view Mathematical Literacy as a potential subject to create job opportunities for the learners. See Susan and Jabu. As I have already presented in chapter 3 the purpose of Mathematical Literacy, in the next section of this chapter it is further presented. Additionally, in chapter 6 I further present the purpose and the aim of Mathematical Literacy. In all these sections the analysis shows that Mathematical Literacy teachers view the purpose of Mathematical Literacy in a broader way, more than just a career link, but for real life or everyday life

The seventh statement was: People do not understand what Mathematical Literacy is. Table 20 below presents the analysis of the responses of the 60 Mathematical Literacy teachers to this statement.

Table 20: People do not understand what Mathematical Literacy is

	Scale	Frequency	Percent	Cumulative Percent
	Strongly agree	8	13.3	13.3
	Agree	32	53.3	66.6
	Unsure	10	16.7	83.3
	Disagree	6	10.0	93.3
	Strongly disagree	3	5.0	98.3
	Total	59	98.3	
Missing	System	1	1.7	
Total		**60**	**100.0**	

It is noted that one teacher out of the 60 did not respond to the question or statement. In Table 20, 40 out of 60 (66.6%) teachers strongly agree, or agree, that they perceive people as not understanding what Mathematical Literacy is. Only 9 out of 60 (15%) teachers indicate that they disagree, and thus agree that people do understand what Mathematical Literacy is. 10 out of 60 (16.7%) of the teachers indicate that they are unsure. In the discussion in chapter 8 I argue about a relationship between the high numbers of ‘unsure’ and how the curriculum was implemented.

The eighth statement was: Mathematical Literacy is not an important subject. Table 21 below presents an analysis of the responses to this statement.

Table 21: Mathematical Literacy is not an important subject

Scale	Frequency	Percent	Cumulative Percent
Strongly agree	1	1.7	1.7
Agree	0	0	1.7
Unsure	2	3.3	5.0
Disagree	30	50.0	55.0
Strongly disagree	27	45.0	100.0
Total	**60**	**100.0**	

Table 21 shows that the majority of the teachers (95%) do not agree with the statement that Mathematical Literacy is not an important subject. Only 1 out of 60 teachers indicated agreement that Mathematical Literacy is not an important subject. Analysis shows that to the larger extent teachers contend that Mathematical Literacy is an important subject. This finding concurs with teachers' responses in the next section of this chapter, and responses in the next chapter, where teachers overwhelmingly expressed their positive sentiments about the significance of Mathematical Literacy. It is interesting to see that there are some responses (3.3%) indicating 'unsure'.

The ninth statement under this sub-section was: In Mathematical Literacy real life contexts are more important than Mathematics content. Table 22 below shows the responses to this statement.

Table 22: In Mathematical Literacy real life contexts are more important than content

	Scale	Frequency	Percent	Cumulative Percent
	Strongly agree	24	40.0	40.0
	Agree	22	36.7	76.7
	Unsure	3	5.0	81.7
	Disagree	8	13.3	96.0
	Strongly disagree	2	3.3	98.3
	Total	59	98.3	
Missing	System	1	1.7	
Total		**60**	**100.0**	

The majority of the responses (76.7%) are in favour of the statement that contexts are more important than Mathematics content knowledge. This aligns with the data in Table 14 where 98 % of the teachers agree, or strongly agree, that Mathematical Literacy is driven by real life contexts. Table 21 shows that only 17% of the responses indicate disagreement with the statement. There are 3 (5%) responses that indicate 'unsure'. One teacher did not respond to the statement. In Chapter 6 the issue of content and context in Mathematical Literacy is discussed in detail.

The last statement (the tenth) in this subsection was: In Mathematical Literacy both content and contexts are equally important. Table 23 below presents an analysis of responses of the 60 Mathematical Literacy teachers, to this statement. The statement seems to be opposing the previous statement with regard to content and context in Mathematical Literacy. The responses, however, do not seem to oppose the previous statement in which the majority of the responses indicated that context is more important than mathematics content.

Table 23: In Mathematical Literacy both content and contexts are equally important

Scale	Frequency	Percent	Cumulative Percent
Strongly agree	22	36.7	36.7
Agree	30	50.0	86.7
Unsure	1	1.7	88.3
Disagree	6	10.0	98.3
Strongly disagree	1	1.7	100.0
Total	**60**	**100.0**	

Table 23 shows that the majority (87%) of the responses support the statement that both contexts and content are equally important in Mathematical Literacy. This is in coherence with findings in Table 14 and Table 22. While all the three items interrogate the issue of the relationship between content and contexts, depending on a question, there is some instability in some teachers' views as the percentages are not the same across these tables. Almost 11% of the responses do not support the statement that both content and contexts are equally important in ML**.** Two possibilities exist: Either they think that context is more important than content, or that content is more important than context. Only one response indicates ‘unsure’.

Summary of the analysis of the first guiding question: What is Mathematical Literacy?

Above I presented the analysis of the responses on the first set of ten questions or statements, meant to answer the first guiding question*: What is Mathematical Literacy?* The responses to these ten sets of questions provide insight into teachers’ interpretations of Mathematical Literacy. The responses thus respond directly to the first critical question of this study which seeks to understand teachers’ interpretations of the intended Mathematical Literacy. In 8 out of 10 guiding questions more than 60% of the teachers share the dominant views of what Mathematical Literacy is. More than 90% of the 60 teachers agree, or strongly agree, that Mathematical Literacy is an important subject which is driven by real life contexts. This finding coheres with the overarching principle depicted across all Mathematical Literacy policy documents. While 86 % of the 60 teachers agree, or strongly agree, that both content and context are equally important in Mathematical Literacy contrary to this 76.7% of the 60 teachers agree, or strongly agree, that contexts are more important than content. This finding shows instability, or inconsistency, amongst some of the responses.

The analysis has also shown that Mathematical Literacy teachers have diverse views on whether or not Mathematical Literacy is an easy version of mathematics. However; the majority agree, or strongly agree, that it is not similar to Standard Grade Mathematics. This finding is in coherence with the findings in part two of this chapter where Teacher 12 responded on the questionnaire:“It (Mathematical Literacy) is not a Standard Grade Mathematics”.

(ii) How is Mathematical Literacy taught?

Following the same procedures as presented in the first guiding question, the next ten sub-questions were presented to Mathematical Literacy teachers to respond to, again using a Likert scale. The response to each sub-question is presented in Tables 24 to 33. Below, the summary of the analysis of the ten sub-questions is presented.

Dominant views of the ML teachers on how Mathematical Literacy is taught

(a) 88.3% of the 60 teachers support the statement that teaching Mathematical Literacy is exciting and interesting.

(b) 85% of the 60 teachers support the statement that in order to teach Mathematical Literacy you need a good background of Mathematics.

(c) 78.4% of the 60 teachers support the statement that if you taught Mathematics in the FET then you can teach Mathematical Literacy.

(d) 75% of the 60 teachers support the statement that special training to teach Mathematical Literacy is essential, even if you had taught Mathematics in the FET before.

(e) 70% of the 60 teachers disagree that teaching Mathematical Literacy is easy.

(f) 68.4% of the 60 teachers agree, or strongly agree, that in Mathematical Literacy learners must first be taught mathematics content and then be taught to deal with real life contexts.

(g) 65% of the 60 teachers disagree with the statement that teaching Mathematical Literacy is like teaching Mathematics.

Mixed *v*iews of the ML teachers on how Mathematical Literacy is taught

For the statements below the views of the 60 teachers were more mixed, with almost half agreeing and the other half disagreeing.

a) 59.4% of the 60 teachers do not agree that in Mathematical Literacy it is sometimes important that you teach only mathematics content.
b) 55% of the 60 teachers agree, or strongly agree, that there are more challenges in teaching Mathematical Literacy than any other subject.

c) 46.7% of the 60 teachers agree, or strongly agree, that the challenges of teaching Mathematical Literacy are similar to those in FET Mathematics.

Below, I present the summaries and specific tables of the responses to each of the ten sub-questions/ statements, in response to the question: How is Mathematical Literacy taught?

The first statement was: Teaching mathematical Literacy is easy. Table 24 below shows how Mathematical Literacy teachers responded to this statement.

Table 24: Teaching Mathematical Literacy is easy

Scale	Frequency	Percent	Cumulative Percent
strongly agree	7	11.7	11.7
Agree	9	15.0	26.7
Unsure	2	3.3	30.0
Disagree	31	51.7	81.7
strongly disagree	11	18.3	100.0
Total	**60**	**100.0**	

Table 24 shows that the majority (42 out of 60), 70% of the responses disagree that it is easy to teach Mathematical Literacy, while only 26.7% of responses indicated agreement with the statement that it is easy to teach Mathematical Literacy. Table 24 further shows that very few responses (3.3%) indicated they were unsure. This shows that most teachers are aware whether or not they find teaching Mathematical Literacy easy. This is evident in Part 2 of this chapter where 81.7% (49 out of 60) teachers indicated that they had had positive experience in teaching Mathematical Literacy.

The second statement was: Teaching Mathematical Literacy is like teaching Mathematics. Table 25 below presents the responses of the teachers.

Table 25: Teaching Mathematical Literacy is like teaching Mathematics

		Frequency	Percent	Cumulative Percent
	Strongly agree	6	10.3	10.3
	Agree	10	16.7	27.0
	Unsure	3	5.0	32.0
	Disagree	32	53.3	85.3
	Strongly disagree	7	11.7	96.7
	Total	58	96.7	
Missing	System	2	3.3	
Total		60	100.0	

Responses show that only 27% of the 60 teachers agree that teaching Mathematical Literacy is like teaching Mathematics and 65% of them disagree or strongly disagree. A small number 5% (3 of 60) of teachers indicated that they were unsure if the teaching of Mathematical Literacy and Mathematics subjects is the same. It is indeed expected that those teachers who never taught Mathematics before teaching Mathematical Literacy will be likely unsure since they do not have experience of teaching mathematics.

The third statement was: In Mathematical Literacy learners must be taught content then contexts. This sub-question intended to establish teachers' views on how context and content should be handled in teaching Mathematical Literacy. Table 26 shows the responses from the 60 Mathematical Literacy teachers.

Table 26: In Mathematical Literacy learners must be taught content then contexts

Scale	Frequency	Percent	Cumulative Percent
Strongly agree	16	26.7	26.7
Agree	25	41.7	68.3
Unsure	3	5.0	73.3
Disagree	13	21.7	95.0
Strongly disagree	3	5.0	100.0
Total	60	100.0	

Table 26 shows that the majority of the responses, 41 out of 60 (68.3%), indicated that content must be taught first, while only 26.7% of the responses did not agree with this statement. These findings are consistent and concur with the findings in Table 27 below where 35 out of 60 responses indicated disagreement with the statement that sometimes only content can be taught without any reference to context. In the analysis of the lessons observed (in chapter 7) Alfred argued that he prefers to teach content first, then later expose the learners into various relevant contexts. This view of teaching content, then context later departs from the official policy document principles which detect balance in the use of context and content, and some favour context more than content. Again, very few responses (5%) indicated they were unsure. This shows that 95% of the teachers indicated that they are confident with what should be done when teaching Mathematical Literacy, particularly when dealing with content and context.

The fourth statement was: In Mathematical Literacy sometimes it is important to teach only Mathematics content. This statement contains a similar idea to the third sub statement presented above. Table 27 below presents the responses of the 60 Mathematical Literacy teachers to this statement.

Table 27: In ML sometimes it is important to teach only Mathematics content

	Scale	Frequency	Percent	Cumulative Percent
	Strongly agree	3	5.0	5.1
	Agree	14	23.3	28.4
	Unsure	7	11.7	40.1
	Disagree	28	46.7	86.8
	Strongly disagree	7	11.7	98.3
	Total	59	98.3	
Missing	System	1	1.7	
Total		60	100.0	

Table 27 shows that 58.4% of responses do not agree that it is sometimes important that only Mathematics content is taught in Mathematical Literacy, while 28.8% of the responses indicated that teachers agree with this statement. This analysis provides a basis for the argument that there are mixed views amongst the teachers on how content and context should be handled in teaching Mathematical Literacy. In the lesson observations (see chapter 7) the issue of content and context was explored, and further discussed in chapter 8. Notably, one teacher did not respond to this statement. For this item several (11.7%) of the responses indicated 'unsure'. The absence of certainty can be related to the curriculum mixed messages where it is emphasised in the rhetoric that Mathematical Literacy is driven by life-related context, yet the Assessment Standards (AS) often contradicted this as shown in Chapter 3.

The fifth sub-statement was: Teaching Mathematical Literacy is exciting and interesting. This statement is intended to determine teachers' general experiences of teaching Mathematical Literacy. Table 28 presents responses of the 60 teachers on this statement.

Table 28: Teaching Mathematical Literacy is exciting and interesting

	Scale	Frequency	Percent	Cumulative Percent
	Strongly agree	29	48.3	48.3
	Agree	24	40.0	88.3
	Unsure	1	1.7	90.0
	Disagree	5	8.3	98.3
	Strongly disagree	0	0	98.3
	Total	59	98.3	
Missing	System	1	1.7	
Total		60	100.0	

Table 28 shows that the vast majority of the responses (89.8%) indicated positive experiences in teaching Mathematical Literacy, through agreeing with the statement that teaching Mathematical Literacy is exciting and interesting. These responses concur with teachers views presented in the next section of this chapter, where more than 80% of the teachers (49 out of 60) indicated that teaching Mathematical Literacy is interesting, exciting and enjoyable. Only a small portion (less than 6) (8.3%) of the responses indicated disagreement with this. Only one teacher indicated 'unsure' and one did not indicate at all. Interestingly, there was no response that indicated 'strongly disagree' to this statement. The general findings on the issue of teaching Mathematical Literacy suggest that the majority of teachers enjoy teaching this subject; this is further confirmed in the subsequent chapters (particularly 6 & 7) which will be presented later.

The sixth statement was: To teach Mathematical Literacy you need a good Mathematics background. This statement was intended to determine teachers' views on the role of mathematical background in teaching Mathematical Literacy. Table 29 below presents an analysis of the responses to this statement.

Table 29: To teach ML you need a good Mathematics background

Scale	Frequency	Percent	Cumulative Percent
Strongly agree	18	30.0	30.0
Agree	33	55.0	85.0
Unsure	4	6.7	91.7
Disagree	3	5.0	96.7
Strongly disagree	2	3.3	100.0
Total	60	100.0	

According to Table 29, the majority of the responses (85%) agree, or strongly agree, with the statement that a Mathematical Literacy teacher needs a good Mathematics background to teach Mathematical Literacy. As shown in Table 11, most teachers (80%) in the sample had had formal training in mathematics, so it is understandable that the majority of teachers will agree with this statement. Again, in chapter 6, teachers with a strong mathematics background argued that mathematics content knowledge for the teacher is essential. In chapter 8 I further discuss this issue in detail. 8.3% of the responses indicated that a Mathematical Literacy teacher does not need a good Mathematics background. This is interesting, because in the next section of this chapter some of the teachers indicated that they did not do mathematics at a tertiary level, but were able to teach Mathematical Literacy successfully (see Khumalo in chapters 6 & 7). Only 4 out of 60 teachers (6.7%) indicated that they were unsure.

The seventh statement was: If you have taught Mathematics before you can teach Mathematical Literacy. This statement intended to determine teachers' views on the role of previous Mathematics teaching experience in teaching Mathematical Literacy. Table 30 presents an analysis of the responses to this statement.

Table 30: If you taught Mathematics before you can teach Mathematical Literacy

	Scale	Frequency	Percent	Cumulative Percent
	Strongly agree	16	26.7	26.7
	Agree	31	51.7	78.4
	Unsure	7	11.7	90.1
	Disagree	3	5.0	95.1
	Strongly disagree	2	3.2	98.3
	Total	59	98.3	
Missing	System	1	1.7	
Total		60	100.0	

Table 30 shows that the majority of the responses (79.7%) indicated that if you have taught Mathematics before, you can teach Mathematical Literacy. Only 8.3% of the responses indicated that if you have taught Mathematics before you cannot teach Mathematical Literacy. A significant number of the responses (11.7%) indicated 'unsure', and one teacher did not respond to this question. It is relevant to indicate that none of the seven teachers who indicated 'unsure' had any previous experience of teaching Mathematics.

The eighth statement was: Special training to teach Mathematical Literacy is essential, even if you were teaching Mathematics in the FET. This statement was meant to determine teachers' views on the role of special training for Mathematical Literacy teaching. Table 31 below presents the responses to this statement.

Table 31: Special training to teach ML is essential, even if you taught Math in the FET

Scale	Frequency	Percent	Cumulative Percent
Strongly agree	25	41.7	41.7
Agree	20	33.3	75.0
Unsure	1	1.7	76.7
Disagree	11	18.3	95.0
Strongly disagree	3	5.0	100.0
Total	**60**	**100.0**	

The analysis shows that the majority (75%) of the responses indicated that special training is essential. The 23.3% of the responses indicated that special training is not essential. It is necessary to indicate that these 14 teachers (23.3%) who disagreed that special training is essential had taught Mathematics before Mathematical Literacy was introduced, and all of them had formal qualifications in mathematics.

Only one response (1.7%) indicated ‘unsure’. In chapter 6 teachers raised the importance of in-service training or teacher support, and argued that in Mathematical Literacy it was ineffective and inefficient.

The ninth statement was: There are more challenges in teaching Mathematical Literacy than in any other subject. Since all teachers who are teaching Mathematical Literacy are, or were, also teaching other subjects, this statement was intended to establish the views of the teachers as to whether the teaching of Mathematical Literacy is more challenging than teaching other subjects taught in the FET phase.

Table 32 below presents an analysis of responses to this statement.

Table 32: There are more challenges in teaching ML than any subject

Scale	Frequency	Percent	Cumulative Percent
Strongly agree	15	25.0	25.0
Agree	18	30.0	55.0
Unsure	8	13.3	68.3
Disagree	17	28.3	96.7
strongly disagree	2	3.3	100.0
Total	60	100.0	

Just over half of the teachers (55%) indicated that there are more challenges in the teaching of Mathematical Literacy than in teaching any other subjects. 31.6% of the responses indicated that it is not true that teaching Mathematical Literacy has more challenges than the teaching of other subjects. A significant number (13.3 %) of the responses indicated ‘unsure’.

The tenth statement was: Challenges of teaching Mathematical Literacy are similar to those in FET Mathematics.

Table 33: Challenges in the teaching of ML are similar to those in FET Math

Scale	Frequency	Percent	Cumulative Percent
Strongly agree	4	6.7	6.7
Agree	24	40.0	46.7
Unsure	13	21.7	68.3
Disagree	16	26.7	95.0
Strongly disagree	3	5.0	100.0
Total	60	100.0	

Table 33 shows that there are mixed views on whether or not challenges in Mathematical Literacy and Mathematics are similar. Of the responses, 46.7% indicated that the challenges are similar in the teaching of Mathematics and Mathematical Literacy. 31.7 % of the responses indicated that the challenges of teaching Mathematical Literacy and Mathematics are not similar. A very significant number (21.7 %) indicated 'unsure'.

Summary of the analysis of the second guiding question: How is Mathematical Literacy taught?

The second guiding question of Part 1 of the questionnaire intended to explore teachers' views and understanding on how Mathematical Literacy should be taught. These views include the kind of teacher envisaged to teach Mathematical Literacy and the manner in which content and contexts should be handled in the Mathematical Literacy lessons. Responses to this guiding question attempted to respond to the first part of the critical question 1 of this study which seeks to understand teachers' experiences of teaching Mathematical Literacy. The analysis shows that Mathematical Literacy teachers have diverse views on how Mathematical Literacy should be taught. Although the vast majority of Mathematical Literacy teachers (89%) agree that teaching Mathematical Literacy is interesting and exciting, there is a significant number of Mathematical Literacy teachers who are not sure about the challenges related to the teaching of Mathematical Literacy. For example, (13 out of 60) 22% teachers are unsure if challenges in teaching ML are similar to those in FET maths and (8 out 60) 13% of the teachers are unsure if there are more challenges in teaching ML than in teaching any subject. Additionally, 11.7% (7 out of 60) teachers are not sure if the teacher who has taught mathematics before can teach Mathematical Literacy.

There is a strong view (85%) shared amongst the teachers that Mathematics background knowledge is essential for the Mathematical Literacy teacher to teach successfully. This finding concurs with responses in table 30, where 79.7% of the teachers agree, or strongly agree, that if you taught mathematics before then you can teach Mathematical Literacy. This view on the role of background content knowledge of mathematics is seen emerging in the next chapter (during the interview analysis, see Alfred and Jabu) where teachers such as Alfred, Jabu and Susan contend that mathematics background knowledge is essential in teaching Mathematical Literacy.

Importantly, the role of context and content in Mathematical Literacy, and the way in which the two (content and context) may be handled in teaching, appeared significant. The majority (above 60 %) of teachers favour the foregrounding of contexts over content. Foregrounding contexts over content cohere with the official curriculum policy which stresses that contexts are central to the development of Mathematical Literacy (DoE, 2003). Contrary to this view, It was noted that 68.4 % agree, or strongly agree, that learners must be taught mathematics content first, and then be taught to deal with contexts. This view departs from the official policy curriculum document (DoE, 2003) which suggests the approach that needs to be adopted in developing Mathematical Literacy; which is to “engage with contexts rather than applying mathematics already learned to context” (p. 42).

In Chapter 8 I will discuss these key findings from the analysis and arguments on the relationship and impact of these responses to teachers’ interpretations and implementation of the intended curriculum.

Conclusion

In this section I have presented the responses to 20 sub-questions or statements based on two guiding questions: (i) What is Mathematical Literacy? and (ii) How is Mathematical Literacy taught? Mostly, we saw a great deal of coherence with the Mathematical Literacy curriculum statement, although the mixed messages, as indicated in the inclusion of mathematics content in the assessment standards, did indicate divided and inconsistent views on some aspects of the content-context relationship.

In the following section I will present an analysis of the qualitative data.

PART 2: QUALITATIVE DATA

Introduction

Part 2 presents analysis of qualitative data drawn from the responses to the two open-ended questions that form the second section of the questionnaire:
(i) Why is Mathematical Literacy taught?
(ii) What are teachers' experiences of teaching Mathematical Literacy?

These two open-ended questions address the critical research question 2. The analysis is presented in the form of a story. I begin the story by giving a context of the story and some background of these teachers, i.e. who they are and how they were recruited to teach Mathematical Literacy. Following the background I provide descriptions of their experiences in Mathematical Literacy and their views on the purpose and/or aim of Mathematical Literacy. I also discuss contradictory experiences communicated by the teachers. I conclude the story by presenting a summary of the analysis.

Sixty teachers were asked to write about their experiences in teaching Mathematical Literacy (see Appendix 1). All their responses were collected and analysed through the inductive analysis model, as described by Hatch (2002). The responses of individual teachers presented in the inductive analysis revealed the following three categories of responses namely (i) description of Mathematical Literacy,(ii) teaching experiences and (iii) the aim and purpose of Mathematical Literacy. These three themes are described below, as follows:

Theme 1: Description of Mathematical Literacy

In this theme an analysis of the teachers' descriptions of what 'Mathematical Literacy is' is presented. Three main descriptions of Mathematical Literacy emerge: (i) description of Mathematical Literacy in relation to Mathematics; (ii) description of

Mathematical Literacy according to what it does; and (iii) description of Mathematical Literacy according to what it is.

Theme 2: Teaching experiences

In this theme I present an analysis of the teachers' experiences of teaching Mathematical Literacy for the first time. The analysis is presented in three emergent sub-themes: (i) positive experiences; (ii) negative experiences; and (iii) contradictory experiences.

Theme 3: The purpose and/or aim of teaching Mathematical Literacy

In this theme I present an analysis on how teachers view the purpose and the aim of teaching Mathematical Literacy.

In the section below the analysis for each theme is presented in detail, and evidence from data is presented. To begin with, background information on how teachers were recruited to teach Mathematical Literacy (when it was introduced in the year 2006) is provided. This information is necessary because it connects with the way in which teachers interpret and implement the intended Mathematical Literacy curriculum. In Chapter 6 I argue that the way in which teachers view ML depends on where they come from, that is, their background, particularly if they have or have not a Mathematics education background.

How teachers were selected to teach Mathematical Literacy

It is interesting to find out how each teacher was selected to teach Mathematical Literacy. There are different reasons why teachers were recruited to teach Mathematical Literacy. There are teachers who were requested by the school to teach Mathematical Literacy because in the previous curriculum (NATED 550) they were teaching Mathematics at FET. Some of the teachers volunteered to teach Mathematical Literacy. There were two main reasons, namely: (i) they had a good Mathematics background (in their post matric studies) or (ii) they believed they would cope with the challenges of the subject, even though they had no Mathematics background, especially at a tertiary level. All 60 teachers were offered a bursary[21] by the Eastern Cape Provincial Department of Education to do the ACE course (Mathematical Literacy) at local universities, but only 25 out of 60 teachers enrolled for the ACE course. *See* Table 10.

When these teachers were asked why they taught Mathematical Literacy they responded in various ways. Several indicated that they came to teach ML because they were *instructed* to (8 out of 60). Two examples are given, as shown in teacher responses below:

> I was asked by the school to teach Mathematical Literacy. [T03]
> I was told to teach Mathematical Literacy. [T14]

Others (10 out of 60) indicated that they volunteered to teach Mathematical Literacy because they perceived a need. Two examples are:

> I was teaching Mathematics before I opted to teach Mathematical Literacy. [T24]
> No one was available to teach Mathematical Literacy. [T53]

The other teachers (40 out of 60) responded with indications of a willingness to teach Mathematical Literacy either because they love it, and/or they have qualification to teach it. Comments related to these are given below.

Teachers who said they love Mathematical Literacy (11 out of 60), for example:

> I love Mathematical Literacy. It is a challenging subject. [T2]
> I love Mathematical literacy. It helps me in my own life [T10]
> I love teaching Mathematical Literacy. (T28]
> I have the love of working with numbers [T51]

Teachers who said they teach Mathematical Literacy because they have the qualification to teach (9 out of 60), for example:

> I am a qualified mathematics teacher. [T15v
> I did Advance Certificate in Education (Mathematical Literacy) [T17]
> ML is one of my major subjects [T29]
> I was trained. [T49]

[21] In 2005 the DoE offered Bursaries to all FET teachers who were willing to teach ML in 2006. Each school had to send one teacher to enrol for a two year Advance certificate in Education. The programme was offered part-time and took two years to complete.

Additionally, some teachers (20 out of 60) made general comments: such as “passionate to teach’ and or “teaching experience to teach Mathematical Literacy”. For example:

> I have a passion in mathematics and Mathematical Literacy. [T6]
>
> I was teaching mathematics before I opted to teach ML. [T24]

These responses highlight the range of different reasons why they teach Mathematical Literacy. The interview phase provides a more in-depth explanation of why different teachers teach Mathematical Literacy (see the next chapter).

In the next section I present teachers’ descriptions of Mathematical Literacy; what they say about the purpose or role of ML; their first experience in teaching the subject; and what they have gained through teaching Mathematical Literacy.

Teachers’ descriptions of Mathematical Literacy

The 60 Mathematical Literacy teachers in this study describe Mathematical Literacy in many ways. Some (7 out of 60) describe it in relation to Mathematics, while others (17 out of 60) describe it according to what it does or what it is all about. The following are examples of teachers’ descriptions of Mathematical Literacy in relation to Mathematics. Notably, in doing so they draw a distinction or comparison between Mathematics and Mathematical Literacy. For example:

> It is easier than Mathematics. [T03]
> It is not Standard Grade (SG) Mathematics. [T12]
> Mathematical Literacy is not as abstract as Mathematics. [T41]

The following examples of teachers describe Mathematical Literacy according to what it deals with. Interestingly, there are key words common in their descriptions; words such as ‘*real life’.* In the next chapter these key words “*real life*” are dominant across the interviewees. There is much evidence to suggest that these teachers have a common understanding of what Mathematical Literacy deals with. For example:

It deals a lot with *real life* issues. [T05]
Mathematical Literacy deals with *real life* problems. [T07]
It deals with *real life* and everyday life. [T20]
Mathematical Literacy is exciting, challenging, informative and is based on *real life* situations.[T48]

The 3 out of 60 teachers below, describe Mathematical Literacy according to what Mathematical Literacy *does*, the *purpose* and or *aim*. For example:

> Mathematical Literacy provides an opportunity for learners who do not have the potential to do Mathematics. [T24]
> Mathematical Literacy prepares the learner for dealing with real-life situations. [T25]
> Mathematical Literacy develops logical thinking in learners. [T35]

The above categories of description relate closely to the descriptions provided in the next chapter. Apart from describing Mathematical Literacy, 23 out of 60 teachers did not describe Mathematical Literacy. Instead they reflected on their experiences of teaching Mathematical Literacy, as discussed below.

Teachers' experiences of teaching Mathematical Literacy

In 2006, when Mathematical Literacy was introduced, teachers had different expectations[22]. One teacher was surprised to see that Mathematical Literacy was not what he/she thought it would be, for example:

> I thought it is easy but it has also some challenges. It must not be taken lightly [T05]

This particular teacher shows that he or she had a certain view of Mathematical Literacy before starting to teach the subject, and that his or her views changed after engaging with ML. This suggests that one of the influences on teachers' interpretation of the intended curriculum is their experience of teaching ML.

2 out of 60 teachers indicated that they were *excited* and *curious* to teach Mathematical Literacy. They were eager to find out what the content of the Mathematical Literacy curriculum would be, for example:

> I was curious to see what content it deals with. ML is enjoyable. [T25]

[22] Drawing from my experience interacting with Mathematical Literacy teachers in KwaZulu-Natal

> Initially students were not confident to do Mathematical Literacy – but later they achieved good results. [T53]

Below, I share the impressions that some of the teachers had about Mathematical Literacy. It appears that more than 80% of the teachers (49 out of 60) had positive feelings and impressions of teaching Mathematical Literacy; these include interest in the subject, and enjoyment and excitement of teaching Mathematical Literacy. Three examples are:

> I find Mathematical Literacy interesting... [T46]
> Mathematical Literacy is very nice...T04]
> Mathematical Literacy is exciting….[T08]

One teacher further explained why he/she was so excited about teaching Mathematical Literacy, for example:

> I love teaching Mathematical Literacy. Mathematical Literacy makes it easier for me because it deals with Mathematics principles put in a practical context. [T28]

It was evident that most teachers (49 out of 60) were gaining much from teaching Mathematical Literacy. Three teachers indicated that they had gained access to mathematical skills which they had missed out on when they were at secondary school. One example:

> I do not have a Mathematics background. Doing Mathematics was my dream, now it is fulfilled through Mathematical Literacy. [T42]

Additionally, it is noted that, even though most of these teachers (48 out of 60) were teaching Mathematics before Mathematical Literacy was introduced (see Table 11), teaching Mathematical Literacy made them enjoy teaching more than when they had taught Mathematics. Two examples:

> I was teaching mathematics before. I am now feeling very comfortable and enjoying teaching Mathematical Literacy. [T31]
> I find it more rewarding than pure Mathematics. I find it more interesting and realistic. [T12]

The two examples presented above show that when these teachers were teaching Mathematics they had some difficult challenges, but when they started teaching Mathematical Literacy they felt more comfortable.

Some of these teachers benefited from the ML to the extent that they indicated that they are now ‘numerate consumers of mathematics’. They now apply mathematics knowledge to their everyday lives; having gained financial management skills. For example:

> Mathematical Literacy has opened my eyes. I have learnt to economise, invest at the right bank. [T02]
> Mathematical Literacy deals with real life situations. I am also learning to manage my finances and tax. [T30]

As part of what teachers said they experience in teaching Mathematical Literacy, they made comments about their learners. Below I present those comments, and provide some selected comments to illuminate the types of comments.

Teachers’ positive experiences

Although, in the questionnaire, teachers were not directly asked to talk about their learners, in an attempt to express their experiences of teaching Mathematical Literacy, some teachers made comments about their learners. These comments can be categorised into positive and negative experiences of learners in Mathematical Literacy. These experiences, presented below, are important in the sense that they affect implementation of the intended curriculum. I first present the positive experiences of the learners in the Mathematical Literacy and thereafter the negative experiences.

Teachers cite a number of issues around the success of learners doing Mathematical Literacy. It is not only teachers who are excited and enjoying Mathematical Literacy, but the learners as well. The following teachers’ comments indicate that their learners enjoy Mathematical Literacy and find it doable. For example:

> Learners find it easy, learners like it, learners understand it, and children love it. Learners pass it, except the lazy ones. [T03]

In this comment there are five key positive words related to learners' success in Mathematical Literacy: easy, like, understand, love and pass. There is a connection between these words – learners find the subject easy, they understand it, they love it hence they pass it. Another example of positive experiences is that ML is more interesting for learners, learners understand it, and learners enjoy it. For example:

> It is more interesting for learners. Learners understand it. [T05]
> Learners find it challenging and interesting. [T40]
> Mathematical Literacy is easy for learners. Learners understand ML. [T27]

These teachers link interest and enjoyment with the understanding of Mathematical Literacy. The possible link is that learners find Mathematical Literacy interesting, and then they like it and understand it.

Other teachers, like Teacher 15 below, further explain the kind of learner who is likely to be successful in Mathematical Literacy and the kind of skills required to understand Mathematical Literacy.

> Learners realise that Mathematical Literacy is useful in their daily life. From my experience, learners with good language and interpretation skills do achieve well in Mathematical Literacy. [T15].

It is interesting to note that some teachers see Mathematical Literacy as helping their learners achieve, not only academically, but in life in general. The teacher above identifies "good language as one of the keys to succeed in Mathematical Literacy". Language is mentioned in different sections of this report.

Below, the role of Mathematical Literacy in the future worklife of a learner is indicated by Teacher 01:

> Mathematical Literacy makes a learner's workplace ready. [T01]

Not only positive experiences were reported by Mathematical Literacy teachers in relation to learners. Some reported negative experiences. The section that follows presents the negative experiences seen by teachers through their interaction with their learners.

Teachers' negative experiences

The negative experiences reported can be categorised into three main categories, namely: the language of learning and teaching, negative attitude, and absence of basic mathematical knowledge and skills. I will first present a short description of language-related issues, followed by issues of attitude and content knowledge.

Language of learning and teaching

Many teachers seem to have some concerns about the language of instruction, particularly in Mathematical Literacy. Some teachers contend that Mathematical Literacy demands particular levels of language competency, in order to do it successfully. Unfortunately, learners, especially English second language speakers, are relatively poor in the English language, which is the language of instruction.

Given the nature of the subject in which a problem is presented in real life contexts, the problem needs to be solved mathematically through the process of mathematization[23]. Some teachers opined that learners fail to solve the problem because of the language that has been used.

> Learners experience problems in interpreting word sums into mathematical equations due to the language. Learners struggle to understand questions. [T30]
> Learners have a problem with the language. [T18]
> Mathematical Literacy is challenging for learners, because of language. [T21]

One teacher pointed out that the language problem can produce very negative results, including learners losing interest in the subject:

> Language is a real problem to learners – it can make them lose interest. [T35]

Besides the language issue, a small number of teachers (3 out of 60) had some concerns about the negative attitude of the learners towards the subject, as discussed below.

Negative attitude toward Mathematical Literacy

[23] A fundamental process used to solve real-life problems. (OECD/PISA, 2003:38)

A small number of teachers (3 out of the 60 teachers), were worried about the attitude of the learners toward the subject. In this context, when they talk about *attitude* they mean negative attitude. Teachers maintain that learners perceive Mathematical Literacy as being similar to Mathematics which is a 'difficult subject', hence they lose hope of doing well in the subject. For example, teachers wrote:

> Students still have (negative) attitude towards Mathematical Literacy. [T19]
> A challenge is that some learners have a negative attitude toward Mathematical Literacy. [T37]

In later discussions with these teachers they clarified that such learners were in Grade 10, and explained that these 'attitudes' disappeared gradually as the learners progressed to the next Grades.

Absence of basic mathematical knowledge and skills

There has been an overwhelming concern from Mathematical Literacy teachers that when the learners reach Grade 10 they lack significant basic mathematical knowledge. Teachers understood and acknowledged that in Mathematical Literacy the focus is on solving real life problems, but learners need some basic mathematical knowledge in order to be able to solve these real life problems. They stated that a lack of basic mathematical knowledge results in the poor performance of some learners. This lack of basic mathematical knowledge affected the way in which Mathematical Literacy teachers said how they teach the subject. For example, three teachers wrote:

> Most learners lack Mathematics background. [T37]
> Learners lack basic numeracy. [T26]
> Learners lack basics. [T29]

Some teachers stated that learners, especially at Grade 10 level, lack both mathematical knowledge and an understanding of the instructions. This is due to the poor background from Grades 8 and 9. For example:

> The learners have a problem to understand the language of instruction. Some learners have a problem to understand a context. Most learners in Grade 10 do not have basic mathematics skills. [T57]

The three key issues presented here; language, attitude and content knowledge are discussed further in Chapter 6.

Opposite experiences

From the teachers experiences it is noted that there are some differences amongst what teachers say about Mathematical Literacy, the teaching of the subject, and about the learners who are taking the subject. I have already highlighted both the positive and negative experiences of the teachers in relation to what they have observed from their learners. I now want to pay attention to what the teachers say about teaching Mathematical Literacy. Some teachers, for example, consider teaching Mathematical Literacy easy while others say it is not easy, see Table 34 below:

Table 34: Examples of opposite experiences

Easy to teach ML	**Not easy to teach ML**
Mathematical Literacy is easier to teach than Mathematics. [T11] ML makes it easier for me because it deals with mathematics principles put in a practical context [T28]	It is not as easy as teaching pure Mathematics. [T16] It is not easy to teach Mathematical Literacy [T27]

These four teachers have different views and experiences of teaching Mathematical Literacy. It would indeed be interesting to hear more from these teachers. One thing that can be deduced here is that these four teachers have had experience of teaching both subjects (Mathematical Literacy and Mathematics). Given these opposing statements it is evident that Mathematical Literacy teachers have diverse views, understandings, approaches and classroom practices.

The aim and purpose of teaching Mathematical Literacy

The third theme of this analysis examines the aim and/or purpose of Mathematical Literacy as viewed by teachers. The data analysis shows a wide range of teachers' views on the purpose and the aim of Mathematical Literacy. For example:

> I want to empower learners who are not good in Mathematics. [T53]
> I want to guide and lead learners to develop problem solving skills, to help learners communicate, to see learners enjoying Mathematics, and to eradicate fear of Mathematics from learners. [T60]

In addition to the above aims and purposes of teaching Mathematical Literacy, the teachers further provided their views on how to teach Mathematical Literacy successfully:

> You have to be patient when teaching Mathematical Literacy because some learners don't like numbers. [T51]

The above information provides insight into understanding how teachers deal with the challenges in teaching Mathematical Literacy. In the next chapter I present different challenges in teaching Mathematical Literacy.

Key findings from the analysis of questionnaires

The questionnaire has two sections. The first section concerns quantitative data and the second section concerns qualitative data. The key findings are presented below:

Quantitative data section of the questionnaire

The quantitative data section of Chapter 5 involved two questions which had a total of 20 sub-questions. The first question was intended to establish teachers' understanding of *what Mathematical Literacy is*. The analysis of the 10 sub-questions revealed that up to 98.3% of the 60 teachers agree that Mathematical Literacy is driven by real life contexts. This shows that teachers understand the importance of real life contexts in Mathematical Literacy. It was further established that the majority (95%) of the 60 teachers believe that Mathematical Literacy is an important subject. It was found that there were mixed (53.3%) views whether Mathematical Literacy was an easy version of Mathematics. On the issue of Mathematical Literacy being compulsory, there was no dominant view; only 43% of the 60 teachers agreed that learners who were not taking Mathematics must do Mathematical Literacy, indicating that many do not agree with the 'compulsory' nature of the subject as an alternative to mathematics.

With respect to the second question, which was intended to establish teachers' views on how Mathematical Literacy is, or should be, taught. Overwhelmingly 89.8% of the 60 teachers agreed that teaching Mathematical Literacy is exciting and interesting. 85 % of the 60 teachers believed that, in order to teach Mathematical Literacy, a good background of Mathematics was needed. A significant number of teachers 79.7% thought that if you taught Mathematics in the FET then you could teach Mathematical Literacy. Analysis further revealed that 75% of the 60 teachers agreed that special training to teach Mathematical Literacy was essential, even if teachers were teaching Mathematics in the FET before. There were mixed views on the issue of challenges in Mathematical Literacy. Analysis showed that 55.0% of the 60 teachers agreed that there are more challenges in teaching Mathematical Literacy than in any other subject.

Qualitative data section of the questionnaire

In this section the following findings reflected the five themes presented above. These findings related to: (i) the way in which teachers were recruited to teach Mathematical Literacy; (ii) the way in which teachers described Mathematical Literacy; (iii) teachers' experiences when they taught Mathematical Literacy for the first time; (iv) the way they felt about teaching Mathematical Literacy, (v) what they have gained through teaching Mathematical Literacy, and, finally, their views on the Mathematical Literacy curriculum and the learners who were doing Mathematical Literacy.

Analysis of the responses of Mathematical Literacy teachers on the open-ended questions has revealed that teachers teaching Mathematical Literacy are from diverse groups, and were recruited in different ways. Some were requested, and others volunteered, to teach Mathematical Literacy. The analysis shows that teachers have different ways of describing Mathematical Literacy and different views on the role and purpose of Mathematical Literacy. It was further established, through analysis, that teachers have different experiences in teaching Mathematical Literacy (both negative and positive). Positive experiences tended to dominate the responses. It was noted that there are some common experiences across the different groups. These common experiences relate to enjoyment and excitement in teaching Mathematical Literacy, similar challenges encountered when teaching the subject, such as lack of basic mathematics skills from the learners and language issues. It was also found that some of the experiences and views contrast with each other, such as the view that teaching Mathematical Literacy is easier than teaching Mathematics, while other teachers had opposite view in this regard.

Conclusion

In conclusion, the positive experiences of the majority of the teachers sampled in this study are interesting, given the newness of the subject. It was evident during my visits to these schools that there was overwhelming willingness of the majority of the teachers to talk at length about their views and their experiences of this subject.

In the next chapter I present data analyses of the interviews. Issues related to the definition and description of Mathematical Literacy, challenges in Mathematical Literacy, and teaching approaches in Mathematical Literacy are analysed.

CHAPTER 6

ANALYSIS OF INTERVIEWS

Introduction

In this chapter, in an attempt to understand the teachers' interpretations, semi-structured interviews were conducted with seven Mathematical Literacy educators: Alfred, Bongani, George, Khumalo, Myeza, Jabu and Susan (pseudonyms). Their ages ranged from 32 to 50 years. They had a range of teaching experience of between three and twenty-five years. All of them had the minimum teaching qualification in Mathematics or Mathematical Literacy. Jabu and Susan had both Mathematics and Mathematical Literacy qualifications. Initially, a sample of ten teachers had been chosen, but three of them did not make themselves available for interviews, as discussed earlier.

Table 35: Details of the teachers selected for interviews

TEACHER	TEACHING EXPERIENCE	QUALIFICATION
Jabu	15 -20 yrs	STD (Maths and Sc) ACE (ML), B Ed Hons
Khumalo	10-15 yrs	STD (BIO), ACE (ML), B ED Hons
Bongani	15-20 yrs	STD ACE (GET Maths)
George	5-10 yrs	B Sc (Maths and Sc), Diploma in Education
Alfred	15-20 yrs	B Sc (Maths and Sc), Hons, M Sc
Susan	15-20yrs	BA (Social Sc), STD (Maths and Sc), ACE (ML), B Ed Hons
Myeza	15-20 yrs	STD, ACE(GET Mathematics)
Priscilla*	5-10 yrs	B Sc Edu (Mathematics)
Rebecca*	15-20 yrs	STD (Math and Sc), ACE (ML)
Noxolo*	15-20 yrs	STD, ACE (ML), B Ed Hons

(*) indicates those who did not avail themselves for interview

According to Hitchock and Hughes (1995) the semi-structured interview is a much more flexible version of the structured interview (p.157). They further assert that the semi-structured interview allows depth to be achieved by providing the opportunity on the part of the interviewer to probe and expand the respondent's responses (p.157). Similarly, De Vos et al. (2002) concur that the semi-structured interview gives the researcher and the participant much more flexibility (p.302). In this regard, they write:

> The Researcher is able to follow up particular interesting avenues that emerge in the interview, and the participant is able to give a fuller picture (p.302).

The interview questions were carefully formulated and were intended to gather data for the focus question: 'What are teachers' interpretations of the intended Mathematical Literacy curriculum?' The question format was open-ended and the responses were recorded by the interviewer using a voice recorder device. This allowed for transcription of data at a later stage (see Appendix 12). Each interview was 30 to 40 minutes long.

The following key questions were asked:

For critical question 1 (teacher interpretations of ML)

(a) What is your understanding of Mathematical Literacy?

(b) How do you view the purpose, nature and scope of Mathematical Literacy?

(c) How do you find teaching Mathematical Literacy?

For critical question 2 (teacher experiences of teaching ML)

(d) What do you consider to be challenges in implementing the Mathematical Literacy curriculum?

(e) How do you manage these challenges?

(f) What do you see as the positive aspects of teaching Mathematical Literacy?

For critical question 3 (coherence with, or departure from teachers' interpretations and experiences of the ML curriculum)

(g) How relevant do you find departmental curriculum documents (such as NCS Grades 10-12 policy, Assessment Guideline, Learning Programme Guideline and the Teacher Guide) in your teaching of Mathematical Literacy?

(h) How have you used these documents, if at all?

(i) What would you like to change or add to the current Mathematical Literacy curriculum, and why would you like to make such changes?

Data collected through the interviews were analysed through the Wilkinson and Birmingham (2003) method of content analysis. As discussed in previous chapters, my content analysis involves two methods; conceptual analysis and relational analysis. Drawing from Hatch's (2002) models of qualitative data analysis, typological analysis was used for it was relevant and appropriate for this study. In the typological model, themes or categories are predetermined. Typological analysis involves dividing the data into categories or groups. In this study I used Graven's (2002) orientations of Mathematics and Graven and Venkat's (2007) spectrum of Pedagogic Agendas as descriptive tools for the analysis of teacher interpretations of Mathematical Literacy.

Graven's (2002) orientations of Mathematics

Orientation 1: Mathematics for critical democratic citizenship. It empowers learners to critique mathematical applications in various social, political and economic contexts.

Orientation 2: Mathematics is relevant and practical. It has utilitarian value and can be applied to many aspects of everyday life.

Orientation 3: Mathematics as induction into what it means to be a mathematician, to think mathematically and to view the world through a mathematical lens.

Orientation 4: Mathematics as a set of conventions, skills and algorithms that must be learnt. Many will not be used in everyday life but are important for further studies.

Example of these would be calculus and factorisation; such topics do have application in the real world but not in everyday life.

In some categories, like a category on how teachers teach Mathematical Literacy, I used Graven and Venkat's (2007) spectrum of Pedagogic Agendas as a tool for descriptive analysis of teacher experiences of teaching ML. The summary of the pedagogic agendas is presented below in table 36.

Table 36: Spectrum of agendas

Agenda	**Description of pedagogic agenda**
1.Context driven	To explore context that learners need to interact and engage with in their lives, and to use mathematics to achieve this.
2.Content and context driven	To explore a context so as to deepen mathematics understanding and to learn mathematics and to deepen understanding of that context.
3. Mainly content driven	To learn mathematics and then to apply it to various contexts.
4.Content driven	To give learners a second chance to learn the basics of mathematics in GET band.

Given the inclusion of some Assessment Standards that take content beyond the GET band, Agenda 4 might be adapted to include mathematics content beyond the GET band. The spectrum of pedagogic agendas is particularly important in that it provides a lens through which teachers' implementation of the curriculum is viewed and explained. This explanation of how teachers experience the implementation of the Mathematical Literacy curriculum is required in answering the critical question 2.

Below I present a typological model of analysis of the interview responses of the seven Mathematical Literacy teachers.

Typological model for data analysis

Based on key aspects of the critical questions of the study, five categories were determined. These key aspects, concerned with Mathematical Literacy, are: descriptions, purpose, policy documents, teaching and challenges in Mathematical Literacy. These categories were formulated in order to capture all information that would help to answer critical research questions on teachers' interpretations and experiences of the implementation of the Mathematical Literacy curriculum in Grades 10 – 12. Below I present an overview of the five categories:

Category 1: Description of Mathematical Literacy

This category provides descriptions of Mathematical Literacy as presented by the seven teachers in interviews. This includes, but is not limited by, the definition and explanation of what Mathematical Literacy is.

Category 2: Purpose of Mathematical Literacy.

In this category I present the teachers' views on the purpose of Mathematical Literacy from their experience as Mathematical Literacy teachers. To a certain extent I also present the scope of Mathematical Literacy as communicated by teachers.

Category 3: Policy documents of Mathematical Literacy.

In this category I present two important issues related to the policy documents. The first issue is the use of the policy documents. Three main views on the use of the policy documents are presented and discussed. The second issue is on the revision of the curriculum policy. Teachers suggested five key areas in the curriculum, to be changed.

Category 4: Teaching of Mathematical Literacy

This category presents teachers' views of how they teach Mathematical Literacy in Grades 10-12.

Category 5: Challenges in the Mathematical Literacy curriculum

In this category I present different challenges experienced by Mathematical Literacy teachers in implementing the Mathematical Literacy curriculum. Ten different challenges that teachers raised in interviews are presented and discussed.

In the next section I present an analysis of each category.

Teachers' descriptions of Mathematical Literacy

In this category I analyse not only what individual teachers said about Mathematical Literacy when they responded to the question: 'What is your understanding of Mathematical Literacy?', but I further identify and analyse other elements of Mathematical Literacy descriptions that appear throughout the interview. I do this by discussing each teacher, one at a time, and then comparing and contrasting them. To begin my analysis of interview data, I first revisit the description of ML provided by the Department of Education. It provides the point of departure for discussion on the intended Mathematical Literacy curriculum. The DoE (2003) defines Mathematical Literacy as:

> Mathematical Literacy provides learners with an awareness and understanding of the role that mathematics plays in the modern world. Mathematical Literacy is 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 (p.9).

The above definition has the following key aspects of Mathematical Literacy that correspond with Graven's (2002) Mathematics Orientations in the following ways:

Table 37: Mathematical Literacy as defined by the Department of Education

Mathematical Literacy, key aspect	**Primary corresponding orientation**
Mathematical Literacy is driven by life-related applications of mathematics.	Orientation 2

Mathematical Literacy provides learners with an awareness and understanding of the role that mathematics plays in the modern world.	Orientations 1 and 2
Mathematical Literacy enables learners to develop the ability and confidence to think numerically and spatially.	Orientation 2
Mathematical Literacy enables learners to critically analyse everyday situations.	Orientations 1and 2
Mathematical Literacy enables learners to solve problems.	Orientation 2

This analysis shows that definition of Mathematical Literacy presented in the official curriculum document corresponds consistently with Orientation 2 (mathematics as relevant and practical) and with some reference points to Orientation 1 (mathematics for critical democratic citizenship). Other orientations are absent from this definition but, as shown in the document analysis (in Chapter 3), they emerge in the Assessment Standards. However, it should be remembered that while the orientations are presented as distinct, there is of course some overlap. So, for example, *solving problems* overlaps with Orientation 4 (mathematics as a set of conventions and skills).

In the next section I analyse the teachers' descriptions of Mathematical Literacy, using these orientations in order to illuminate an argument. During the interviews the seven teachers were asked a question: What *is your understanding of Mathematical Literacy*? They responded by describing Mathematical Literacy as follows:

How Jabu describes Mathematical Literacy

> Jabu: My understanding of Mathematical Literacy as a subject, is that *Mathematics in real life* is *a practical subject* in that it assists learners not only to know numbers but they must know what they are doing, practically.

The key aspects of Mathematical Literacy as described by Jabu are: *mathematics in real life* and *practical subject*. This description of Mathematical Literacy is, to a large extent, foregrounding Orientation 2. This description matches somewhat with the definition of Mathematical Literacy given in the departmental policy of Mathematical Literacy. It is noted, however, that Jabu includes ‘practical’ as a key aspect of Mathematical Literacy. Jabu describes Mathematical Literacy on the basis of its nature “*Mathematics in real life”* and what it does for learners, what its role is. That is, “it assists learners”. Jabu puts it clearly that the learners will “not only to know numbers” but they will apply these numbers in real life situations, thus foregrounding Orientation 2.

How Khumalo describes Mathematical Literacy

> Khumalo: Mathematical Literacy is a subject introduced in our curriculum, basically which equips learners with mathematical knowledge that can be applied to everyday life.

Similarly to Jabu, the key aspect of Mathematical Literacy as noted by Khumalo is the application of mathematical knowledge to everyday life. This description matches with Orientation 2. Again, here there is little to suggest that Orientation 4 is catered for in this description, although the issue of “mathematical knowledge” for use in everyday life is referred to by Khumalo. The amount of mathematical knowledge that is required in Mathematical Literacy is discussed later.

How Bongani describes Mathematical Literacy

> Bongani: In Mathematical Literacy, mathematics is there, but the level is *not* the same as in the pure Mathematics. To me, Mathematical Literacy is more hands-on Learning Area; Mathematical Literacy is more relevant to everyday situations.

This description shows that Bongani compares Mathematical Literacy with Mathematics, but Mathematical Literacy is simpler than Mathematics. In the later stage of analysis I further attempt to interpret what is meant by ‘mathematics’. The use of ‘hands-on’ signifies practical application. This, coupled with the relevance to everyday situations implies Orientation 2. The use of the term *Learning Area* in the FET Band (Grades 10 – 12) is not common; the official term used is ‘subject’. This may indicate the level of understanding of the curriculum in general by Bongani, or the influence of the GET band.

How George describes Mathematical Literacy

> George: I look at Mathematical Literacy as some aspect, that aspect of mathematics that prepares learners for real life situations.

Once again, real life situations are central to how George describes Mathematical Literacy, as mathematics that prepares learners for real life situations. However, it is not clear in what ways mathematics prepares the learners for real life situations. Later in the analysis I make more connections in this regard. Again here Orientation 2 is foregrounded.

How Alfred describes Mathematical Literacy

> Alfred: Best of my knowledge and understanding Mathematical Literacy, I could link Mathematical Literacy to *arithmetic* where by a basic knowledge in everyday usage of mathematics is being exposed to our learners so that they cannot go out to the world *becoming mathematical illiterate*.

Alfred points to two key aspects of Mathematical Literacy, arithmetic and everyday usage of mathematics. The second aspect of Mathematical Literacy, as seen by Alfred; "*every day usage of mathematics''* foregrounds Orientation 2 "*Real life and practical*". As with the others this coheres with the definition presented in the official policy documents of ML.

How Susan describes Mathematical Literacy

> Susan: Mathematical Literacy is a Mathematics that is used in contexts whereby learners are expected to know how to calculate.

Both Alfred and Susan refer to mathematics calculations (or basic knowledge) in the service of use in contexts, i.e. Orientation 4 in the service of Orientation 2. This description given by Susan has some emphasis on 'mathematics', a particular kind of mathematics that is used in 'contexts'. The two key aspects of Mathematical Literacy, as seen by Susan, are (i) use mathematics in context and (ii) do calculations. The second aspect is not clear enough to suggest the nature of calculations referred to here. However, later in the interview Susan argued strongly that in the present examinations for Grade 12, in the Mathematical Literacy paper the section where the learners are required to "simply calculate", should be removed from the paper. I present more information under category 6 towards the end of typological analysis.

How Myeza describes Mathematical Literacy

> Myeza: The kind of mathematics that is, and the style that it is…presented for learners to interact with, is aah some kind of functional or practical approach, kind of approach that is there with it…and in real life situation.

Similar to Jabu and Bongani, Myeza describes Mathematical Literacy as "practical mathematics" which is used in real life situations. The key aspect in his description is *practical and real life situation*, thus foregrounding Orientation 2.

Interestingly, the aspect of Mathematical Literacy as "*every day usage of mathematics''* seems to dominate all descriptions that were provided by the seven teachers. The table below presents a summary of all descriptions given by the Mathematical Literacy teachers in their interviews, and in the corresponding orientations.

Table 38: Summary of teachers' key words of Mathematical Literacy

Teacher	**Key aspects/ words/ descriptions of MATHEMATICAL LITERACY**	**Orientations**
Jabu	assists learners, mathematics in real life, practical subject.	2
Khumalo	subject, equip learners with mathematical knowledge, applied everyday life.	2
Bongani	hands-on "learning area", relevant to everyday situations', daily life, practical .	2
George	aspect of mathematics, prepares learners for real life situations.	2
Alfred	linked to arithmetic, basic knowledge in everyday usage, mathematics is being exposed to our learners, becoming mathematical literate.	2 and 4
Susan	Mathematics, used in contexts, learners, expected to calculate.	2, 4
Myeza	kind of mathematics, for learners to interact with,	2,

	functional or practical, real life situation	

From this table above, a conclusion can be made that Orientation 2 is the dominant orientation across all the descriptions, thus 100% (7 out of 7) teachers describe *Mathematical Literacy as relevant, or practical mathematics that is used in real life situations* (Orientation 2) with 2 out of 7 referring to orientation 4 in the service of Orientation 2. This shows strong coherence with the curriculum definition as presented in the official policy documents of Mathematical Literacy.

Following the analysis of teachers' descriptions of Mathematical Literacy I present the second category of the interview analysis. As explained previously, this category entails teachers' views on the purpose of Mathematical Literacy. I used Graven and Venkatakrishnan's (2007) spectrum of pedagogic agendas as a tool for descriptive analysis of teacher experiences of teaching ML, as described in Chapter 3.

How teachers articulated the purpose of Mathematical Literacy

The seven teachers interviewed explained the purpose of Mathematical Literacy differently. Some stated the purpose as 'making learners mathematically aware'. Others contended that 'it was to help learners to assist others when they leave school (out of school)'. There were some teachers who said 'Mathematical Literacy supports the learning of other subjects, such as Mathematics, Accounting, and Geography etc.' The table below contains extracts from the range of responses of the seven teachers. I have italicised the aspects foregrounded in the analysis.

Table 39: Teachers' views on the purpose of Mathematical Literacy

Response	**Analysis**
Alfred: .... therefore the purpose of making them *highly numerical consumers* of mathematics to me personally is not the best way to put it, but to make them more to use mathematics in everyday life should be more applicable so that the content of	There is an official curriculum discourse- Alfred however is critical of the discourse. Pedagogic Agendas 1 (context driven)

material should be little relaxed not to test them on knowledge but to test them on the skills *using Mathematical Literacy in daily lives,* although the idea sound sweets but is actually not practical in our system.	and 2 (context and content) are foregrounded and Orientation 2 The comment indicates that the curriculum does not serve its purpose as expected.
Khumalo:....., the purpose is… since mathematics is and it has been part of our day life, every day we need background knowledge of *mathematical application*… I think then the DoE has decided to teach it formally where all learners will be equipped, so as to equip the future citizens, as we know that learners are the future citizens. So they need the background, they need knowledge, ability to use the mathematical knowledge. I *can't confidently say we are serving the purpose*, eeh, because we still have got a lot to deal with. There is still some learners with a negative attitude. Some learners confuse Mathematical Literacy with Mathematics. Some learners had negative attitude towards Mathematics so that also applies in Mathematical Literacy. The reason I am saying this that we are almost there is because now we can see the learners' attitude is now changing. You can now see learners are eager to use calculators. Their numeracy levels are improving. They *can now* work difficult mathematical problems. I can say we are not 100%**.**	In the first part Khumalo foregrounds Agenda 2 and Orientation 2 although he possibly indicates the DoE is promoting Agenda 3 (teach mathematics formally then apply it). The view of Khumalo is that the purpose of Mathematical Literacy is not served due to some of the challenges. One of the key challenges in Mathematical Literacy is the negative attitude of the learners towards the subject, since they perceive it (ML) as similar to Mathematics. Similar challenges were identified in the previous chapter and will be discussed in chapter 8. From this extract, it is acknowledged, though, that the attitude of learners towards ML changes gradually from time to time – from negative to positive; making progress towards the purpose.
Bongani: The purpose is to make learners to relate what they learn in class and make it relevant to what is happening outside the classroom. In that way, Mathematical Literacy is a living learning area.	While Bongani explains the purpose of Mathematical Literacy he does not provide information where this purpose of ML is possible and/or realised in the classroom situation. While open to interpretation his view

	on the purpose of ML seems likely to foreground Orientation 2, and emphasises mathematics for life.
Myeza: ...Fortunately the kind of mathematics that it is, is not coming to the fore for the first time, it has been there as what used to be called functional mathematics. And sectors it would be categorized as mmmh financial mathematics... to do with economics. When you look at *the structure and syllabus* of Mathematical Literacy…it *can reach* even to your lowest kind of artisans and people, unskilled people. No matter how low their skills are because when you look at it, there is something to do with plumbing, angles, counting, town planning etc., things that are done mainly by many people, semi-skilled are able to be catered here!	Myeza views the purpose of Mathematical Literacy as *to prepare learners* for working life, but limited to specific work. Functional mathematics is not incorporated in Graven's Orientations, nor clearly described in Graven and Venkatakrishnan's spectrums of agendas even while it aligns mostly with Agenda 2 and Orientation 2. His view coheres with aspects of the official curriculum discourse.
Jabu: The purpose of Mathematical Literacy is to *make the learners mathematical aware*. It also assists them to assist others when they leave the school (out of school). The problem in the school environment is that the learners are doing the subject for the sake of answering questions in the exams. They are not practising it in the real life. *And I see it when I ask them some questions*.	Again here, Jabu views the purpose of ML in the same way as Khumalo, aligning mostly with Agenda 2 and Orientation 2. While recognising the potential of Mathematical Literacy to prepare learners for real life situations, he raises concerns related to the learners.
Susan: ... Mathematical Literacy does fulfil its purpose because, now if *we are looking at the aims of teaching Mathematical Literacy we need to meet those learners to be self-managed*. Now if they know how they are going to conduct themselves when they go out of the world. I have got so many learners who have come out of the system now. They were doing Mathematics Literacy they are using that Mathematical Literacy *knowledge at work*. They *are calculating*, for instance the other one is working with BUILD IT	Susan views the purpose of Mathematical Literacy as described in the official policy document; there is much alignment to the curriculum discourse foregrounding Orientation 2 and Agenda 2. Much emphasis is on the application of mathematics in real life particularly in

(hardware shop), now what they are doing is they are calculating each and everything there, people are coming there to buy material, they know how to calculate the costs of the material that is needed, even the quantity of the material that is needed for the building there because they will bring them the building plans and they *are able to interpret* the building plans.	work place situations.
George: I look at Mathematical Literacy as some aspect, that aspect of Mathematics that prepare *learners for real life situations*, it helps them to know about any dealings with situations that they come into contact with, it deals with practical hence life like the goods divide by the number of the amount of tax invoice they will have on the receipt, how to exchange when they come to the market or how to deal with general transactions about ideally numeracy at this and all those things. So Mathematical Literacy basically prepares the learners *for real life situations*, how to calculate the distance and all those things which are about their life situation, how to interact with those things. **...**, definitely, Mathematical Literacy is *fulfilling its purpose* when you look at the content and all those things we are doing at school with learners definitely it will make them highly numerate consumers of mathematics. It's definitely fulfilling that purpose.	The view (preparing learners for real life situations) shared by Susan and Jabu is similar to George's and foreground Orientation 2 and Agenda 2. Interestingly, his view on the issue of attaining the purpose of "highly numerate consumers of mathematics" is the opposite to Alfred's as Alfred raised several challenges to fulfilling the purpose.

The analysis above reveals that 5 out of 7 teachers emphasised that the purpose of ML is to prepare learners for real life situations, including work place situations. This view aligns with the official curriculum discourse. Two out of seven teachers did not view the purpose of Mathematical Literacy being fulfilled yet. In coherence with the curriculum discourse, Orientation 2 and Agenda 2 are foregrounded across all responses.

Below is the analysis of data which falls under Category 3 described above, i.e. policy documents of Mathematical Literacy.

How teachers view and use the policy documents of Mathematical Literacy

Analysis shows that there are three main groups of views in the seven Mathematical Literacy teachers. The first is that all policy documents provided by the department are ‘good’ and must be implemented as they are. I refer to this as *alignment*. Alignment in this case is not used in a deterministic way of structures imposing on teachers but from a socio cultural perspective and in the sense that it is used by Jaworski (2006).

The second is that, as much as these curriculum documents are good, teachers need to modify them to suit the context. I refer to this as *adapted alignment*.

The third group of teachers is those who believe that the policy documents are generally good. They believe in developing their own learning programmes which are informed by policy but not strictly conforming to the policy. They totally reject some aspects of the policy. I refer to this as *critical alignment*. Critical alignment is used here as it is used by Jaworski (2006) adapted from Wenger’s notion of alignment as one of three modes of belonging. She asserts:

> It is hard to do justice to these ideas in a short space, but the notion of alignment, as I expand it here, needs a further comment. Alignment within a community of practice results in individual members aligning themselves with conditions or characteristics of the practice. Through the exercise of imagination during engagement, alignment can be a critical process in which the individual questions the purposes and implications of aligning with norms of practice. I refer readers to Wenger for a more thorough discussion of these modes of belonging. For my purposes here I will suggest a form of critical alignment in which it is possible for participants to align with aspects of practice while critically questioning roles and purposes as a part of their participation for ongoing regeneration of the practice (p.190).

Thus, below I analyse responses in terms of alignment, adapted alignment and critical alignment with necessary the departure.

Table 40: Teachers' views on the policy documents

Response	Analysis
Bongani: Those documents, I think what is contained there is *100% good* because the vision and idea is okay for our learners. It is *very good*.	Policy documents viewed as blue-prints – good documents. Here there is **alignment**
Myeza: Policies are *quite relevant* because at times it is like, they are good in *benchmarking* you. They provide information about the required level. Some topics are the same but you have to *up a notch a bit for a certain class*, you know, because there more aspects you have to bring in, in terms of your Assessment Standards and LO's. So, they really do *guide you*, so that you wouldn't be doing the same thing you did in Grade 8 for a Grade 10 learners. You know that there is a point where you have to up the standard some bit. So, they also really help you even in terms of pacing yourself as to when you should be doing a particular section, at what time you should be doing some, and time to finish that particular section.	Policies should guide you as they are good 'benchmarking', but with caution. There is a need to modify them to fit 'a certain' context of the classroom. Here there is **adapted alignment.**
George: So those policy documents that are there *help the teacher a lot*. It does not give room for each teacher to do things on their own, you get up next day and I am going to class I am going to do what I think I should do, no. *There is something that you have to go in according to and those documents are prepared* inline the needs of South African citizens, the learners who are upcoming. **Themba**: So, in your case if the policy says 2 assignments, do you do 2 assignments only? **George**: Ya, I *go strictly* with that.	Policies need to be 'strictly', followed with caution. Here there is **alignment.**
Susan: They are helpful because you have to be guided with something but the problem now with it, what we are having is the policy document that was written long ago it needs to be at *least revised* – there must be a *revision*.	Policies need to be followed with caution – there is a need to modify it because the policy becomes outdated. Here there is **adapted alignment.**
Khumalo: The Department of Education has supplied us with the lesson plan; you just have to modify the lesson plan. They supply us with the pace setters, work schedule, they supply us with everything. For us is just to modify what has been	Modification-he modifies the policy to meet the contexts of the classroom. Here there is **adapted alignment.**

supplied and take it to the class.	
Alfred: Ya, the documents are *quite good* they are okay, I will say they are *very good they are right*, I don't accept the lesson plan from the department because I don't buy a cook, cooked material and implement, I *prefer to do my own lesson plan*. So I take this entire document with me when I'm preparing my lesson plan before the class. *I don't always go according to what the NCS* (Mathematical Literacy) says.	Accepts mostly, but not all, policy as a guide and rejects lesson plans. Here there is **critical alignment** or perhaps critically **selective alignment**.
Jabu: Firstly I must thank the dept for year programme the department has provided us with. The *programme has been well arranged* by dept and also in the learning programme, it assists us how we can use some material we find in our schools. The Guidelines also *assists us to know exactly what is expected* at the end. E.g. LO1 – deals with numbers, it assists us to know what area to be covered in Grades 10, 11 and 12. It also helps us not to overdo some sections. E.g. not to do Grade 11 work in Grade 10, or vice visa. The subject statement tells us broadly about the subject, what is expected from the learners after learning the subject and what the educators should do.	Jabu sees the Policy documents as blueprints, saying 'exactly what is expected'. Here there is **alignment.**

These three views about policy documents can be summarised as follows, in table 41 below.

Table 41: Summary views on the use of policy documents

Main view	Description	Frequency out of seven
Use the policy as it is **(Alignment).**	Curriculum is perfect or good, needs no change	2 out of 7
Modify and adapt it (**Adapted alignment).**	Modify and adapt the policy before using it.	4 out of 7
Use it as a reference (**critical or selective alignment).**	Do not rely on policy documents	1 out of 7

Both tables 40 and 41 show that there is general alignment across responses. In chapter 8, I discuss alignment in detail.

Teachers' views on the current curriculum and possible changes

The policy document on the Norms and Standards for Educators (DoE, 2000) describes teachers as interpreters of the curriculum. Teachers are presented with a curriculum in the form of policy, and their task is to interpret and implement it at classroom level. Teachers have their own views about curriculum policy. The seven participants were asked the following question on curriculum policy: *What would you like to change or to add in the current Mathematical Literacy curriculum?*

Analysis reveals that though teachers are generally happy with the current Mathematical Literacy curriculum (which coheres with the alignment discussed above); some changes are suggested:

Myeza responded as follows:

> Myeza: Eeh, most of the things that are there are relevant. I would be happy if it could be more functional than it is right now, that is more be contextualised as much as possible than it is now so that when they get out of school they will be able to really identify what they learnt from school.

It is apparent that Myeza foregrounds contexts more than mathematics content and he sees the current Mathematical Literacy lacking in this aspect. This is consistent with his responses in the earlier analysis that indicated his alignment with Pedagogic Agendas 1 and 2. His response is also consistent with his adapted alignment view of policy documents discussed above.

Khumalo suggests some changes in certain sections of the curriculum, particularly in the Learning Outcome (LO) 4. This is how he responded to the question on possible changes in the curriculum:

> Khumalo: For me I would go straight to LO4, Data Handling. I think there is too much work there. Well, statistics is okay but when you go to quartiles etc. this needs to be cut off. The purpose is not to low the standard of Mathematical Literacy but to bring what is needed by the learners for real life. We need to stick to the topics that the learners will need in the real life**.**

It is revealed by analysis that even though Myeza and Khumalo have different views on different aspects of Mathematical Literacy, the reasons for their views are similar, that is, to make Mathematical Literacy relevant to the real life of the learners. Notably, Khumalo states that Mathematical Literacy should be of a high standard and at the same time relevant to the real life of the learners. He points to some topics that are mathematical in nature but not relevant to real life situations. His response is consistent with his alignment to pedagogic agenda 2 and his adapted alignment stance above.

Similarly, Susan's response is consistent with her Pedagogic Agenda 2 and adapted alignment to the curriculum:

> Susan: What I do not like in the present curriculum is the first part of calculating, it is there in Paper One, they will always give you the direction but in Paper Two it is not there and that is the section of simplifying – it is a lot of simplification.

Notably, teachers like Bongani expressed a view which suggests alignment to the official curriculum. For example:

> Bongani: Well, generally- I cannot say I can add or take something out of the current curriculum. I trust those people who designed the curriculum.

Similarly, George sees nothing to be changed in the curriculum. When he was asked what he would like to change or add in the current Mathematical literacy curriculum, his response was *more aligned* to the current curriculum. For example:

> George: in fact that one, I have not, ...to think of what to change in the curriculum that they have implemented. There, I don't have, I have not done much thoroughly study of something that need to be changed in there.

The examples presented above provide insight into how teachers understand, interpret, experience and implement the intended Mathematical Literacy curriculum, and how they would like to change it. The categories of alignment, adapted alignment and critical alignment are useful descriptions of teacher positions. In Chapter 8, I further engage with these categories in order to establish the extent to which these teachers' interpretations and experiences cohere or deviate from the intended Mathematical Literacy curriculum.

The above analysis indicates that teachers have diverse views on issues around examinable sections and specific topics to be included in the Mathematical Literacy curriculum. There was some concern from teachers whether topics that are non-examinable should or should not be removed from the curriculum. Bongani argued that even though those topics are non-examinable, there is a need to expose learners to the knowledge. For example:

> Bongani: With trigonometry (which is non-examinable), I do believe that trigonometry is quiet bit difficult for learners but the elementary sections like ratios can be taught. I once did it with my Grade 11 when ML was introduced but only to find that in the following year we were told that these sections are then out of syllabus. They can do the elementary sections *it won't harm*. I found one's textbook very useful in regard, *it provided them with some skills.*

Contrary to Bongani's view, Susan had a different view with regard to the non-examinable topics. For example:

> Susan: Yes, some topics must be removed because they are misleading because you will find that most of the teachers will teach Trigonometry, where else the learners go to the exams there is no trigonometry. Then if now we are telling them that this section is not there they will say how to know it because it is there in the policy document now I am guided by the policy document not by somebody else so it is you against the policy document.

There were diverse views on specific topics that should or should not be part of the curriculum. Some teachers argued that certain topics, such as trigonometry, should be brought into the ML curriculum because they can be applied in real life contexts, e.g., in building. On the other hand, some teachers argued that trigonometry and other mathematics-related topics should be removed from the curriculum as they may make Mathematical Literacy too difficult for learners to access, thus not serving the purpose. However, there was overwhelming agreement on the view around the importance of contexts in Mathematical Literacy. All participants emphasised that

Mathematical Literacy should have a relevant context that is meaningful to the learners; hence the policy document should be clear about that.

Below I present the 4th category which examined the views of teachers on how they teach Mathematical Literacy.

How teachers teach Mathematical Literacy

The second research question aimed to probe how teachers implement the Mathematical Literacy curriculum. The interview probed two important aspects: (i) teachers views on how Mathematical Literacy should be implemented and (ii) teachers views and experiences in implementing Mathematical Literacy in Grades 10 – 12. Data analysis shows that teachers use a variety of approaches in implementing Mathematical Literacy. Below I present an analysis of the responses of each teacher, and a summary of key methods used by each ML teacher. Given the similarities in the findings from the sample, I further present findings in Table 42 which summarise a number of teachers using a particular approach or method.

Interviewing Khumalo on how he teaches Mathematical Literacy revealed the following:

> Khumalo: When I started teaching then, I started to show them the good side of Mathematical Literacy. I *analysed our daily situations* where I told them that there is no need to have negative attitude towards Mathematical Literacy – because you use Mathematical Literacy every day. If you take a taxi and you sit in the front seat, you have to give change to the passengers. You have to *use basic operations* of Mathematics. I *managed to win* their hearts, everyone then was willing to participate in class. We shared our experiences; talking about the use of mathematics in general. The first assignment I gave them I asked them to identify the use of mathematics in their everyday life. When they came back, I managed to boost their egos. They felt ready to be part of my class. As a result their enthusiasm was there to those learners until they passed their Grade 12. This *is evident* since I got 91.4% pass in Grade 12 last year even though I was given those learners who were considered incompetent in Mathematics.

In this extract the following key aspects of teaching Mathematical Literacy are emphasised by Khumalo: (i) motivation, (ii) relating the subject to real life, (iii) sharing with learners/ participative approach and (iv) assigning projects. From this extract it is evident that he views these teaching approaches as good, since he sees them producing good results, so that learners became positive, motivated and successful and passed at the end of the year.

Additionally, Khumalo further explained how he teaches particular topics of Mathematical Literacy, for example, Khumalo articulated how he teaches Learning Outcome (LO) 3, which deals with shapes and measurements:

> Khumalo: When it comes to LO 3, I might appear mentioning LO 3 now and again, for me everything that is in class, something that assist me in teaching I use box of chalk, I use walls as resources for my lesson. So you do not find it difficult to get teaching resources for the lesson. *There is one thing positive about the subject, if you bring the subject to context.* Sometimes you even refer learner back to their rural areas to refer to rondavel and you can then talk about volumes and cylinder etc. you can bring the bottle of water in class to teach**.**

Apart from the positive experiences in teaching Mathematical Literacy presented above, Khumalo acknowledged that it is not always simple to teach Mathematical Literacy. In the following extract he reflects on some negative experiences in teaching some sections of Mathematical Literacy:

> Khumalo: It is difficult to find the relevant teaching strategies. For instance, you find yourself going back to the traditional style where you stand in front of the class and just talk, talk and talk; e*ven though we know that that should not happen.* We as teachers we suppose to guide the learners. This is because of the lack of maximum participation from the learners. You end up deliberating everything to the learners, asking questions; which is supposed to be the first part of the lesson.

These extracts are important in providing some insight into what influences teachers to teach the way they do. This is particularly important, as it addresses research question 3 on how teachers' experiences influence the implementation, and how the implementation influences their interpretation of the curriculum. The following aspects in teaching Mathematical Literacy were reflected in the above extract: At times it is: (i) difficult to find a teaching strategy, hence (ii) a traditional style of teaching like just talking is used, in instead of (iii) guiding the learners. Analysis shows that the teacher understands the methods that should be used in teaching, but because of the classroom situation the teacher finds him/herself using undesirable methods.

Interestingly, in chapter 7, where I analysed Khumalo's lessons, I noted connections between what Khumalo said and what he did in a classroom situation. I further discuss these connections in Chapter 8.

In the interview with Myeza, who had been teaching Mathematical Literacy since it was introduced in 2006; his response to how he teaches Mathematical Literacy was as follows:

> Myeza: Eeh, definitely as a teacher you have to improvise. You make do, use of what you have. *You go around and try to get some material*. But at times you do not succeed. Hence I say you make do what you have to teach the kids as much as possible, *drill them, and do all kind of things,* give them extra lesson, even getting people from outside to do that, *even empowering yourself* make sure that you go to workshops, do some special courses.

In analysing this response that Myeza gave, the following key aspects are significant in his teaching of Mathematical Literacy, namely, improvising, and use of the various materials and methods: drilling, providing extra lessons, professional development and networking with other Mathematical Literacy teachers. As the interview proceeded, Myeza further highlighted the way he was implementing Mathematical Literacy as follows:

> Myeza: Teaching Mathematical Literacy is a revelation every day. Is *a revelation* in the sense that you see stuff (anything) that *you teach now that you were not aware* of some years ago. You find that you get to the chapter dealing with angles and say you *can design a soccer field or a netball field*, something you never thought you could do. *The excitement that the learners find when you do practical work*, you find that it helps the learners. At times you find that these learners *will do all kind of jobs* in the location (local area) applying knowledge gained at school in Mathematical Literacy class. The learners come with their own concepts. Some time ago we were doing 'the right angle triangle'; it was based on the Nelson Mandela bridge structure and design. Looking their faces when we were doing that, it was so easy and *they were so excited.*

Analysis of this extract revealed that Myeza draws current and local experiences into his lessons and that learning about these is a '*revelation*' for his own learning and he experienced excitement from his learners and notes aspects of a learner centred approach in his teaching, e.g., "l*earners come with their own concepts*".

From this extract, the key aspects of teaching Mathematical Literacy here are *contextualisation* of mathematics, *using practical* objects to explain concepts including all resources readily available in class and *relating the subject to the real life* of the learners.

Alfred (with his mathematics strong background) gave a different response to how teachers teach ML:

> Alfred: I assume at the beginning of the topic that my kids know very little about that topic. So I take it from the sweeping, *I take it from the ground level and build it up* and make them aware that at ground level will be very interesting and very sweet... we are building from the ground level upwards, so, sometimes it works, but not all of them get *the understanding from basic although* I might have done it.
> And *secondly* I try to *make work more research* entity where I give them the topic and go out and find out about the topic they do the presentation in class. And thirdly I tried to introduce other teachers like a team work, where the kids don't only listen to one particular teacher, I call teacher A to come and teach this particular topic, teacher B to come and teach this particular topic, so I could see that the kids have *variety of teachers* to listen.

From this extract Alfred seems to use different approaches to teach Mathematical Literacy, namely: starting from the basics, co-teaching, or team teaching, assigning research projects, allowing learner to do presentations. His starting from the basics seems to contrast Khumalo and Myeza's emphasis on contexts. Learners seem to be actively involved in tasks, but from this extract there is nothing to suggest that the tasks are based on real life contexts although there is a chance that 'topic' could be interpreted to include contexts e.g. taxation, as emphasised by Khumalo and Myeza. In Chapter 7 I analyse lessons presented by Alfred and try to make connections between teachers' mathematical background, experience, understanding and implementation of the curriculum.

Similar to Alfred, Jabu had a strong education background of Mathematics and had also studied Mathematical Literacy. In his response on how he was teaching Mathematical Literacy; he responded as follows:

> Jabu: I teach from Grade 10 to 12. I have a *Teacher guide* document. Every time when you teach you must *have context*. *Sometimes learners do not understand context* used hence you must go to their level... you as a teacher you need then to go back to various textbooks available.

There are four important findings from this extract that related to the way in which Jabu teaches Mathematical Literacy. These key aspects are: (i) he uses the teacher guide document in teaching; (ii) he uses context in every lesson (Agenda 1); (iii) he determines the level of his learners and teach according to their level; and (iv) he used various textbooks to teach. His response is consistent with his alignment with the curriculum discussed above.

Jabu further explained how he teaches specific topics (e.g. Financial Mathematics). He responded as follows:

> Jabu: If my topic is about investments, I give them information about investment, formulas, taxes and how to calculate thereafter when they understand. I then ask the school to provide transport. They go to different insurance companies or the banks in the nearby. They ask about different interests these banks charge. They find out about different accounts they need to know. After that I allow them to come back to ask me some questions about what they have found. I then ask them to make a summary of what they have experienced.

Here in this extract there is much emphasis on practical investigation and application of mathematics to real life situation (consistent with Pedagogic Agendas 1&2).

Below in Table 42 I summarise teaching strategies used by the seven teachers.

Table 42: Summary of teaching strategies stated by the teachers

Teaching strategy Use of:	Description	Frequency out of 7
Use real life context	Use real life or every day contexts that the learners are familiar with.	6
Policies	Use subject guidelines, Learning guidelines and other related policies of Mathematical Literacy.	5
Motivation	Generate interest and explain how important Mathematical Literacy is.	5
Cooperative teaching	Ask other teachers to co-teach particular topics	
Textbooks	Use a variety of textbooks to explain a particular section of Mathematical Literacy	4
Extra lessons	Offer extra lessons for those who do not understand	3
One on one approach	Attend to individual learners who have problems	3
Start from basics	Start with basic mathematics principles and advance to more complicated contexts that require more mathematics content	4
Research based projects	Give learners research projects that will enable them to deal with the application of mathematical procedures and principles	4
Expose learners to practical experience	Engage learners in practical work, that is, learning by doing. For an example, if dealing with measurement learners practically measure the objects using the relevant tools.	6
Class discussions, debates and presentation	Allowing the learners to do presentations and debates on real life issues that involve the application of mathematics.	4

These teaching strategies together with those teaching strategies observed during the lesson observations of two teachers, Alfred and Khumalo, are discussed in chapter 8.

Challenges in implementing the Mathematical Literacy curriculum

Several key challenges were raised by the teachers. These challenges are associated with five aspects namely: Mathematics background, support from Department of Education, learning support material (LTSM) and learners.

Mathematics background knowledge

In the previous chapter, the issue of mathematics knowledge was raised as one of the important aspects in teaching and learning of Mathematical Literacy. Similarly, during the interviews with the teachers this aspect was raised in the interview and is analysed below.

Analysis shows that all teachers consider mathematics content knowledge as having a great influence (positive or negative) to them and their learners. Particularly those teachers who have strong Mathematics education background argue strongly that Mathematical Literacy teachers must have good mathematics content knowledge in order to implement Mathematical Literacy successfully. They further contend that their previous experience of teaching (pure) Mathematics helps them to teach Mathematical Literacy successfully.

Below I present analysis of views of the three teachers who expressed a strong view on the role of mathematics content knowledge in teaching Mathematical Literacy. The other four participants did not suggest any view on the role of teacher mathematics content knowledge for teaching.

Table 43: Mathematics content knowledge required for ML

Response	**Education background & experience**	**Analysis**
Jabu: What I find it interesting is that I do have a good background of Mathematics because I was teaching Mathematics in the FET (in Grades 10 and 11) before I taught ML.	Jabu has both mathematics and Mathematical Literacy education background.	Jabu says good Mathematics education background (and previous experience of teaching Mathematics) has positive impact in teaching ML. It appears from this statement that Jabu is *confident* about teaching the subject because he has a good Mathematics background.
Myeza: As a learner I did functional Mathematics some years back but I changed to *pure Mathematics so I know the ins and outs of the subject*. I have taught Mathematics at GET phase before ML was introduced. You find that some teachers teaching the subject, *they do not have Mathematics* background, even themselves they *are not sure a*s to what suppose to be happening	Myeza has a background of mathematics as a leaner, student and a teacher.	According to him a good mathematics education background (and previous experience of teaching Mathematics) has positive impact in teaching Mathematical Literacy. Myeza expresses his confidence about ML because he did a subject similar to Mathematical Literacy and has also taught Mathematics before teaching ML. Myeza draws from his personal observation-poor Mathematics education background has a negative impact in teaching ML.
Alfred: I consider the teacher who has never done Mathematics but teaching ML that he/she has *a very limited knowledge of ML.*	Alfred has a mathematics background and experience of teaching mathematics and ML at secondary school and university levels.	According to him poor Mathematics education background (of the teacher) has a negative impact in teaching ML. Drawing from his experience as a Teacher Educator (for ML programme) and a senior teacher at his school, If the teacher does not have good mathematics background is likely to have limited knowledge of ML.

While 3 out of 7 teachers indicated that a good mathematics background of the teacher serves as an advantage Jabu cautioned on the possible negative influence of a teacher having much content knowledge of mathematics. For example,

> Jabu: Even myself when I teach I find that the learners do not understand the lesson because of the content. I then lower myself because this is not Mathematics it is Mathematical Literacy. Teachers must be aware that learners are afraid of mathematics. The Mathematics teachers usually focus on content and ignore context, even some textbooks also focus on content.

This extract suggests that Mathematics education background of the teacher may sometimes have a negative influence in teaching and learning of Mathematical Literacy.

Another important aspect of content knowledge that came from the seven teachers was the learners' mathematics knowledge. Most teachers indicated that learners, particularly in Grade 10, do not have sufficient mathematics content knowledge for Mathematical Literacy. It is assumed that the learners should have acquired basic mathematics knowledge in Grades 8 and 9 by the time they are in Grade 10. In Grade 10 Mathematical Literacy learners are expected to be able to apply the basic mathematics knowledge in real life contexts. Susan for example responded as follows:

> Susan: The problem is that our learners do not have enough Mathematical knowledge from Primary upwards, when they get to FET phase they should come with some knowledge with them but it is lacking and we are building on that.

She argued that FET Mathematical Literacy requires a background of mathematics content knowledge acquired from GET Phase and raised concerns that learners lack basic mathematics knowledge. She further contended that it has a negative impact on the effective learning Mathematical Literacy if learners lack basic mathematics knowledge. For example:

> Susan: It does impact because it is very important that they have a good background of Mathematics because you are teaching Mathematics in context, so that means that Mathematics which is the context which is needed there they have to apply it, so if they don't have it they won't have the chance of getting this right. so in my experience I have observed that most learners lack in the Mathematical Literacy background which is a real problem for them, especially if you take fractions, when you are teaching in FET you do not expect a child who has passed Grade 9 not to know how to add, subtract, multiply and divide fractions because you know those basic operations were dealt with in the primary level and in Grade 8 and 9.

In the same way, George also argued that most learners lack basic mathematics knowledge. For example:

> George: If a learner does not go through one phase well it affects the next phase and the foundation of the subject (Mathematical Literacy) was the major problem I was facing in class because at Grade 10 where I am teaching I expect the learners to have learnt how to do simple addition of fractions and subtraction of fraction but you could see that at that level most of them don't know how to go about that… so it makes it very difficult for you to build upon that.

The analysis of these responses revealed that there is a strong viewed which is shared by the teachers that the lack of good Mathematics background influences the way in which teachers implement Mathematical Literacy curriculum. Consequently, teachers tend to push *pedagogic agenda 4* (To give learners a second chance to learn the basics of mathematics in GET band).

Support from the Department of Education

With respect to the challenge of the support from the DOE, teachers raised concerns that the support from the DoE was insufficient and did not address their professional needs. For example, they said that most if not all DoE workshops focused on curriculum issues, without focusing on developing Mathematical Literacy teachers with mathematics content knowledge, especially for those teachers with little mathematical background as explained above. Below I present analysis of teachers' views on the support from DoE in relation to my critical questions.

Critical question 2 relates to teachers' experiences of teaching Mathematical Literacy and the influence of these experiences in interpretation and implementation of the intended Mathematical Literacy curriculum. Almost all the teachers interviewed reflected on professional development as one of the critical elements that influence both teachers' interpretation and implementation of Mathematical Literacy. Responses suggest that in the Education District where this study was carried out, the Department of Education did not offer appropriate support to assist teachers of Mathematical Literacy. For example, Susan responded as follows:

Susan: We are supporting our self in district level; you find that there are no subject advisors who have done Mathematical Literacy so that is the problem.

This response above shows that some teachers assisted others irrespective of the lack of support from the DoE. On the other hand Bongani reported to have received support from the DoE though he said was inadequate, for example:

Bongani: Generally, I can just say most of us we have undergone a short session or workshop of Mathematical Literacy training. Some of us expressed challenges and problems in teaching Mathematical Literacy. For me I think, if possible, we need twice or once per term further training at a local cluster or district. This will help us to discuss and plan for the term the section we will cover.

Similarly Alfred acknowledged that the DoE did support the teachers but he had serious concerns on the nature of the professional support that was given by the DoE:

Alfred: I have got one concern which I think it will be more appropriate to share here, is that teachers are always advised to attend w/s in Mathematical Literacy, now, instead of building the content knowledge of these teachers, which is not done by the Department of Education, they rather teach them the NCS [curricula related issues]. And it is not very easy to get the teacher who has limited scope in content knowledge to come and teach Mathematical Literacy content.

Alfred argued that professional development and support for Mathematical Literacy teachers should focus on mathematics content knowledge as he viewed mathematics content knowledge as more important than any curriculum knowledge.

Myeza responded that as a teacher one should empower yourself and rather than focus on the DoE support he referred to teacher professional development support in the form of accredited University programs such as the ACE:

Myeza: As a teacher you need to be empowering yourself make sure that you go to workshops, do some special courses, like as I was saying we used to do ACE programmes at the University.

Here Myeza maintained that whether the department of education supports teachers or not, the teacher him/herself should seek professional development.

The Learning and Teaching Support Material (LTSM)

Teachers raised concerns with LTSM for Mathematical Literacy. For example, the absence of 'good' Mathematical Literacy textbooks available in schools and those books that are available in schools are insufficient to cater all the learners. Teachers argued strongly that contexts used in most textbooks do not cater for all learners' backgrounds, particularly those learners who are from rural areas or townships.

Khumalo's comment points to the issue of relevance and availability of textbooks:

> Khumalo**:** I cannot say there are no challenges. Because we are still short of support material, you have to group the learners to use one textbook. Mentioning the textbook, we have different textbooks and most of these textbook are not informed by policies, they do not translate what is in our work schedules. In order to cover your work schedule you need to use various textbooks. These textbooks are not available to the learners; they are only available to the teachers. You work with 100 learners only to find that you have 10 text books.

Similarly, Jabu argued that textbooks were not well written to meet learners' needs particularly with regard to their real life contexts – this poses a challenge for learners as they try to understand Mathematical Literacy problems that are presented in unfamiliar contexts.

> Jabu: I teach from Grade 10-12. I have Teacher Guide, every time when you teach you must have a context. Sometimes the learners do not understand the context hence you must go to their level. Sometimes you find that you are about to finish a chapter only to find that learners are not understanding the sections taught. You as a teacher you need then to go back to various textbooks available. Unfortunately, when you go to textbooks you find the different challenges with the books.

In addition to the challenge of textbooks, Khumalo raised the issue of the absence calculators. For example:

> Khumalo: In any learning the most important resource is a scientific calculator, but you will find that in a class of 30 learners you find that there are only 3 learners with calculators. Then they struggle to get it. Some of the learners cannot afford to buy calculators and mathematical set. I can say this is the one of the challenges.

In my lesson observation analysis of Khumalo (discussed in chapter 7) I describe the classroom context which includes the shortage of calculators and textbooks noted.

Challenges related to the learners

Several challenges related to the learners were raised across the seven teachers. These include poor language, negative attitudes towards the subject, an absence of basic Mathematics background knowledge and poor participation in class across Grades 10 – 12. For example Susan identified language as a key problem:

> Susan: My first challenge is *Language* because Mathematical Literacy must be in context, now they have to be given a certain context and in that scenario and then interpret whatever they have to do and then there are key words that they need to take care of them ,if they do not take care of those words then they miss, for instance if there is 30% increase, let say you say somebody was earning R1000 and then you got 5% increase what they will do is to calculate that 5% of R1000 and then its ends there, they won't include that one in that salary.

Learners' attitude towards Mathematical Literacy was explained by teachers to be very negative. For example:

> Khumalo: We still have got a lot to deal with. There is still some *learners with a negative attitude.* Some learners confuse ML with Mathematics. Some learners had n*egative attitude towards Mathematics* so that also applies in Mathematical Literacy.

These learners had a negative attitude towards Mathematical Literacy because they associated it with mathematics. Similarly Myeza also observed the challenge of a negative attitude amongst his learners:

> Myeza**:** The challenges that are there in teaching the subject, one is *the attitude of learners*, and I do not know if I should say the stigmatisation, but the attitude they have towards numbers, Mathematics is there, so they have a phobia. That anything that has to do with numbers, shapes and other things is not for them- it is something difficult for them to understand. So first, that is it. Some (learners) *negative attitude* and also …like there I would say they have inferiority complex when it comes to challenges that might arise and looking at numbers themselves, is the phobia I can put it like that..

Additionally, Alfred also observed that some of his learners do not see Mathematical Literacy applicable to their real life situation, for example:

> Alfred: One challenge is the *attitude of the learners towards the* subject area; some of them are very negative towards maths lit. Because they felt that they assume that they are not going to use this Mathematical Literacy anywhere in their lives, and some feel that they are being forced to do Mathematical Literacy, so, *that is the attitude.*

While the analysis concerns with the negative attitude of learners towards Mathematical Literacy, it is interesting that one teacher said he also had had a negative attitude towards Mathematical Literacy. For example:

> Bongani: It was not easy for me to teach ML. To me, thought ML undermines our learners' ability in Math. At first, I had a negative attitude towards it.

Another challenge related to the learners is a lack of basic mathematics knowledge and poor participation in class. I have already indicated the role of mathematics knowledge in Mathematical Literacy. At this stage I link the lack of basic mathematics content knowledge with poor learner participation in class. Like other challenges already presented, these two aspects together negatively affect the effective teaching and learning of Mathematical Literacy. For example:

> Khumalo: Ya, when come to the challenge to teaching it is difficult to find the relevant teaching strategies. For instance, you find yourself going back to the traditional style where you stand in front of the class and just talk, talk and talk. Even though we know that should not happen. We as teachers we suppose to guide the learners. This is because of the lack of maximum participation from the learners. You end up deliberating everything to the learners, asking questions. Which suppose to be the first part of the lesson. The learners lack maximum participation in class. For instance, if you guide them with questions you might end up not reaching the stage you wanted to reach with your lesson. So that forces us sometimes to go to traditional methods.

The two related challenges mentioned here are *poor Mathematics background* and poor *learner participation* both affecting effective teaching. Similarly, Alfred also raised the issue of poor learner participation in class. For example:

> Alfred: The kids don't contribute in class, that's one thing I find little bite disturbing they believe in teachers who talk and talk and talk and give exercises.

Similarly, Myeza identified gaps between the GET Phase Mathematics content knowledge and Grade 10 Mathematical Literacy content. For example:

> Myeza: There is a problem that I have observed from the learners. It seems that there is a gap between Grades 9 and 10 classes

All these experiences influence teachers' implementation of the intended Mathematical Literacy curriculum. Below in Table 44 I present a summary of eleven challenges identified by the seven teachers during the interviews (discussed above).

Table 44: Challenges in implementing Mathematical Literacy.

Challenge no	Description of the challenge	Frequency out of 7
Challenge 1	Negative attitude of the learners towards ML	5 out of 7
Challenge 2	Language-learners have a problem with English as a medium of instruction	4 out of 7
Challenge 3	Learners' mathematics content knowledge background	3 out of 7
Challenge 4	Context used in Mathematical Literacy(textbooks) sometimes is irrelevant to the real life (of a learner)	3 out of 7
Challenge 5	Specific topics like LO 3 and other topics which too mathematical.	3 out of 7
Challenge 6	The learning and teaching support material (LTSM)	3 out of 7
Challenge 7	Support from the Department of Education	3 out of 7
Challenge 8	Poor learner participation in class	3 out of 7
Challenge 9	Perceptions of Mathematical Literacy	2 out of 7
Challenge 10	Time available to teach Mathematical Literacy	2 out of 7
Challenge 11	Relevant teaching strategies	1out of 7

Notably, most of these challenges were identified in the previous chapter (chapter 5), across the 60 teachers such as language, lack of basic mathematics content knowledge, perceptions and teaching strategies. In Chapter 8, I discuss these challenges in detail and relate these challenges to the findings from the lesson observations (chapter 7).

Summary of the analysis of the interviews

Chapter 6 concerned the analysis of the interviews with seven participants. These seven Mathematical Literacy teachers participated in the study through semi structured interviews of 40 to 60 min (the criteria for selection are described in Chapter 4). The responses were analysed by using 5 categories. The focus question was: What are teachers' experiences and interpretations of the intended Mathematical Literacy? The key findings are presented below:

Description of Mathematical Literacy

The study shows that teachers described Mathematics Literacy in different ways. It was noted that the common key aspect of the description is 'real life/ everyday life'. The descriptions teachers gave resonate with Orientation 2 and Pedagogic Agenda 2. There is substantial evidence that suggests strong alignment with the DoE's definition of Mathematical Literacy which all the participants were familiar with.

Purpose of Mathematical Literacy

This study has shown that teachers have different opinions on the role and purpose of Mathematical Literacy. Some teachers contend that the purpose of Mathematical Literacy is fulfilled while some felt that the purpose/ aim of Mathematical Literacy is difficult to fulfil, in other words, it is too high (see Alfred's comments). Other teachers, for example Jabu, Susan and Khumalo saw the purpose of Mathematical Literacy as beyond the one presented in the official policy documents.

Policy documents of Mathematical Literacy

In this category I presented two important issues related to the policy documents. The first issue was the use of the policy documents. Three main views on the use of the policy documents were presented and discussed. The second issue was on the possible revision of the curriculum policy. The results show that the seven teachers had different views on the design and the nature of the Mathematical Literacy curriculum. The three main views were: (i) the curriculum is fine and there is no need to change it (Bongani and Myeza). The second view was that (ii) the curriculum is not fine, it has a lot of pure Mathematics topics that may confuse learners hence it must be modified to meet the level of the learners (Susan, Khumalo and Jabu). The third view was that (iii) the curriculum is not fine and as such it needs to be improved by enriching it with more Mathematics topics so that learners will be equipped with the basic skills of mathematics to solve problems (Alfred).

Teaching of Mathematical Literacy

In this category I presented teachers' views of Mathematical Literacy teachers on how they teach Mathematical Literacy in Grades 10-12. The results revealed a number of aspects related to the teaching and learning of Mathematical Literacy. These aspects relate to the teaching approach and strategies. There was substantial evidence suggesting that most teachers say they present Mathematical Literacy lessons which are context driven and or content and context driven (Agendas 1 and 2). From the analysis, there is much evidence to suggest weak framing and weak classification in the teaching and learning of Mathematical Literacy. Competence pedagogic models are foregrounded by seven participants. The analysis revealed that only one teacher (Alfred) states that he presents lessons that are content driven (Agendas 3 and 4).

The analysis further revealed that teachers say they have a number of creative and innovative methods of teaching Mathematical Literacy. These methods include, but are not limited to: cooperative teaching, team teaching, project based teaching, experiential teaching and learning, motivation and other constructivist approaches.

Challenges in the Mathematical Literacy curriculum

In this category I presented different challenges experienced by Mathematical Literacy teachers in implementing the Mathematical Literacy curriculum. Eleven different challenges that teachers raised in interviews were discussed and presented in Table 44. These eleven challenges are closely connected such that challenges influence each other. For example, a negative attitude of the learners towards Mathematical Literacy (challenge 1) affects participation in class (challenge 9). This affects the teaching strategy (challenge 8) and this affects the pace at which the lessons are presented (challenge 11).

Learner participation in Mathematical Literacy

While the focus of the study was on the teachers and not the learners particularly, it was found from the analysis of the teachers' responses that learner participation is key to the nature and approach in which Mathematical Literacy is implemented. The study revealed that there is a general problem across schools with regard to the participation of the learners in Mathematical Literacy classrooms. Common issues raised by all teachers related to the: participation in class, the content gap between Grade 9 and 10, negative attitudes, and the language of teaching and learning.

Content knowledge

The study revealed that there are teachers who believe a strong Mathematics education background is necessary. They state that a Mathematical Literacy teacher must have a strong mathematics content knowledge in order to be successful in teaching Mathematical Literacy. These teachers argue that their Mathematics education background makes them to teach Mathematical Literacy better (e.g. Jabu, Susan and Myeza). On the other hand, those teachers who do not have a strong Mathematics education background (e.g. Khumalo) do not state that content knowledge of mathematics is essential for a Mathematical Literacy teacher.

Specific topics in Mathematical Literacy

The results show that some teachers are unhappy with certain Mathematics topics that appear in the curriculum and feel that these topics, such as trigonometry, linear programming, and other related topics are not necessary in the Mathematical Literacy curriculum. Other teachers, particularly those with an education Mathematics background, contend that Mathematical Literacy should be enriched with some content topics such as trigonometry topics.

Some of the specific topics mentioned frequently by teachers as particularly challenging are in LO 3. Measurements and shapes were identified as challenging topics for learners to cope with across Grades 10 – 12. Topics related to map work were also identified as challenging to the learners (Susan, Jabu, and Khumalo).

Teacher professional development and support

The analysis shows that there is a close relationship between the teacher's professional curriculum understanding or experience and the implementation of the curriculum. Most of the teachers felt that the department of education is doing little to support them in order to implement the curriculum. Some believe that they need someone from DoE to support them (Bongani), while others feel that they can support themselves (Susan) and others feel they can support others since they have a good Mathematics education background (Alfred and Jabu).

It was established that the support that the DoE had provided for the teachers focused on curriculum issues such as NCS with little emphasis on content knowledge. Alfred argued that teacher support should rather focus on mathematics content knowledge because some teachers lack mathematics content knowledge.

Conclusion

In conclusion, analysis has revealed that teachers have diverse views on what counts as valid Mathematical Literacy knowledge and valid transmission of such knowledge. Some teachers had views that agreed with others; but teachers also had divergent views from others on interpretations of the intended Mathematical Literacy curriculum. Data also suggested diverse pedagogical approaches although most teachers favour Pedagogic Agenda 2 in their responses. In the third phase of data analysis, where I report on classroom observations I discuss the implication of diverse interpretations of intended curriculum.

In the next chapter I present the analysis of the final phase of data collection. This phase involves analyses of four lessons observed with two of the Mathematical Literacy teachers who were interviewed, namely, Khumalo and Alfred.

CHAPTER 7

ANALYSIS OF LESSON OBSERVATIONS:

CASE STUDY OF CLASSROOM IMPLEMENTATION

Introduction

The previous chapter presented an analysis of the interviews, to determine the teachers' interpretations and understanding of the intended Mathematical Literacy curriculum. Thus I attempted to address critical question 1, and partially, critical questions 2 and 3. Subsequent to the interviews discussed in the previous chapter, that is Phase 2, the teachers interviewed were invited to participate in the last phase of data collection which involved lesson observation. The target was to have three participants across the following criteria: i) a teacher who had no Mathematics education background but who had undergone formal training in Mathematical Literacy; ii) a teacher who had a Mathematics education background; and iii) a teacher who had both Mathematics education background and who had received Mathematical Literacy training. Khumalo and Alfred met criteria (i) and (ii) and volunteered to participate.

Four consecutive lessons were observed with each participant, followed by teacher reflection on each lesson. For the purpose of this analysis four lessons (two from each participant) were analysed. The two lessons from each participant were selected on the bases of representative approaches used by the individual teachers. In analysing these four lessons the following key areas were considered:

(a) Introduction of the lesson.
(b) How the relationship between mathematical content and context unfolds in the lesson.

(c) Nature of learner participation and engagement during the lesson.
(d) Teacher responses and feedback to learner's questions and responses.

Issues highlighted in the previous chapters, which related to these teachers' comments on curriculum, resources and learner participation were also considered in the analysis of the lessons.

Following now is an analysis of the lessons observed in two Grade 11 classes in two different schools. This was particularly important in that it provided observational (rather than articulated) data on how Mathematical Literacy is implemented by two case study teachers. It also provided the opportunity to relate what teachers said about Mathematical Literacy with how they teach it (i.e. implemented classroom practice). This phase is presented in two case studies: Part 1 Khumalo's lessons and Part 2 Alfred's lessons. I conclude this chapter by discussing the similarities and differences between the two sets of lessons observed, and relating these to data and analyses in the previous chapters.

After considering the issues identified above, I draw from Graven and Venkatakrishnan's (2007) spectrum of pedagogic agendas as a tool for analysis, as described in chapter 3. I also draw from Bernstein's pedagogic models as a theoretical framework. I present the lesson description and teacher reflection. After the descriptions and teacher reflections of the two lessons of each teacher have been presented I present a critical analysis of the lessons in relation to my third critical question.

PART 1: KHUMALO'S LESSONS

Lesson 1 – Probability

Lesson description 1

I first present the description of the lesson by highlighting the context of the classroom, followed by the four important aspects of the lesson presented in the introduction to this chapter, namely introduction, content and context, learner participation and teachers' responses and/or feedback.

Context of the classroom

This lesson was presented on 13 October 2010 in a Grade 11 Mathematical Literacy class at a township school. The class had 24 learners, 7 boys and 17 girls. The class started with 22 learners, two more learners came almost 15 minutes after the lesson had started. There were only four Mathematical Literacy textbooks available in class for the use of the 24 learners. There were only two calculators shared by the whole class. It is important to note that the class is known as the 'Geography class' – as the learners doing Mathematical Literacy also do Geography, History, Life Sciences, Life Orientation and two official languages (IsiXhosa and English). The learners were arranged into groups of 3 or 4. The lesson started at 8h00 and ended at 9h00.

How the lesson was introduced

The lesson was introduced by reviewing the previous lesson for 3 to 5 minutes. The previous lesson was based on Learning Outcome (LO) 4, and Data Handling. The teacher then wrote on the board '*Probability* '.

Khumalo: *Today we will continue to deal with LO 4, but our focus will be on 'Probability'.*

All learners were quiet and appeared to be listening. The teacher then drew the following diagrams on the board, as shown below in Figure 6.

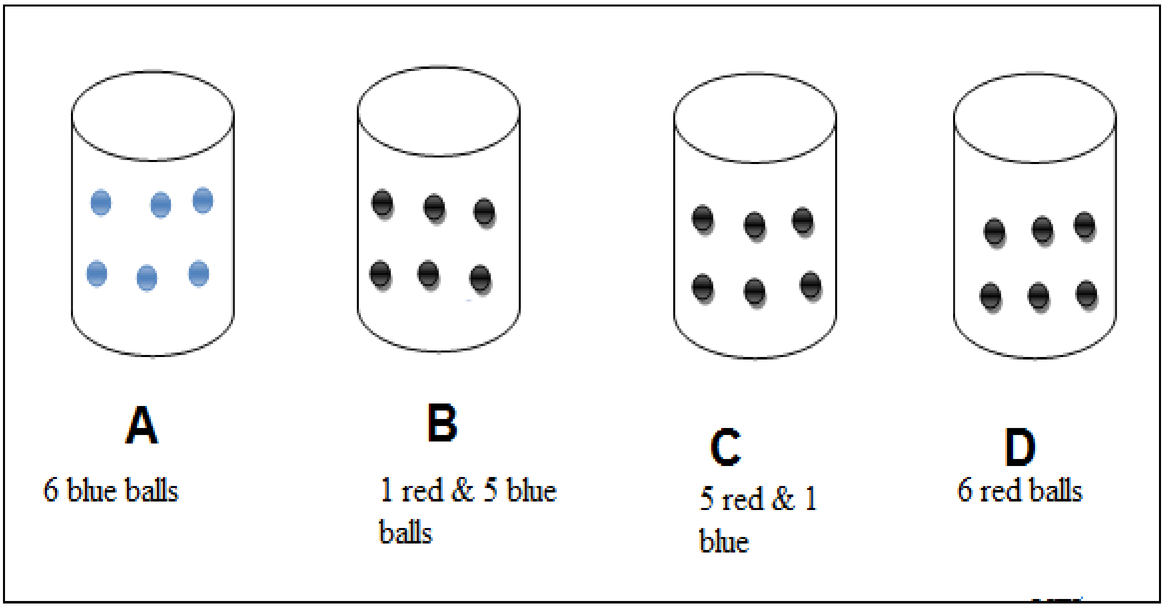


Figure 6: Probabilities

In an attempt to introduce the concept of probability, Khumalo asked the class the following questions:

Excerpt 1 : Khumalo's lesson 1

Khumalo	: Is it possible to get a red ball in **A**?
Class (all)	: no, it is impossible
Khumalo	: Is it possible to pick a red ball in **B**? Are there any chances?
Learner 1	: Possible, sir!
Learner 2	: very few chances!
Khumalo	: What about in **C**? Is there any chance to pick a red ball?
Class (all)	: It is possible!
Class (all)	: There are more chances
Khumalo	: Is it possible to pick up a red ball in **D**?
Class (all)	: Yes, sir it is possible. They are all red.

Mr Khumalo introduced a probability scale. He drew the following diagram on the board as shown below:

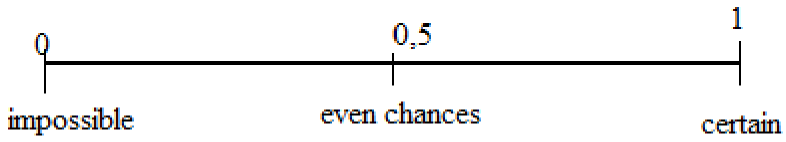


Figure 7: Probability scale

After introducing the probability scale, Khumalo introduced percentage (%) on the scale that 0 represents 0%, 0.5 represents 50% and 1 represents 100%. He then gave them a class exercise taken from the textbook. It was noted that there were only four of these textbooks available in a class of 24 learners. The learners were required to share books, and work on the class exercise as a group. See the exercise below:

Class activity 1: Probability scale

Copy the percentage probability line: Fill in probabilities for the following on the number line:

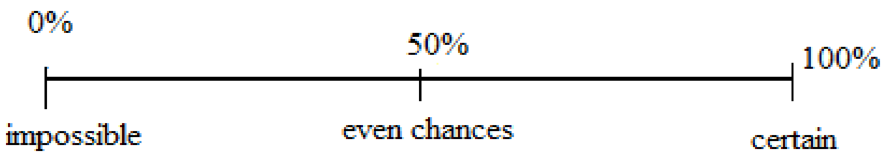
(a) It will get dark tonight

(b) It will rain this month

(c) This year there will be a drought

(d) A coin will fall on heads when tossed

(e) It will snow in Polokwane



Source*: Understanding Mathematical Literacy* (p.255.)

Role of context in the lesson

In this lesson a variety of contexts were used. In the introduction, the blue and red balls were used to explore the concept of probability. It was noted that in number

(e) above, the learners were confused by the context used. Learners did not know where Polokwane was, and they did not have any idea of the weather patterns in Polokwane. There was also confusion about question (c) if there will be ‘a drought’. Further confusion was caused by the time of the year in which this exercise was done. I indicated earlier that this classroom observation was conducted in October.

How the relationship between mathematical content and context unfolded in the lesson

The lesson was predominantly context driven, which resonates with Pedagogic Agenda 2. Little mathematics content was dealt with in the first part of the lesson. It was noted that the use of context in the first example of balls, led to the understanding of probability key concepts, such as *impossible*, *even chances* and *certain*. These concepts lead to some basic mathematics concepts such as 50% chances = 0.5 (introduction of % and decimals). In the last part of the lesson there was a shift in focus from context-based to content-driven agendas. The last part of the lesson was driven by both context and content (Pedagogic Agenda 2). The move to content in the last part was stimulated by learners’ misconceptions about decimals. The learners were unable to determine which the bigger number was between, for example: 3.12 and 3. 9. To address these misconceptions the teacher gave the learners a second activity:

Class activity 2:
Arrange the following numbers in ascending order:
0.2458; 0.9; 0.679 and 0.8

Activity 2 shifted the pedagogic agenda from Pedagogic Agenda 2 to Agendas 3 and 4. That is a focus on content for both the sake of content, and for the purpose of later application to context.

Below I present an analysis of learners’ participation and engagement, including responses to both class activities.

Nature of learner participation and engagement

The learner participation in the class was very engaging. Learners were not only responding to the teacher's questions but were also asking questions. Resources such as textbooks and calculators were very limited (only 4 textbooks and two calculators in a class of 24 learners) and this affected learners' maximum participation when textbook activities were given. While the context of Polokwane was unknown, it also provided an opportunity for discussion and learning about this 'unknown' place. There was a problem in dealing with decimals, like allocating 0, 3; 0, 19 and 0, 8 on the probability scale. Most learners thought 0, 7 < 0, 12 by considering only 7 and 12.

Nature of teacher questioning and feedback to learners

In the first part of the lesson the teacher was very dominant. As the lesson progressed the learners started to dominate the lesson by engaging in answering questions and also asking questions. It was noted that the teacher was teaching directly from the textbook page by page, except the first example which was used in the introduction (see Figure 6).

The teacher asked questions which were frequently derived directly from the textbook, but some questions he created himself – see in Excerpt 1. The teacher was able to ask and probe where he noticed there were misconceptions, e.g. **Class activity 2**. This activity was given by the teacher in order to correct misconceptions. The feedback given to learners was very informative and relevant to learners.

Teacher reflection after lesson 1

After the lesson, Khumalo was excited about his lesson – he said he felt very confident that the lesson went well and according to his plan. The following excerpt captures his reflection after lesson 1.

Excerpt 2 below presents Khumalo's reflection on lesson 1:

Excerpt 2 : Khumalo's reflection on lesson 1

Themba: How did your lesson go?

Khumalo: Well, it went well...and I was so happy. The learners were participating.

Themba: Was there anything that did not go according to your plan?

Khumalo: According to my plan, everything was okay except and my learners were actively participating throughout the lesson. I was surprised that the learners did not have basic understanding of simple concepts like probably, certainly, etc.

Themba: There was a problem with the question about "Polokwane". Your learners did not know what and where is Polokwane. What is your view on the use of context such as this one?

Khumalo: My understanding is that Mathematical Literacy should integrate all subjects from commerce, science and humanities. This problem integrates Geography and these learners are doing Geography, they should have seen 'Polokwane' on the map. I am surprised that they did not have any idea of where is Polokwane.

Themba: Do you think such contexts should be avoided in Mathematical Literacy so that learners will not be confused by contexts?

Khumalo: No. In attempt to create future citizen – we need to expand their scope. This includes exposing learner to a variety of Contexts. I wanted to achieve the following objectives: (i) introduce the learners to probability; (ii) provide learners with general understanding before introducing them to advanced level of 'probability' and to provide opportunity for the learners to engage with a variety of contexts and expose them to examination type exercises.

His reflection foregrounds his Pedagogic Agenda 2 and is consistent with his interview data, although he did not specifically reflect on his shift to Pedagogic Agendas 3 and 4, when learners did not know decimals. In the analysis section I refer to this excerpt in my analysis.

Below I present Khumalo's second lesson:

Khumalo's Lesson 2 – Surveys

I present this lesson in the same manner in which I presented the first lesson. I present the lesson description followed by the teacher's reflection.

Lesson description 2

Below I describe the lesson by first presenting the context of the lesson, followed by the key aspects of the lesson.

Context of the classroom

This lesson was presented on the 14th October 2010. This was the same Grade 11 Mathematical Literacy class as described in Lesson 1. In lesson 2, 27 learners were present, of which 8 were boys and 19 girls. The learners were again arranged into groups of 3 or 4. The lesson followed the pattern of lesson 1 presented above, and started at 8h00 and ended at 9h00.

Introduction to the lesson

The teacher introduced the lesson by reviewing the previous lesson on 'Probability', through asking a few questions as follows in excerpt 3:

Excerpt 3 : Khumalo's lesson 2

Khumalo	: What did we learn yesterday about Probability?
Learner 1	: Probability scale
Learner 2	: 50 % chances and 100 % chances and…
Khumalo	: What did we say about probability scale?
Learner 3	: It has 0; 0,5 and 1….

The teacher continued to summarise the previous lesson on 'Probability'. He wrote on the board 'Survey'. He then introduced 'population and sample'. He asked the learners about these key concepts and found that they knew little about these concepts. After explaining these concepts he then directed the learners to the activity from the textbook, he wrote notes on the board and drew a table since most learners did not have a textbook.

Notes**:** *A group of three learners conducted a transport survey at their school. They asked a sample of learners how they got to school. They reported the following answers to the Question:*

What is your main form of transport to and from school?

	Thando	**Jake**	**Elizabeth**
On foot	4	2	7
Car	6	7	10
Taxi	5	24	40
Bus	5	8	16
Train (and walk)	10	19	37
Total asked	**30**	**60**	**110**

(Source: *Understanding Mathematical Literacy* (p.256.))

The teacher then drew another table on the board from the same textbook and page:

	Frequency	**Total in survey**	**Relative frequency**
Thando	5	30	$\frac{5}{30}$ = 0, 1666 = 0 , 167
Jake	24	60	
Elizabeth	40	110	
Total			

(Source: *Understanding Mathematical Literacy* (p.256.))

The teacher explained how to calculate relative frequency by writing on the board $\frac{5}{30}$ and used a calculator to get 0.167. He gave the learners the following activity to do in their respective groups:

Class activity 3

(a) Copy the above table and find the relative frequency of learners who came to school by taxi in each of the three individual surveys.

(b) Find the total frequency for all three groups and work out the relative frequency of all learners who came to school by taxi, in this survey.

(c) Draw up tables like the one above to show the frequency of learners who:

(i) Walk to school

(ii) Travel to school by bus

(iii) Travel to school by train

(iv) Travel to school by car.

(Source: *Understanding Mathematical Literacy* (p.256.))

These activities were dealt with in groups until the end of the lesson. Groups did not report back their solutions; instead the teacher went from group to group to monitor the progress and give feedback to the groups.

Role of context in the lesson

The real life contexts that were used in the lesson were forms of transport (bus, taxi, car and train). It was observed that the learners were making sense of the contexts used in the lesson. They seemed able to understand the nature of the context of the activity since there were no questions asked about the context. This is probably because some of the learners in class used taxis, buses or trains or walked to school.

How the relationship between mathematical content and context unfolded in the lesson.

As indicated above, the contexts in the lesson seemed to help learners access the nature of the activity, as they were related to their daily life. It was noted that there were mathematical ideas, content knowledge (frequencies) that were learnt while they were engaged with real life contexts. The mathematical content knowledge that was involved in the lesson was basic mathematics calculations of relative frequency.

This included working with fractions and rounding off numbers to a specific decimal place.

Nature of learner participation and engagement

For almost 40 minutes the learners worked on class exercises. It was observed that, as much as the learners were actively involved in class activities, they were also having problems in calculating relative frequency, particularly in rounding off numbers to a required decimal place. It was observed that the learners were not familiar with the use of calculators. As explained in lesson 1, there were only two calculators available, hence participation was affected.

Nature of teacher's role in the lesson, and nature of teacher questioning

The teacher was responsible for introducing the lesson and also for giving guidance to the learners on the tasks. No other questions were asked by the teacher, except those from the textbook.

Teacher reflection after lesson 2

In the lesson reflection Khumalo again foregrounded Pedagogic Agenda 2 that has real life contexts and mathematics frequency tables interconnected.

Excerpt 4 : Khumalo's reflection on lesson 2

> Themba: How did you see your lesson?
> Khumalo: My lesson was okay. I was happy with the way *learners were participating.*
> Themba: What is it that you wanted to achieve in this lesson?
> Khumalo: You see, in *real life* the learners may find themselves exposed to tables, especially when they read newspapers. I have managed to expose them to information presented in tables, and now I am sure they can be in a better position to *interpret it*.
> Themba: I have noticed that you are drawing most of your activities from the book. Are you only using this specific book?

Khumalo: No sir, I normally use three *different kinds of textbooks*. I compare these books and choose one per specific topic. For LO4, Data handling, this book is good.
Themba: How is this lesson similar to or different from other Mathematical Literacy lessons you have taught?
Khumalo: As you have seen yesterday I was introducing the probability, today is the continuation of the previous

I have presented the detailed description of two lessons; I now present an analysis of these two selected lessons.

Analysis of Khumalo's lessons

In analysing the two lessons described above I draw from the theoretical frameworks and analytical tools described in chapters 2 and 4. The key issues presented in the previous analysis chapters, such as curriculum and pedagogy related issues, resources, learner participation and content knowledge, were considered in the analysis.

Curriculum and pedagogy related issues

In Chapter 6 I presented views and challenges related to teaching Mathematical Literacy, and amongst those issues the curriculum was mentioned. In Bernstein's notion of a message system curriculum defines what counts as valid knowledge, and pedagogy is concerned with the transmission of knowledge. The two Bernstein's message systems are relevant in this study and provide a framework for my analysis that follows.

For both lessons Khumalo presented a real life related lesson which integrates content and contexts - this kind of lesson is associated with an integrated curriculum type with a weak classification of knowledge. In Khumalo's reflection it was established that, though the learners had a problem with not knowing the "*Polokwane*" context, Khumalo took it positively (an opportunity for learning about this context). From the excerpts presented above, it is evident that Khumalo contends that contexts used in Mathematical Literacy should not necessarily be related to local contexts and situations, but should include national and international contexts that will enrich learners' knowledge. This will broaden their general knowledge of the global community. In this regard he cited the issue of world currencies – dollars, pounds etc. From Excerpt 4; it was established that Khumalo's lesson was driven by Pedagogic Agendas 1 & 2. The pedagogic models visible in the lesson were promoting active learner participation, thus competence models were more dominant than performance models. Further discussion is presented in chapter 8.

Resources

In the previous chapter the role of resources in Mathematical Literacy was raised by most teachers. Generally, learning and teaching support materials (LTSM) play a significant role in all subjects. Mathematical Literacy, as a subject driven by real life context, demands a variety of resources. Three out of seven teachers identified LTSM as one of the challenges in teaching Mathematical Literacy (see Table 44). For both lessons presented only two key LTSM resources were used, namely, textbooks and calculators.

With respect to textbooks only one textbook was used by Khumalo in these lessons. Even though, during the observation of the four lessons the teacher was using one textbook, the interview revealed that Khumalo also uses other textbooks for other topics.

Learner participation

Although, during the interview, 3 out of 7 teachers argued that learner participation in Mathematical Literacy was a challenge, in Khumalo's class it did not appear to be a challenge. It was found that active learner participation was prominent in class, and according to Khumalo, that is an indicator of a successful lesson.

In the next section I present the analysis of Alfred's lessons.

PART 2: ALFRED'S LESSONS

I now present two of Alfred's lessons. Again I use the same approach as I used in part 1.

Lesson 1 – Business Mathematics

Lesson description

Context of the classroom

This lesson was presented on the 13th October 2010. At the school, in a Grade 11 Mathematical Literacy class, there were 38 learners; 19 boys and 19 girls. The seating arrangement was that of an ordinary classroom set up. The subject grouping consisted of Mathematical Literacy, Geography, History, Agricultural Science, Life Orientation, IsiXhosa and English.

Introduction of the lesson

The teacher introduced the lesson by reviewing key concepts dealt with in the previous lesson. These concepts are presented below in Excerpt 1.

Excerpt 5 : Alfred's lesson 1

Alfred	: What is break-even point?
Learner 1	: It is when income = expenses
Alfred	: What about profit?
Learner 2	: It is when income > expenses.

The teacher then explained the concepts of fixed costs and variable costs. He then gave learners a class activity from a worksheet that was distributed to all learners. He requested a volunteer to lead class discussion. He chose a boy who was showing interest and willingness to lead the discussion. The task was, as shown below, about the monthly expenses for Poncho's Portable Phones.

Class activity 1

Poncho's Portable Phones: income and expenditure

Item	Price
Rent	R5 100,00
Salaries	3 x R 3 4 20, 00
Coffee and tea	R500, 00
Stationery	R975, 00
Staff clothing	2 x R156, 00
Petrol	R431, 72
Cleaning supplies	R87, 23
Telephone	R622, 97

a) Determine which expenses are fixed and which are variable.

b) Calculate the total amount that Poncho's Portable Phones spends on business expenses.

The learner leading the discussion led the class in answering questions 1 (a) and (b). The teacher took a back seat, and allowed the learners to discuss the answers. The lead learner was strong and confident and was able to control the learners, even those who were out of order. He did not accept any answer – unless the learner who was giving the answer gave reasons. There was a long and interesting argument about the price for 'telephone', as to whether it is a fixed or a variable cost. Some groups were saying 'the rent for the telephone is fixed' while others were saying 'the telephone bills vary from month to month, depending on how much you have used the phone'. The teacher did not enter into the discussion until they had completed Activity 1.

The teacher gave the class another activity, and requested the same learner to lead the discussion. This task was taken from the worksheet that was distributed at the beginning of the lesson.

Class activity 2

Income and expenditure (continued)

Themba is a street vendor who sells vegetables that he grows in his garden. The table below contains a list of Themba's monthly income and expenses.

Item	Price
Vegetable seeds	R12,32
Compost/fertilizers	R25,00
Water	R18,75
Money from vegetables sales	R103,28
Rental of stall space	R35,00

a) Decide which items in the table are sources of income and which are expenses.
b) How much does Themba spend on expenses, and how much does he earn in income?
c) Does Themba make a profit from selling vegetables, in this particular month? If so how much does he make?
d) Use the formula profit margin = margin = $profit\ margin = \frac{income - expenses}{expenses}\ x\ 100\%$ to calculate the profit margin that Themba makes from the sale of his vegetables.

Role of context in the lesson

The context used was related to finance, income and expenditure. In both exercises the main focus was on contexts.

How the relationship between mathematical content and context unfold in the lesson

The real life context was overriding in the lesson.

Nature of learner participation and engagement

The learners were actively involved in answering all the questions that they were given by the teacher. They argued about some aspects of the answers.

Nature of teacher's role in the lesson

The teacher was responsible for guiding the learners as they were engaged with various class activities. He gave responses and feedback to learners' questions and responses.

Teacher reflection after lesson 1

After the lesson was completed, Alfred was requested to reflect on his lesson. The following key questions were used as a guide: How is this lesson similar to, or different from, other ML lessons you have taught? Give some key reflections or insights gained during the lesson. Alfred foregrounded the importance of discussion and debate in his lesson reflection. This is consistent with his responses during the interview in the previous chapter.

Excerpt 6 : Alfred's reflection on lesson 1

Themba : How was your lesson?

Alfred : It was great.

Themba : What did you achieve in this lesson?

Alfred : In fact this is the continuation of the previous lesson. I wanted my learners to manage finances and budgets.

Themba : I have noted that you gave more opportunities to the learners to dominate the lesson. Is this your approach in teaching Mathematical Literacy?

Alfred : It depends on the nature of the activity. If I see that the learners can handle it. I give them that opportunity. I allow more interaction amongst them. I promote effective communication and encourage or promote classroom discussions and debates.

It is important to note that, from this excerpt above, Alfred is consistent in his views expressed during the interview, on how he teaches Mathematical Literacy. In the previous chapter (6) Alfred emphasised communication, classroom discussion and debate.

Below I present lesson 2.

Lesson 2 – Linear equation

Lesson description 3

Context of the classroom

This was the second lesson taught by Alfred, which I observed on the *14th October 2010*. This followed a lesson on income and expenditure. The lesson was conducted with the same class observed the previous day. There was no change in learner attendance or sitting arrangements.

How the lesson was introduced

There was no link to the previous lesson, taught the previous day. Alfred introduced the lesson, writing on the board ‘linear graphs’. He explained a few concepts, such as ‘linear’ and ‘line segment’. He asked the learners if they still remembered methods which are used to solve a linear equation. After interacting with learners the following methods were mentioned:

- Table method
- Intercept method.

Class activity 3

Alfred wrote the following equation: $y = 2x - 5$ and requested one learner to come forward and lead the discussion. One learner stood up and volunteered to solve the linear equation with the class. The instruction was to draw a linear graph, but first to solve the equation using different methods.

The lesson continued until the equation was solved, and the graph was drawn accordingly.

Role of context in the lesson

For the entire lesson there was no real life context, except a pure mathematics problem thus foregrounding Pedagogic Agenda 4.

The relationship between mathematical content and context unfolded in the lesson

Only mathematics content knowledge was dealt with in the lesson and the focus was on achieving mathematics content knowledge without application to real life.

Nature of learner participation and engagement

There was a high level of learner participation throughout the lesson. The learners were actively involved for almost 95% of the lesson, as evidenced by their writing and discussion. The teacher provided guidance only when it was necessary.

Nature of teacher's role in the lesson

The teacher's role was to facilitate the start of the lesson. After that the rest of the work was done by the learners themselves.

Teacher responses and feedback to learners' questions and responses

It was interesting to note that the learners did not ask the teacher any questions. All questions were directed at each other, and they tried by various means to answer all the questions, while the teacher observed the learners working on the mathematical problem that he had given them.

Teacher reflection after lesson 2

During the teacher reflection session I was interested in finding out how the teacher felt about the whole lesson, since it was purely mathematics content based. The extract below reflects the conversation with Alfred shortly after the lesson.

Excerpt 7 : Alfred's reflection on lesson 2

Themba: *How did your lesson go?*

Alfred : Well, I can say it went well.

Themba: *What do you think you have achieved by presenting this lesson?*

Alfred: Now learners know types of linear graphs and different methods of determining it.

Themba: *Your lesson focused on the content of mathematics with no reference to real life. Did you have similar lessons in the past?*

Alfred: Yes I did. You need content knowledge before the contexts but not at the large extent.

Themba: *Is this the way you approach the subject?*

Alfred : Yes. I teach them content and relate it to the real life situations

Themba: *So, in the examinations you set mathematics content as well?*

Alfred : Most assessment tasks are based on application of content in real life. I have a very limited content knowledge in assessment.

Themba: *How did you see the participation from your learners?*

Alfred: They always participate. I always create an environment for flow of communication.

When I present the analysis of lessons I will refer to this excerpt.

Analysis of Alfred's lessons

Having presented the description of the two lessons, and Alfred's reflections, I now present the analysis of these two lessons. Here again, I will pay more attention to the key aspects identified in the introduction of this chapter. These are related to curriculum and pedagogy, resources and learner participation.

Curriculum and pedagogy

The two lessons described above were very different in most aspects e.g. content and focus. There are, however, similar teaching styles used in both lessons. Both types of curricula, as described by Bernstein, were represented in the two lessons. Lesson 1 represented an integrated type, while lesson 2 represented a collection type. Lesson 1 was driven by both content and contexts (Pedagogic Agendas 1 & 2) while Lesson 2 was mainly content driven (Pedagogic Agendas 3 & 4) with no application or reference to real life contexts. The content that was presented in lesson one was weakly classified, while the content presented in lesson 2 was strongly classified. This is consistent with Alfred's interview presented in Chapter 6.

It was shown in Part 1 of Chapter 5 that 68.3% of the 60 teachers agree with the statement that learners must be taught content then contexts. Furthermore, 58.4% of the 60 teachers agreed with the statement that sometimes in Mathematical Literacy it is important to teach only mathematics content. In Chapter 6 Alfred argued that basic mathematics concepts must be taught without necessarily relating them to real life contexts. The analysis of lesson 2 concurs with Alfred's stated Pedagogic Agendas and Orientations in the previous chapters. In excerpt 7, Alfred explains why he taught content only without any reference to context. His explanation is consistent with the responses he gave during the interviews in chapter 6.

Resources

In both lessons there were no evident problems associated with resources. All learners were provided with copies of worksheets. These worksheets were compiled from different textbooks. While in the previous chapter resources were identified as a challenge in Mathematical Literacy, in these two lessons this problem did not emerge.

Learner participation

In both lessons learners were actively involved, irrespective of the nature of the content they were dealing with. Neither mathematics content nor context seemed to negatively impact on learner participation. This finding provides a different view from the general view shared by other teachers which assumes that more content knowledge in Mathematical Literacy would affect learners' active participation.

Summary of findings of lesson observations

In this phase I have presented an analysis of four lessons, across two teachers in different schools. Analysis of these lessons has revealed that the two teachers have mixed approaches to teaching Mathematical Literacy. There was consistency in the lessons presented by Mr Khumalo. It is possible to explain his implementation of the Mathematical Literacy curriculum as in Pedagogic Agendas 1 and 2. On the other hand, Alfred had different approaches, particularly when coming to the issue of contexts and content. His first lesson resembled Agendas 1 and 2 and his second lesson resembled Pedagogic Agendas 3 and 4. Pedagogic Agendas observed were largely consistent with what these teachers had stated in earlier interviews about the purpose and teaching of Mathematical Literacy. Table 45 below presents a summary of classroom observation notes:

Table 45: Summary of classroom observation notes

Aspect of the lesson	Khumalo	Alfred
Introduction of the lessons	In both lessons Khumalo introduced the lesson by indicating to learners the purpose of the lesson. He continued to guide the learners for further classroom discussions. He always linked each lesson to the previous lesson(s).	Alfred introduced the lessons- He allowed learners to continue with classroom discussions.

Teaching strategy	In all lessons observed a teacher-centred approach and activity-based teaching strategies were used with a lot of guidance.	A learner-centred approach was used with activity-based teaching in both lessons. Alfred mentioned cooperative teaching as a strategy.
Focus and emphasis	The lessons focused on contexts and put more emphasis on real life contexts with little emphasis on mathematics content knowledge. Khumalo emphasised that learners need to engage with real life contexts.	Varies lesson by lesson. Lesson 1 was context and content focused while lesson 2 was strictly content based. Alfred emphasised that learners need some basic mathematics first, before they are exposed to contexts.
Resources	Khumalo relied on specific textbooks - for the lessons observed; only one kind textbook was used by both teacher and learners.	He uses a variety of textbooks that are rich in basic mathematics content knowledge. He developed worksheets from various textbooks for all learners.
Driving agenda	In both lessons Pedagogic Agendas 1 and 2 were foregrounded. There was more emphasis on real life contexts in the lessons observed.	All agendas visible (Pedagogic Agendas 1 - 4). Lesson 1 forgrounded agendas 1 and 2 and lesson 2 forgrounded agendas 3 and 4. Lesson 1 addressed both content and contexts while lesson 2 focused on content only.
Orientations	In both lessons only Orientations 1 and 2 were foregrounded. More emphasis was on contexts.	All orientations were visible (Orientations 1-4). Lesson 1 was dominated with Orientations 1 and 2 and lesson 2 with Orientations 3 and 4.
Assessment	Assessment was based on the textbook provided. All activities were drawn directly from the textbook.	Assessment was based on the worksheets provided drawn from various sources.
Feedback	Feedback was given to individual groups; Khumalo was actively involved in giving solutions.	Feedback was given to the whole class.
Pedagogic models	In all lessons which were analysed, competence models were more foregrounded.	The lessons were moving between performance and competence models, e.g. lesson 1 (on business finance) was more aligned to competence model and lesson 2 (on linear equation) was more aligned to performance model.

Summary of the key findings from the analysis of lesson observations

Chapter 7 presented the case study of two Mathematical Literacy teachers' lessons. Data was collected through the classroom lesson observations presented in Chapter 7. The focus question was on how teachers implement or teach Mathematical Literacy. This focus question was addressing critical question 2 of the study. The four lessons that were analysed provided insight into how the two teachers teach Mathematical Literacy. Besides the nature of the content that was presented by the two teachers, it was evident how the teachers' Pedagogic Agendas and understanding of effective teaching and learning of ML play out in teaching.

Connections in the three phases of this study

Analysis of the three phases revealed some connections across phases. At this stage it is relevant to present visible connections amongst the three phases of data analysis. In doing so, I pay special attention to findings related to the three aspects, namely; main idea, common idea and contradicting ideas. These aspects are presented in table 46 below:

Table 46: The connections and common findings in the three phases of data analysis

	Phase1 **questionnaire**	**Phase 2** **Interviews**	**Phase 3** **Lesson observations**
Main idea and key findings	General view about what Mathematical Literacy is, and how it should be implemented. ML is a real life subject	Experiences in teaching Mathematical Literacy, successes and challenges. The idea that ML is a real life subject was shared	How Mathematical Literacy is implemented at classroom level.

Common idea	Positive and negative experiences in implementing the Mathematical Literacy curriculum	Some of the positive experiences and negative experiences shared in Phase 1 are similar to the those shared in Phase 2	The first lessons presented by both teachers were driven mainly by real life contexts, while the second lesson presented by Alfred was purely mathematics content based.
Contradicting ideas	Teaching Mathematical Literacy is easy, while others say it is difficult.	Policies and specific topics to be included in Mathematical Literacy.	The second lesson presented by one of the two teachers (Alfred) did not include any examples of real life application in the content presented. The lesson was driven mainly by mathematics content knowledge, with no reference to a real life situation. In the lesson presented by the other teacher, although context based, it did not help the learners to solve the problem because the context was unfamiliar to them.

The three Chapters on data analysis have provided important information on: (i) how teachers interpret and implement the Mathematical Literacy curriculum. It has also provided some explanations of (ii) what influences teachers' interpretations, and implementation of the intended curriculum. Finally, it has provided information on (iii) connections between the intended and the implemented curriculum – as well as deviations from the intended in the implemented Mathematical Literacy curriculum.

Conclusion

This chapter and the previous chapters on data analysis revealed important issues for further discussion. These key issues for discussion, arising from data analysis are: (i) teacher knowledge; (ii) teaching and learning Mathematical Literacy; (iii) recontextualising the curriculum; (iv) mathematisation in Mathematical Literacy; (v) contexts in Mathematical Literacy. In the next chapter I discuss results, and these issues, insofar as they relate to the research questions and findings.

CHAPTER 8

DISCUSSION OF RESULTS

Introduction

In the previous chapters, the three phases of data analysis comprising questionnaires, interviews and lesson observation analysis have been presented. In this chapter I present the key findings of the analysis of the three phases and discuss these findings in detail. This chapter is divided into two parts. These are outlined as follows:

In Part 1, I discuss the results in relation to critical research questions. This study tries to understand teachers' understanding of the intended and implemented Mathematical Literacy curriculum. The three critical research questions were formulated to help capture teachers' understandings and experiences (see Chapter 1 for detail).

In Part 2 I discuss the issues that arise from the results. The results from the analysis of questionnaires, interviews and lesson observations gave rise to the five issues for further discussions. These issues which are presented and discussed relate to the following: teacher knowledge, teaching and learning Mathematical Literacy, Recontextualising the curriculum, Mathematisation in Mathematical Literacy and contexts in Mathematical Literacy.

PART 1: DISCUSSION OF RESULTS IN RELATION TO CRITICAL QUESTIONS

Critical question 1

What are teachers' interpretations of the intended Mathematical Literacy curriculum?

From the three data sources presented in Chapters 5 – 7, it was found that teachers have diverse interpretations of the intended Mathematical Literacy curriculum. The results show that the teachers tended to interpret, or make sense of, Mathematical Literacy by making a reference to Mathematics. Such references to mathematics include statements like: '*It is not a Standard Grade Mathematics* (T12)', '*a subject not abstract as Mathematics* (T41)' and "*a subject which provides a chance for learners who do not have the potential for mathematics* (T24)'. Overwhelmingly, in both Chapters 5 and 6, more than 90 % of the teachers agreed, or stated, that Mathematical Literacy *is a real life, context based, practical and enjoyable* subject. Analysis shows that there were mixed interpretations amongst teachers (chapter 6) on the content and/or curriculum policy of Mathematical Literacy. While teachers like Bongani and George said the curriculum policies and content contained in the curriculum are relevant and appropriate, others, such as Susan and Alfred, had a critical or selective view on the current policy documents, suggesting the curriculum be reviewed or modified to make it more responsive and relevant to real life.

Analysis shows that there are different groups of Mathematical Literacy teachers. The differences amongst these groups are education background and teaching experiences, before they were appointed to teach Mathematical Literacy. In this study the teachers with formal qualifications in Mathematics, who had also taught Mathematics before teaching Mathematical Literacy have different interpretations of the intended curriculum from those who do not have any formal qualifications in Mathematics and/or teaching experience of Mathematics (this was more evident in Chapter 6 although the small number of teachers interviewed means this cannot be generalised). Teachers with both Mathematics and Mathematical Literacy qualifications appeared to have more insight and understanding of the Mathematical Literacy curriculum, particularly in understanding the line between Mathematics and Mathematical Literacy.

The study found that teachers have different views on the curriculum policy of Mathematical Literacy. Some see it as a blueprint, a good and perfect document, while others see some gaps in the policy and suggest some possible adjustments to make it more meaningful and relevant.

Critical question 2

What are teachers' experiences of teaching Mathematical Literacy, and how do these experiences influence their practice and interpretation of the Mathematical Literacy curriculum?

This critical question has two aspects: (i) teachers' experiences of teaching Mathematical Literacy, and (ii) the influence of experiences in their practice, and their interpretation of Mathematical Literacy.

Teachers' experiences of teaching Mathematical Literacy

This study has found that teachers have mixed experiences of teaching Mathematical Literacy. They have both positive and negative experiences. The positive experiences are associated with successes and enjoyment in teaching Mathematical Literacy. The negative experiences were summarised in the challenges identified in Chapter 6. Some of these experiences were also presented in Chapter 5. The most common experiences are associated with the following: poor learner participation in class as a result of language and the absence of basic mathematics knowledge from the side of the learners, shortage of relevant textbooks, and lack of professional development support programmes. All these experiences were found to have a direct impact on teaching Mathematical Literacy. Some of the teachers, particularly those who were teaching mathematics before teaching Mathematical Literacy, found teaching Mathematical Literacy more rewarding and meaningful than teaching mathematics.

Influence of experiences on teachers' practices and interpretation

There is evidence to suggest that teachers' experiences influence their practice. This is attested to by the following comment by one of the respondents:

> Khumalo: For instance, you find yourself *going back to the traditional style where you stand in front of the class and just talk*, talk and talk. Even though we know that should not happen. We as teachers we suppose to guide the learners. This is because of the *lack of maximum participation* from the learners. You end up deliberating everything to the learners, asking questions.

From the data in the previous chapters, it is evident that teachers are influenced by the context (situation) and by learners' responses. From the analysis, the following factors were identified as having a great influence on teachers' practices: learners' attitudes (negative or positive), learners' Mathematics background from the GET phase, and the contexts suggested in textbooks. One example was Khumalo's lesson 1 that involved 'Polokwane'. The learners did not know what or where 'Polokwane' is. The teacher was forced to handle the lesson in an unexpected way by having to introduce a map of South Africa, and to locate Polokwane on the map.

Similarly, the lack of mathematics content knowledge of the learners affects the way teachers tend to implement the Mathematical Literacy curriculum. For example:

> Jabu: Even myself when I teach I find that the learners do not understand the lesson because of the content. I then lower myself because this is not Mathematics it is Mathematical Literacy.

Additionally, negative attitudes of the learners towards Mathematical Literacy (as reported in chapters 5 & 6) were found to have an influence on the manner in which teachers teach Mathematical Literacy.

Analysis shows that some teachers had some perceptions about Mathematical Literacy which were gradually changed by the experience of teaching the subject. For example:

> Bongani: It *was not easy for me to teach Mathematical Literacy*. To me, thought Mathematical Literacy undermines our learners' ability in Math. At first, *I had a negative attitude towards it*. Then it happened that I had to teach it. At first time it was not easy to teach. I saw it being similar to Arithmetic. I did not find it okay. *I did not think it was relevant for the future of the learners*. Also on the other hand, learners were running away from pure Maths to do Mathematical Literacy because they had a perception that Mathematical Literacy is easier than pure Maths. The child needs best symbols in Mathematical Literacy in order to pursue further studies and higher institutions. *But now I understand* it*; I found it easy*, this is *fine and is good* for learners because *now we relate it to daily life* and it is so practically to learners.

In this example we see Bongani's first interpretations and attitude changing through engaging with the subject. Thus his experience was shaping his interpretation and implementation of the subject. From "*not easy to teach*" to "*now I understand" and "I found it easy".* The way in which Bongani was interpreting Mathematical Literacy is not the same as the way he is interpreting it now.

Critical question 3

How do teachers' interpretations and implementations of the curriculum depart from, or cohere with, the intended Mathematical Literacy curriculum?

Across all the phases of the data analysis it was established that most of the findings show that, to a larger extent, teachers' interpretations and implementation of the curriculum cohere with the intended Mathematical Literacy curriculum. This is informed by teachers' views of the curriculum. As indicated previously, some teachers state that the curriculum is great, and that one has to implement it accordingly without adaptation. In this case, teachers' interpretations and implementation might be expected to strongly cohere with the intended curriculum. However, I have already indicated in Chapter 6 that there are teachers who argue that the curriculum needs to be modified by the individual teacher to suit the context of his or her classroom. Some of the teachers simply reject some aspects of the curriculum because they argue that these aspects are not relevant or appropriate. In cases like this, teachers' interpretations and implementations deviate from the official policy documents.

While there is much coherence between teachers' interpretations and implementations and the official policies, it was found that the implementation part is subject to deviations. The two teachers observed in class demonstrated that, even though teachers said Mathematical Literacy is driven by real life contexts, agreeing with the official policy documents, one lesson presented by Alfred was not driven by real life context. Findings thus suggest that teachers' interpretations may cohere with the intended curriculum but sometimes depart from the intended curriculum in implementation due to circumstances, whether intentionally or unintentionally.

Conclusion

I have presented a summary of results in relation to the three critical research questions of the study. More detailed findings were presented in Chapters 5 – 7, on the three phases of data analysis. These results raise yet other issues for further discussions. These 5 issues are presented below.

PART 2: DISCUSSION OF RESULTS IN RELATION TO CRITICAL ISSUES

The study aimed to understand teachers' interpretations and implementations of the Mathematical Literacy curriculum in Grades 10 – 12. The main focus of the study has been on: (i) teachers interpretations of the curriculum, and (ii) teacher implementations of the curriculum. In the previous chapters I attempted to present the findings drawn from the three phases of data analysis. I further presented results in relation to the critical questions. In the next section I elaborate on these and relate the findings to literature reviewed and the specific theoretical framework(s) adopted for this study.

Issue 1: Teacher knowledge

Teacher knowledge in Mathematics has been the subject of debate and discussion both internationally (see: Ball, Lubienski and Mewborn, 2001; Shulman, 1987) and nationally (Adler, 2000; Brodie and Long, 2004; and Hill, Rowan; and Bell, 2005). Shulman (1987) outlines seven categories of knowledge, namely: content knowledge; general pedagogical knowledge; curriculum knowledge; pedagogical content knowledge; knowledge of the learners and their characteristics; knowledge of educational contexts; and knowledge of educational ends, purposes and values, including their philosophical and historical grounds. Similarly, a study by Hill et al. (2005) on effects of teachers' Mathematical knowledge on student achievement revealed that teachers' Mathematical knowledge was significantly related to student achievement. It is evident that the knowledge of the teacher, pedagogical content knowledge in particular, is imperative for his or her practice. Drawing from Shulman's (1987) categories of knowledge, the nature of the knowledge that Mathematical Literacy teachers should have is explicit.

Teacher Mathematical Literacy knowledge

This study aimed at understanding teachers' interpretations, experiences and implementations of the intended Mathematical Literacy curriculum. It was clarified in

Chapter 1 that Mathematical Literacy is new in the South African curriculum; hence the teachers who are teaching it come from diverse backgrounds. Diverse backgrounds suggest diverse knowledge experiences, particularly in regard to Mathematics knowledge. Through a series of questions in Chapter 5, it was attempted to envisage conceptions of a Mathematical Literacy teacher. The results from the analysis provide different opinions on the kinds of knowledge that a Mathematical Literacy teacher should have. Through the analysis of the teachers' different educational backgrounds, three groups of Mathematical Literacy teachers were identified. These groups are: group 1 – teachers with only Mathematics qualifications; group 2 – teachers with only Mathematical Literacy qualifications (no mathematical studies in their degree or diploma); and group 3 – teachers with both Mathematics and Mathematical Literacy qualifications. The interviews (of 7 teachers) and classroom observations (of 2 teachers) of the teachers indicated differences in pedagogic orientations to mathematics for teachers, depending on their backgrounds. Those teachers with a mathematics background seemed more prone to Pedagogic Agendas 3 & 4. For example:

> Alfred: I think, because I was involved in pure mathematics at university, teaching pure mathematics at the university that is why I have a better understanding of Mathematical Literacy.

It was, however, noted that the sample was too small to generalise this.

It is important to note that teachers in the same group share similar characteristics, and similar interpretations of the intended Mathematical Literacy curriculum. However some of the teachers differ in the interpretation and implementation of the intended curriculum, even though they have the same qualifications. Ernest (1994) argues that teachers can have similar knowledge, but while one teaches mathematics with a problem-solving orientation, the other has a more didactic approach. This also appears to be the case with Mathematical Literacy.

Below, I present a brief discussion on the teaching and learning of Mathematical Literacy as one of the issues that arose from the findings.

Issue 2: Teaching and learning Mathematical Literacy

One of the critical questions of this study relates to the implementation of the Mathematical Literacy curriculum by teachers. In an attempt to explore teachers' experiences of implementing the intended curriculum, the issue of teaching and learning of Mathematical Literacy arose. In all three phases of data collection and analysis, presented in Chapters 5 – 7, teaching and learning of Mathematical Literacy appeared to be an issue for discussion.

As I have already indicated in Chapter 3, when I presented the review of curriculum documents, policies of Mathematical Literacy provide guidance on the approach of teaching and learning Mathematical Literacy. I now want to extend that discussion to the analysis of data in Chapter 8. I start my argument by reflecting on the policy documents of Mathematical Literacy. The Department of Education emphasises that:

> When teaching and assessing Mathematical Literacy, teachers should avoid teaching and assessing mathematical content in the absence of context. At the same time teachers must also concentrate on identifying in and extracting from the contexts the underlying mathematics or content. That is, avoid teaching and assessing contexts without being deliberate about the mathematical content (DoE, 2005b p.7).

The above statement suggests a particular approach in teaching and learning Mathematical Literacy. I have shown in Part 2 of Chapter 3 that there are some contradictions and dilemmas in the policy documents, with regard to the teaching of Mathematical Literacy (see, Christiansen (2006) and Venkatakrishnan and Graven (2006)). These contradictions in the policy documents raise concerns with regards to the teaching and learning of Mathematical Literacy. I shall now draw on findings to further my discussion.

The data shows that teachers foregrounded certain agendas in teaching Mathematical Literacy. Some of the agendas deviate or cohere with the intended Mathematical Literacy curriculum as laid down in the official policy documents. In the first phase of the data analysis, for example, teachers were given some questions based on the teaching of Mathematical Literacy. The responses show that indeed teachers have different personal philosophies and understandings of teaching Mathematical Literacy.

Analysis has shown that 80% – 90% of the 60 teachers contend that teaching Mathematical Literacy is exciting and interesting, but it requires a good background of Mathematics and or special training to teach Mathematical Literacy. Interestingly, there were some teachers (12%), who indicated that they are not sure if it is important to teach mathematics content in Mathematical Literacy. If teachers are not sure how to handle the subject this suggests uncertainty in their interpretation of the curriculum. This could then translate into the manner in which the curriculum is delivered at classroom level.

In sub-questions 7 and 8 (Part 1 of Chapter 5) the object was to explore teachers' views on the teaching experience required to teach Mathematical Literacy. It is important to note that the vast majority of the teachers contend that if one has taught Mathematics before, then one can teach Mathematical Literacy. The vast majority of teachers also indicated that special training in Mathematical Literacy is essential.

The main issue on the teaching and learning of Mathematical Literacy relates to the appropriate approach to handle content and contexts in teaching. As indicated in Chapter 3, the policy documents have mixed messages with regards to the teaching approach – this makes it difficult to decide whether teachers deviate from, or adhere to, the official policy documents of the intended curriculum. Under Issue 5, I discuss the role of contexts in Mathematical Literacy.

The burning issue around the teaching and learning of Mathematical Literacy concerns the specific pedagogical knowledge required to teach Mathematical Literacy. Literature on teaching and learning has provided different approaches to teaching (generally and particularly). Most teaching theories and models are about a specific subject, e.g. Mathematics. It is therefore a challenge to all Mathematical Literacy teachers to decide on a specific approach that will be appropriate to the teaching and learning of Mathematical Literacy. Adapting teaching and learning theories of Mathematics to the teaching of Mathematical Literacy could be challenging, especially to those teachers who have not taught Mathematics before, and do not have a formal qualification in Mathematics. Also, since Mathematical Literacy is different in purpose, the appropriateness of mathematics pedagogic content knowledge is questionable. It is from this background that teachers from the sample cite different teaching approaches. These approaches were derived from: (i) teaching experience of Mathematics or any other subject that the teacher has taught in the past; (ii) training – both formal and informal, in Mathematical Literacy (e.g. ACE and Cluster workshops[24]); and iii) evolving pedagogies[25].

The next section presents a discussion on the recontextualisation of the curriculum with specific reference to Mathematical Literacy.

Issue 3: Recontextualising curriculum

According to Bernstein (1971; 1982) recontextualisation involves the process of giving the meaning of an original context in a new context. In addressing the issue of recontextualisation, Bernstein (1971; 1982) presents the concept of pedagogic discourse[26]. The procedures for the production and circulation of knowledge are particularly important in the present study, as they provide insight into the nature of the interpretation and understanding that the Mathematical Literacy teachers have. Recontextualisation operates as a bridge between the production of knowledge and reproduction of knowledge. See Figure 8 below.

---

[24] ACE two year certificate in Mathematical Literacy called Advanced Certificate in Education offered by Universities in South Africa, usually on part-time basis. Cluster workshops are normally conducted by the Subject Advisor(s) of the specific subject. These workshops are conducted in one to five days.

[25] These are teaching approaches derived from everyday experiences of the teacher, informed by classroom context and learners' responses.

[26] He defines it as an ensemble of rules or procedures for the production and circulation of knowledge within pedagogic interactions.

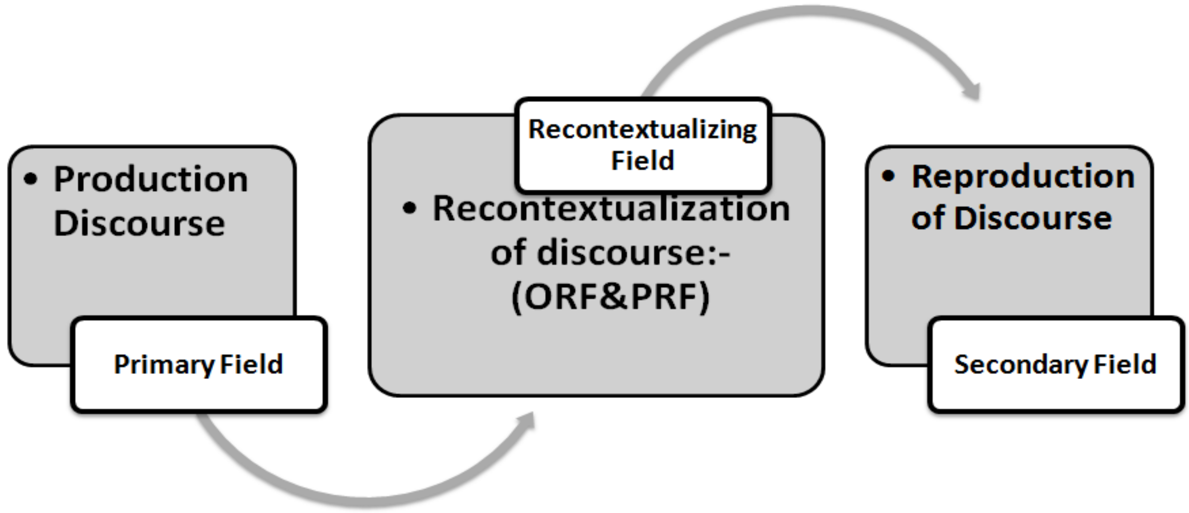


Figure 8: Recontextualisation of Discourses

The issue of recontextualisation of the curriculum is important in this study, since the curriculum is reproduced through recontextualisation. This issue, however, raises concerns about how the curriculum is recontextualised, and its implication in the reproduction of knowledge at the secondary field. Two important fields of recontextualisation presented by Bernstein, as shown in Figure 8, are the official recontextualising field (ORF) and the pedagogic recontextualising field (PRF) (Bernstein, 1971; 1982). As explained in Chapter 2, the ORF consists of specialised departments and sub-agencies of the state and local educational authorities, for example, the DoE. The PRF consists, for example, of university departments of education - their research as well as specialised educational media (Bernstein, 1971; 1982). In the context of the Mathematical Literacy curriculum, the DoE provides ORF in the form of subject policy; assessment guideline documents etc. (see Part 2 of Chapter 3). The universities also provide PRF in the form of formal qualifications, such as ACE in Mathematical Literacy, B Ed honours and PhD in Mathematical Literacy. Specialised educational media, such as educational publishers, publish Mathematical Literacy textbooks. Research or analysis of teachers' responses has shown that some teachers of Mathematical Literacy are not sure about certain aspects of Mathematical Literacy, as well as the ways in which the curriculum has to be implemented (see analysis in Phase 1 of Chapter 5). In the previous discussion in various sections of this study, I have argued, based on teachers' responses and the literature, that there are mixed messages within the departmental documents. Similarly, Mathematical Literacy textbooks use different approaches. All the information presented here suggests that teachers are faced with dilemmas when they are required to reproduce the 'legitimate' curriculum.

This information presented above provides another dimension of understanding curriculum implementation, beyond a model of curriculum that has three components, i.e. the intended curriculum, the implemented curriculum and the attained/ achieved curriculum (TIMSS). This dimension is between the intended and the implemented curriculum; it is the 'understood curriculum'. In this study, this for me is taken to be evidenced by how teachers articulate their understanding of the curriculum. The understood curriculum may, or may not, be similar to the intended curriculum, and may be better than, or not as good as, the intended curriculum. In this case *intended curriculum* refers to the official, or planned curriculum, (Cuban, 1995; Kelly, 1999) at the national department level, which is a field of recontextualisation for both official recontextualising field (ORF) and the pedagogic recontextualising field (PRF) (Bernstein, 1971; 1982).

Challenges associated with recontextualisation result in several consequences in the reproduction of curriculum implementation. I call this situation *systematic distortion of intended curriculum*. This is the situation whereby the teacher deviates from the intended curriculum, perhaps unaware, or perhaps intentionally, and implements it according to his or her understanding. The end product can result in either an advanced curriculum or an inferior or restricted curriculum, as indicated in the table of possibilities below.

Table 47: Reproduction of Mathematical Literacy curriculum

Possible implementation cases	Description of the case
Case 1 Advanced mathematics curriculum	Curriculum that is above the intended curriculum, that is too advanced mathematics and sometimes above the level of the learners. This case normally occurs when the teacher tends to emphasise more mathematics content knowledge.
Case 2 Curriculum as intended	This situation occurs when the implemented curriculum mirrors closely the intended curriculum. This normally occurs when the teacher is clear on the policies and procedures of Mathematical Literacy.
Case 3 Restricted mathematics curriculum	This situation occurs when the teacher implements a curriculum with little mathematics underpinning activities.

These situations presented above occur as a result of the teachers' attempts to interpret the intended curriculum. In the context of this study it is relevant to argue that teachers from different mathematics backgrounds and experiences may likely fall into any of these situations presented. For example, a teacher with a strong Mathematics background, but weak in Mathematical Literacy background, would perhaps tend to focus on the content knowledge (Pedagogic Agendas 3 and 4) and would thus be an example of case 1. Similarly, a teacher with limited Mathematics content knowledge may experience challenges in handling some sections in Mathematical Literacy which require some background of Mathematics knowledge, in order to reproduce the legitimate curriculum. This would be an example of case 3. However since this study only explored the implementation of the curriculum in four lessons of two teachers, this categorisation would benefit from further research across the range of teachers.

In the following section Mathematisation, as an important aspect of Mathematical Literacy, is presented. I will further attempt to relate Mathematisation to the previous issues discussed.

Issue 4: Mathematisation in Mathematical Literacy

The issue of Mathematisation is relevant in this discussion, in the sense that it provides a special approach that can be used in Mathematical Literacy to solve problems. From the results it appeared that teachers are concerned with the ability of their learners to solve contextualised problems, due to the poor background in the language of teaching and learning, i.e. English. In Phases 1 and 2 most of the teachers complained that their learners are unable to solve problems in Mathematical Literacy. For example, 4 out of 7 teachers raised the issue of language as a challenge to problem solving, during the interviews. As discussed in chapter 3 indeed mathematisation is the fundamental process learners use to solve real life problems (OECD, 2003). I argue that in order to get learners to mathematise, teachers most likely need to have both mathematics knowledge advantage and experiential advantage.

Issue 5: Contexts in Mathematical Literacy

As mentioned before, the official documents stress that:

> Contexts are central to the development of Mathematical Literacy in learners.
> It, by its very nature, requires that the subject be rooted in the lives of the learners (DoE, 2003:42).

Since contexts are central to the development of Mathematical Literacy, different teachers explained that they experienced challenges in successfully handling contexts and content. At this point I will present a discussion on *contexts* in Mathematical Literacy as one of the key issues for further discussion. I conclude this discussion by arguing on two important aspects of contexts that were illuminated in the lesson and lesson reflection that facilitate teaching and learning of Mathematical Literacy.

Example 1: lesson 1 – Probability (Khumalo)

The issue of 'Polokwane' as a context affected the learners negatively, in the sense that the learners could not answer the question, not because of the language used, but because they were not familiar with the place and could not locate Polokwane on a map. Therefore, they did not have any idea of weather patterns in Polokwane. If the same question was given to the learners in Limpopo or North West, they would have been more likely to know the context because they are familiar with the area.

Example 2: lesson 1 – Business Mathematics (Alfred)
In this lesson there were some questions where the learners had to determine which expenses were fixed and which were variable. One of the items given was '*telephone*'. There was a debate amongst the learners, as some felt that the use of a telephone was a fixed expense, while others felt that it was a variable expense, depending on how much the phone was used in a particular month. The question itself did not provide an opportunity (or encouragement) for the respondents to support their answers. Such contexts appear to be ambiguous; hence they have the potential of preventing learners from finding the solution to a problem. The real life contexts become ambiguous if there are two or more possible different solutions to a problem. Thus, it is necessary that the style of questioning in Mathematical Literacy be such that it allows the learners to engage in an open discussion without limiting them to "yes" or "no".

These two examples given above show that a problem with contexts is not only limited to language per se, but also to other variables that come into play in teaching and learning Mathematical Literacy. Below, I present a short discussion on contexts and content in relation to the findings of the present study.

Issue of contexts and content in ML in relation to the research findings

This study aimed at understanding teachers' interpretations and implementation of the intended Mathematical literacy curriculum. Some of the key findings of this study relate to teachers' approaches to context and content in teaching Mathematical Literacy. I have already discussed contexts in Mathematical Literacy. At this point I want to extend this discussion by looking at more important aspects of Mathematical Literacy related to content and context which arose from the findings of this study. I refer to these aspects as academic advantage and experiential advantage. I argue that, in some cases, these two aspects of Mathematical Literacy are in conflict with each other.

Academic advantage in Mathematical Literacy

With academic advantage, I mean the amount of mathematics content knowledge that the teacher or the learner has through teaching or learning. The more knowledge the teachers or the learners have, the more advantage they have in mathematising. This was stressed by the teachers who had a strong mathematics background. Myeza and Jabu both note their strong or "good" mathematics background enabling them to teach Mathematical Literacy thus provides academic advantage. For example:

> Themba: Have you done ACE in Mathematical Literacy programme?
> Myeza : Yes, ACE in Mathematics but not Mathematical Literacy programme per se. somebody in the school did. As a *learner I did Functional Math*ematics some years back but changed to pure mathematics so I know the ins and outs of the subject. I have taught Mathematics at GET phase before Mathematical Literacy was introduced
>
> Themba: What motivated you to teach Mathematical Literacy?
> Myeza: It is because I *once taught Functional Mathematics*. In the past there were two classes, one that was mathematics and one that was not doing Mathematics at all. We decided to introduce some kind of mathematics that is softer than pure Math its self; that was functional maths for the class that was not doing mathematics. That was early 90's. I was the one who was teaching that mathematics. When Mathematical Literacy was introduced in 2006 *I came on board and teach it*.

Similarly Jabu expressed confidence on his mathematics background and mathematics teaching experience. For example:

> Jabu: What I find interesting is that *I do have a good background of Mathematics* because *I was teaching Mathematics* in the FET (in Grades 10 and 11) before I taught Mathematical Literacy.

These two teachers (and others) have what I call academic advantage to handle Mathematical Literacy. Similarly, learners who have acquired the relevant basic skills of Mathematics knowledge from the GET phase have an academic advantage when doing Mathematical Literacy at the FET phase. After presenting the experiential knowledge that goes with academic advantage I discuss possible contradictions between the two aspects.

Experiential advantage in Mathematical Literacy

By experiential advantage I mean the experience that one has about context. This means knowledge about the context dealt with. For example, in Khumalo's lesson learners being from East London did not have experiential advantage because they had no idea of 'Polokwane'; but learners from Polokwane would have responded to the question given the experiential advantage that they had, of knowing the context very well. The point I am presenting here is that academic advantage alone does not help the teacher or the learner to solve real life problems in Mathematical Literacy.

Conflict between experiential advantage and academic advantage does occur at times; for example, when the individual has both experiential advantage and academic advantage (solution 3 above). When one uses the necessary calculations correctly the answer one gets is contrary to what one knows in the real life situation. This leaves one in a dilemma whether to take the answer as it is, or to apply one's experiential knowledge. Due to the limited lessons observed there was little information to demonstrate a potential conflict between academic and experiential advantage. I want to maintain that both academic and experiential advantages are essential in teaching and learning of Mathematical Literacy.

Summary of the issues

In Part 2, I have identified and discussed five key issues that emerged from the findings of this study. These five issues are relevant, since they relate to teachers' interpretations and understanding of the intended Mathematical Literacy curriculum and its implementation. It has been argued that for the teacher to interpret and/or understand the intended Mathematical Literacy curriculum he or she must at least first have the mathematical content knowledge as described by Shulman (1987), and then he or she has to recontextualise the curriculum and implement (reproduce) it in a particular way that will be meaningful to the learners. In making Mathematical Literacy meaningful, the teacher has to handle both content and context accordingly.

Conclusion

In this chapter I have presented the discussion on the findings from the three phases of data analysis in Chapters 5 – 7. I have further discussed these findings in relation to the three critical research questions, as presented in Chapter 1. The discussion of the results gave rise to five issues for further discussion. I have discussed these five issues and attempted to relate them to the findings of this study. In the next chapter I will present the conclusions of the report. In the conclusion, the contribution of the study and recommendations are presented accordingly.

CHAPTER 9

CONTRIBUTIONS, RECOMMENDATIONS AND CONCLUSION

Introduction

This study aimed at investigating the question: How do Mathematical Literacy teachers interpret, experience and implement the intended Mathematical Literacy curriculum in Grades 10 – 12? The study drew from a socio-cultural perspective to analyse the Mathematical Literacy Curriculum and the teachers' interpretations of the curriculum. It largely drew from Basil Bernstein's (1971; 1975; 1982; 1996) framework of knowledge system, and the Third International Mathematics and Science Study (TIMSS) (1996) framework of curriculum analysis. Graven's (2002) mathematics orientations and Graven and Venkatakrishnan's (2007) pedagogical agendas were used to analyse the data (see data analysis in Chapters 5 – 7).

The study was conducted in three phases. The first phase of the study involved 60 teachers across schools in the East London (Eastern Cape) education district. The teachers' views and experiences of Mathematical Literacy, as expressed in the questionnaires were analysed by using the Statistical Package for Social Sciences (SPSS) programme. In the second phase teachers were purposefully selected from the 60 teachers who participated in the first phase. The third phase involved lesson observations with two teachers who were selected from the seven teachers who participated in the second phase.

The results show that teachers have different views and understandings of the Mathematical Literacy curriculum, and also have different ways of implementing the subject. Teachers' mathematical backgrounds were found (in terms of what teachers said) to have an influence on how teachers implement the Mathematical Literacy curriculum. The study illuminates connections and disconnections (coherence and departure) between the intended curriculum and the implemented curriculum, and furthermore shows that teachers' interpretations and recontextualisation of the intended curriculum in classroom contexts are key to the nature of the curriculum that is implemented. The study explored five important issues that are key in influencing how teachers interpret, experience and implement Mathematical Literacy. These issues are: (i) teacher knowledge; (ii) teaching and learning in Mathematical Literacy; (iii) recontextualising the curriculum; (iv) Mathematisation in Mathematical Literacy; and (v) content and contexts in Mathematical Literacy.

In Chapter 8, I discussed the findings and key issues that arose from the data. In this concluding chapter I will discuss the contributions, recommendations and conclusion of the whole research process. I will first present the research questions of the study and provide the key findings of the study in relation to each question.

Research questions and the findings

What are teachers' interpretations of the intended Mathematical Literacy curriculum?

Teachers have diverse interpretations of the intended Mathematical Literacy curriculum. Their interpretations are informed by a number of factors, such as their Mathematics background, educational background and continuing professional development in Mathematical Literacy, as well as their experience of teaching. The findings reveal that teachers have different views on what Mathematical Literacy is, what it is for, and how it should be taught. The study revealed that teachers' interpretations are to an extent influenced by the Mathematics education background of the teacher. Some teachers' interpretations cohere with aspects of the intended official curriculum, and others depart from the intended curriculum.

What are teachers' experiences of teaching Mathematical Literacy, and how do these experiences influence their practice and interpretation of the ML curriculum?

The results show that teachers have different experiences in Mathematical Literacy; some had positive experiences, others negative experiences. It was found that some of the experiences that these teachers describe contradict each other. However predominantly teachers articulated positive experiences.

How do teachers' interpretations and implementation of the curriculum depart from or cohere with the intended ML curriculum?

It was found that teachers have a wide range of experiences and understandings of Mathematical Literacy, and that these experiences and understandings are said to have a direct impact on the implementation of the curriculum at the classroom level. The research findings show that to a larger extent, teachers' interpretations and implementation of the curriculum cohere with the intended Mathematical Literacy curriculum as outlined in the official policy documents. The analysis of questionnaires across the 60 teachers showed that 98.3% of teachers agree that Mathematical Literacy is driven by real life contexts indicating strong coherence in this respect. In terms of teacher acceptance of the curriculum document as whole, teachers had more diverse views: Some teachers stated that the curriculum is great, and that one has to implement it accordingly without adaptation. In this case, teachers' interpretations and implementation might be expected to strongly cohere with the intended curriculum. However, there are teachers who argued that the curriculum needs to be modified by the individual teacher to suit the context of his or her classroom. Some of the teachers simply reject some aspects of the curriculum because they argue that these aspects are not relevant or appropriate. In cases like this, teachers' interpretations and implementations deviate from the official policy documents.

Findings from lesson observations show that while there is much coherence between teachers' interpretations and implementations and the official policies, it was found that implementation is subject to deviations.

Contribution of the study to Mathematical Literacy education

This study revealed some important findings that are relevant to mathematics education and Mathematical Literacy education. The contributions of the study relate to: (i) understanding the curriculum and (ii) understanding the teaching and learning of Mathematical Literacy.

This study has shown that some teachers implement the curriculum, not only according to what they understand but according to how the classroom context influences their teaching practice. For example, Khumalo proposed some way of teaching, but the kind of responses he received from the learners affected the delivery of the curriculum in the way he intended which led to a shift from weaker framing to stronger framing (Bernstein, 1971). According to Kelly (1999) the differences between intended curriculum and implemented curriculum “may be conscious or unconscious, the cause of any mismatch being either a deliberate attempt by teachers or others to make what they offer appear more attractive than it really is” (p.5). This provides another dimension to understanding curriculum implementation, beyond a model of curriculum that has three components, the intended curriculum, the implemented curriculum and the attained/achieved curriculum (TIMSS, 1996). This dimension is between the intended and the implemented curricula and I have called it the ‘understood curriculum’. The understood curriculum may or may not be similar to the intended curriculum, and may be pitched at a more demanding or less demanding level than the intended curriculum.

Recommendations

In the light of the findings and discussions presented in the previous sections, I make the following tentative recommendations, with respect to the curriculum, Mathematical Literacy education, classroom practice and further research.

Ongoing curriculum revisions as discussed in chapter 1 have been part of the South African education system for the past decades. As Chisholm (2005) has shown the curriculum emerges from competing perspectives however these competing perspectives can lead to mixed messages and an absence of coherence. Teacher interpretations and experiences to some extent revealed teachers at times struggling to find the balance between aspects of the curriculum documents (curriculum, teacher guides and assessment) that seemed in some respects contradictory.

Recommendations for Mathematical Literacy education

Teacher professional development

Mathematical Literacy education is becoming increasingly widespread in South Africa. The Department of Education introduced Mathematical Literacy as a compulsory subject for learners not taking Mathematics. Many theories being used to understand the teaching and learning of Mathematical Literacy are largely drawn from theories of Mathematics teaching and learning. The theories of teaching and learning Mathematics do not necessarily appropriately address the specificities of Mathematical Literacy. In fact, Mathematical Literacy, in the global world, is often considered not as a school subject, but a competence demonstrated after learning Mathematics. It is recommended that specific learning and teaching theories be researched for applicability to Mathematical Literacy. Graven and Venkatakrishnan (2007) have developed a spectrum of pedagogic agendas that could provide the tools and serve as a framework for the relevant analysis of Mathematical Literacy teaching in the South African context. The research here has indicated usefulness for this purpose.

Professional teacher development for Mathematical Literacy has some limitations. The data gathered in this research indicates that teachers were not entirely confident about the value of the in-service programmes offered by the department and by the universities. Having participated[27] in both formal and informal programmes, I have found that these programmes focus on curriculum knowledge and content knowledge with little focus on specific pedagogical knowledge. My research findings indicated that teachers saw benefit in participating in ACE course but this ACE course was not sufficient to address all teacher professional development needs. The ideal programme should be informed by the needs of the teachers, rather than using the one-fits-all approach.

This study has not focused on the learners or the learning of Mathematical Literacy; it has focused on the teaching of Mathematical Literacy. There is a need for the development of education theories for Mathematical Literacy learning.

Classroom practice

Classroom practice is informed and influenced by many factors, such as school environment, learners and available resources. It is, however, argued that the most influencing factor is the teacher himself or herself. Teaching Mathematical Literacy poses a lot of challenges for teachers, with regard to the teaching approaches to be used. Some teachers use the approaches that they were using when, and if, they were teaching Mathematics, before they were appointed to teach Mathematical Literacy. Other teachers, who have not had any experience of teaching Mathematics, use a general teaching approach adapted from the subjects they taught before teaching Mathematical Literacy. It is, therefore, highly recommended that, whatever approach teachers use to teach Mathematical Literacy, should be such that it develops the abilities given above. Teachers, particularly those with a pure Mathematics background, should be careful not to unnecessarily impose mathematical content. In the same way, teachers should avoid engaging with contexts without addressing the relevant mathematics skills.

[27] As a lecturer for ACE (Mathematical Literacy) in a university faculty education and as NCS facilitator for the KZN Department of Education (2005)

Recommendations for further research

The study investigated a group of teacher's understanding of Mathematical Literacy in an Education District in the Eastern Cape in South Africa. While the results are important and relevant, there is a need for further research to explore other areas which were not part of this study. This study explored teachers' general interpretations of the intended and implemented Mathematical Literacy curriculum for two teachers. It however did not explore the implementation of each of the four Learning Outcomes of Mathematical Literacy over a period of time across a large number of teachers. As it was established that teachers change the approach they use from time to time, depending on the topic, it is possible that further research could reveal changing patterns of how teachers teach various topics.

Since this research focused only on teachers, there is a need for further research which focuses on the relationship between teachers' implementation of the curriculum and the way in which learners learn Mathematical Literacy. This kind of research could go further and look at the impact of the approaches that teachers use in teaching Mathematical Literacy and its relationship to learner performance in the subject. This could then pursue the link between the implemented and the attained curriculum which has not been addressed in this study.

There is also a need for research on the nature of in-service programmes for Mathematical Literacy teachers. This study revealed that some teachers were excited about the in-service programmes (both formal and informal), while others, for example Alfred was not happy about departmental programmes available for teachers. Further research is necessary into the influence of these programmes on the quality of teaching would be useful.

Limitations

While the objectives of the study have mostly been met, it is, however, important to mention some of the limitations of the study. The study was conducted the East London Education District, one of the 23 Education Districts of the Eastern Cape Province. The results of this study, therefore, cannot be generalised for the entire province or for the country at large, although these results can at least provide a picture of how some teachers interpret and implement Mathematical Literacy.

Due to unforeseen circumstances (see Research Process in Chapter 4) the sample of lessons observed was a one week sample. Although the four consecutive lessons observed per teacher were rich in detail, the lessons did not reflect all Learning Outcomes. Additionally the detailed analysis is focused only on two lessons per teacher. Thus while this provided access to how teachers implement the curriculum at a specific point in time this cannot be considered as typical of their teaching across topics and over time.

Since I only recorded a limited number of teachers' lessons I did not feel that I had sufficient data to interrogate how key mathematical concepts were taught through the use of the various contexts teachers introduced in their lessons. Thus my analysis of the lessons has foregrounded the way in which teachers incorporated contexts in their teaching rather than how they developed key mathematical concepts outlined in the curriculum. Further research with a much longer period of teacher observation would benefit from this analysis. Not providing a mathematical analysis of the way in which contexts are used is a limitation of the case study anlysis of teacher practices.

The focus of the study was on the teachers, and not on the learners. The data obtained was from the teachers, and the information which involved the learners was limited to the lesson observations. The TIMSS framework used in this study consisted of the intended, implemented and attained (which involved learners) curriculum; similarly Bernstein's framework consists of curriculum, pedagogy and evaluation (which involves learners). This study has been limited to the intended and implemented curriculum; hence there is little that can be claimed regarding the attained curriculum as this was not the focus of the study.

As indicated in Chapter three, this study focused on teacher interpretation and implementation of the NCS for Mathematical Literacy which was pre the CAPS. Further research could usefully investigate teacher interpretations and implementation of this revised CAPS for Mathematical Literacy. While I have provided a detailed analaysis of the Mathematical Literacy NCS using a Bernstinian lens I have not provided the same analysis for the CAPS as this was only introduced after my data collection. Although I pointed to various changes from the the NCS ML to the CAPS document I noted that the definition, purpose, focus (real life contexts) and principles of Mathematical Literacy remain the same in both versions. Thus several findings highlighted in this study would still be relevant and of interest. However further research on how teachers interpret and implement CAPS in relation to their prior knowledge of NCS would complement the findings of this study.

Conclusion

In conclusion, this study found that Mathematical Literacy is taught by teachers who have different education backgrounds of Mathematics and/or Mathematical Literacy. The interpretation of the curriculum by these teachers is to a large extent informed by teachers' education background of Mathematics, and these teachers say it influences the way they implement the intended Mathematical Literacy curriculum. The study found that different groups of teachers view Mathematical Literacy differently: some view it as mathematics that is presented in real life contexts, fine as is and beneficial for the learners; others see it as weak, scaled-down Mathematics that should be improved by adding more mathematics content so that the learners are exposed to more basic mathematics skills; and others view Mathematical Literacy as mathematics with a lot of mathematics topics, some of which are not relevant to the real life of a learner.

It was found that most teachers contend that the curriculum should be implemented according to the policies (referred to as *alignment*) some of the teachers felt that a few modifications were necessary (referred to as *adapted alignment*). There were a few teachers who felt it necessary to sometimes deviate from policies and instead do what they believed would benefit their learners (referred to as *critical alignment*). With respect to the extent to which teachers' interpretations and implementations cohere or depart from the official policy documents, it was found that the contradictions within the departmental policies are mirrored in inconsistencies with teacher interpretations of curriculum aspects especially as relates to the content-context balance. On a positive note most Mathematical Literacy teachers stated they enjoyed teaching the subject and their willingness to engage about the subject in this research was most welcomed and indicates positive interest by these teachers in shaping the future of the subject.

REFERENCES

Adendorff, S., & Van Heerden, E. (2001). Activity a realistic approach to the learning and teaching of the quadratic functions $y = ax^2 + bx + c$ in Grade 10 mathematics. *Pythagoras* , 58-66.

Adler, J. (2000). Conceptualizing resources as a theme for mathematics teacher education. *Journal of Mathematics Teacher Education* .

Aldous, C. (2004). Science and Mathematics teachers' perceptions of C2005 in Mpumalanga Secondary schools. *African Journal of Reseach in SMT Education, 8* (1), 65-76.

Ball, J., Lubienski, S., & Mewborn, D. (2001). Research on teaching mathematics: The unsolved problem of teachers' mathematical knowledge. In V. Richardson, *Handbook of research on teaching.* (4th ed.), pp. 433-456). New York: MacMillan.

Bell, J. (1993). *Doing your research project. A guide for first time Researchers in education and social sciences.* (2nd ed.). USA: Open University press.

Bernstein, B. (1971). *Class, Codes and Control volume 1: Theoretical studies towards sociology of language.* London: RKP.

Bernstein, B. (1982). Doing your research project. A guide for first time Researchers in education and social sciences. In T. Horton, & P. Raggat, *Challange and change in the curriculum* (pp. 157-176). Milton Keynes: The Open University.

Bernstein, B. (1996). *Pedagogy, Symbolic Control and Identity: Theory, Research, Critique.* London: Taylor and Frances.

Blinko, J. (2004). Mathematics in context. *Mathematics Teaching* , 3-9.

Boaler, J. (1993). The role of contexts in the Mathematics classroom: Do they make mathematics more “real”? . *For the learning of Mathematics* , 12-17.

Bondy, J., & Huges, D. (1999, March 20). *Methods of data collection.* Retrieved April 23, 2006, from http: www.subjects.eu.rmit.edu.au/cj141/secure/2.3.3.html.

Bowie, L., & Frith, V. (2006). Concerns about the South African Mathematical Literacy curriculum arising from experience of materials development. *Pythagoras* , 29-36.

Bowman, J. (1997). *Making math relate to the real world. A Math teacher challenges his students with interesting story problems.* Retrieved July 15, 2006, from http://www.4teachers.org/testimony/bowman/

Brodie, K., & Long, C. (2004). Pedagogical responsiveness in mathematics teacher education. In H. Griesel, *Curriculum Responsiveness in higher Education* (pp. 135-155). Pretoria: South African Universities Vice-Chancellors' Associations.

Brombacher, A. (2006). *First draft of the report on the SAQA Mathematical Literacy Standards at NQF levels 2, 3 and 4.* Pretoria: SAQA.

Brown, B., & Schafer, M. (2006). Teacher education for Mathematical Literacy: A modelling approach. *Pythagoras* , 45-51.

Carraher, J., Carraher, D., & Schliemann, A. (1985). Mathematics in the streets and Schools". *British Journal of Developmental Psychology* , 21-29.

Chacko, I. (2004). Solution of real-world and standard problems by primary and secondary school: A Zimbambean example. *African Journal of Research in SMT Education , 8* (2), 91-103.

Christiansen, I. M. (2007). Mathematical Literacy as a school subject: Mathematical gaze or livelihood gaze? *African Journal of Research in SMT Education* , 91-105.

Christiansen, I. (2006). Mathematical literacy as a school subject: Failing the progressive vision? *Pythagoras* , 6-13.

Christie, P. (1991). *The Right to learn. The struggle for Education in South Africa.* Johannesburg: SACHED/Ravan.

Cohen, L., & Manion, L. (1994). *Research methods in Education* (4th ed.). London: Routledge.

Cohen, L., Manion, L., & Marrison, K. (2000). *Research methods in Education* (5th ed.). London: Routledge.

Coles, C., & Gale Grant, J. (1985). Curriculum evaluation in medical and health-care. *Medical Education , 19*, 405-422.

Cooper, B., & Dunne, M. (1999). *Assessing children's mathematical knowledge: social class, sex and problem solving. London.* London: Open University.

Cornbleth, C. (1990). *Curriculum in context.* London: The Falmer Press.

Cuban, L. (1992). Curriculum stability and change. In P. Jackson, *Handbook of Research on curriculum.* American Educational Research Association.

Cuban, L. (1995). The hidden variable: How organisations influence Teacher Responses to Secondary Science Curriculum Reform. *Theory into Practice , 34* (1), 4-11.

De Vos, A., Strydom, H., C.B., F., & Delport, C. L. (2002). *Research at grass roots.* Pretoria: Paarl Print.

Department of Basic Education. (2011). *Curriculum and Assessment Policy Statement Grades 10-12. Mathematical Literacy.* Pretoria: Department of Basic Education.

Department of Education. (2003b). *Examiners' Report: November 2002 senior certificate examination. KZN Circular No. 18 of 2003*. Pietermaritzburg: Department of Education.

Department of Education. *(2003a). National Curriculum Statement Grades 10-12 (General). Mathematical Literacy.* Department of Education. Pretoria

Department of Education. (2003c). *National Curriculum Statement Grades 10-12*

(General): Mathematics. Pretoria: Department of Education.

Department of Education. (2005a). *National Curriculum Statement Grades 10-12 (general). Learning Programme Guidelines for Mathematical Literacy*. Pretoria: Department of Education.

Department of Education. (2005b). *National Curriculum Statement Grades 10-12 (general), Subject assessment guidelines for Mathematical Literacy*. Pretoria: Department of Education.

Department of Education. (2006). *National Curriculum Statement Grades 10-12 (general). Teacher Guide: Mathematical Literacy*. Pretoria: Department of Education.

Department of Education. (2006). *National Curriculum Statement Grades 10-12 (General): Mathematical Literacy: Teacher Training Manual*. Pretoria: Department of Education.

Department of Education. (2006). *National Curriculum Statement Grades 10-12, Teacher Guide, Mathematical Literacy.* Pretoria: Department of Education.

Department of Education. (2008a). *National Curriculum Statement Grades10-12(general). Learning Programme Guidelines for Mathematical Literacy*. Pretoria: Department of Education.

Department of Education. (2008b). *National Curriculum Statement Grades 10-12 (general). Subject assessment guidelines for Mathematical Literacy*. Pretoria: Department of Education.

Dickson, M.; Long, C., Mei, M.; Scheiber, J.; Sigabi, M. & Laridon, P. (2005). *Mathematical Literacy for the Classroom Grade 10. RADMASTE*. Sandton: Heinemann.

Diener, E. and Crandall, R. (1978). *Ethics in Social and Behavioural Research*. Chicago: University of Chicago Press.

Dowling, P. C. (2001). ‘Basil Bernstein: Prophet, teacher, friend.’ In S. Power et al. (Ed.), *A Tribute to Basil Bernstein* 1924-2000, (114-116). London, Institute of Education.

Du Feu, C. (2001). Naming and Shaming. *Mathematics in Schools*, 30(3), pp. 2–8.

Ensor, P. & Galant, J. (2005). Knowledge and pedagogy: Sociological research in mathematics education in South Africa. In R. Vithal, J. Adler & C. Keitel (Eds.), Researching m*athematics education research in South African. Perspectives, practices and possibilities* (pp. 281-306), Cape Town: HSRC Press.

Ernest, P. (1988). The impact of Beliefs on the teaching of mathematics. In P. Ernest (eds), mathematics teaching: The state of the art, (pp. 249-254). London: Falmer.

Gerdes, P. (1985). Conditions and Strategies for Emancipatory Mathematics Education in Undeveloped Countries. *For the learning of Mathematics, 5*, 15-21.

Graven, M. (2002). *Mathematics Teacher Learning, Community of Practice and the centrality of confidence.* Unpublished PhD Thesis, University of the Witwatersrand, Johannesburg.

Graven, M. & Venkat, H. (2007). Emerging pedagogic agendas in the teaching of Mathematical Literacy. *African Journal of Research in SMT Education*, 11(2) 67-84.

Graven, M. & Venkatakrishnan, H. (2006). Emerging successes and tensions in the implementation of Mathematical Literacy. Learning and Teaching Mathematics. *A journal of AMESA* 4, 5-9.

Green, L. (2001). Taking Teachers Seriously. *Mathematics education Research Journal, 19*, 129-140.

Guion, L. (2001). Conducting an In-depth interview. Retrieved April 23,2006 from http://edis.ifas.ufl.edu/FY393.

Hampton, S. (1994). Teacher change: Overthrowing the myth of one teacher, one classroom. In T.Shanaham (Ed.). *Teachers thinking, teachers knowing*. Illinois; NCRE, pp.122-140.

Handal, B. & Herrington, A. (2003). Mathematics Teachers' Beliefs and Curriculum Reform. *Mathematics education Research Journal, 15,* 59-69.

Harley, K. & Parker, B. (1999). Integrating Differences: Implications of an Outcomes-based National Qualifications Framework for the roles and Competencies of Teachers. In J. Jansen & P. Christie (Eds.), *Changing South Africa (pp. 181-202).* Kenwyn, Cape Town, South Africa: Juta.

Hersh, R. (1979). Some proposals for revising the philosophy of mathematics. *Advances in Mathematics*, 31-50.

Hilderbrand, G.M. (1999). Contesting Learning Models. *Paper presented at the AARE and NZARE conferenc*e, Melbourne, Dec, 1999.

Hill, H.C., Rowan, B & Ball, D.L. (2005). Effects of teachers' Mathematical knowledge of teaching on student achievement. *American Educational research Journal Summer, 42*, 371-406.

Hitchcock, G. & Hughes, D. (1989).*Research and the Teacher. A qualitative introduction to school based research*. London: Routledge

Hitchcok, G. & Hughes, D. (1995). *Research and the Teacher. A Qualitative introduction to School-based Research. Second edition*. London: Routledge

Hoadley, U. (2006a). The reproduction of social class inequalities through mathematics pedagogies in South African primary schools. *Journal of curriculum Studies, 39,* 679-706.

Hoadley, U. (2006b). The reproduction of social class differences through pedagogy: A model for the investigation of pedagogic variation. *A paper presented at the Second meeting of the Consortium for research on Schooling.* Cape Town: *UCT* *and HSRC*.

Hoepfl, M.C. (1997). Choosing Qualitative Research: A Primer for Technology Education researchers. *Journal of Technology Education, 9*.

Honebein, P. (1996). Seven goals for the design of Constructivist learning environments. In B. Wilson, *Constructivist learning environments*, pp. 17-24. New Jersey: Educational Technology Publications.

Howie, S.J and Pietersen, J.J. (2001). Mathematics Literacy of final year students: South African Realities. *Studies in Educational Evaluation, 27*, 7-25.

Howson, A. G. and Wilson, B. J. (1986) School mathematics in the 1990s. Cambridge: Cambridge University Press.

Ishmail, M.I. (2004). *The impact of curriculum transformation on classroom practice in the Northern Cape Schools. Unpublished PhD thesis, University of the Free State*. Bloemfontein.

Jacob, E. (1997). Context and cognition: Implications for Educational Innovations and Anthropologists*. Anthropology and Education Quarterly, 28*, 3-21.

Jansen, J.D. (1999a). Setting the scene: Historiographies of Curriculum policy in South Africa. In J. Jansen & P. Christie (Eds*.) Changing Curriculum: Studies on Outcomes-based Education in South Africa*, 181 – 200. Juta and Co: South Africa.

Jansen, J.D. (1999b). A Very Noisy OBE': The implementation of OBE in Grade 1 Classrooms. In J. Jansen & P. Christie (Eds.) *Changing Curriculum: Studies on Outcomes-based Education in South Africa,* 181 – 200. Juta and Co: South Africa.

Jansen, J.D. (1999c). Why Outcomes-based Education Will Fail: An Elaboration. In J. Jansen & P. Christie (Eds.) *Changing Curriculum: Studies on Outcomes-based Education in South Africa*, 181 – 200. Juta and Co: South Africa.

Jaworski, B. (2006). Theory and practice in Mathematics teaching development: Critical inquiry as a mode of learning in teaching. *Journal of Mathematics Teacher Education*, 187-211.

Johansson, M. (2003). *Textbooks in Mathematics Education: A study of textbooks as the potentially implemented curriculum (licentiate thesis).* Lulea: Department of Mathematics education. Lulea University of Technology.

Jonassen, D. (1991). Evaluating constructivist learning. *Educational technology*, *36,* 28-33.

Julie, C. (2006a). Teachers' preferred contexts for Mathematical Literacy and mathematics actio*n. Proceedings of the 14th annual SARMSTE conference, University of Pretoria*, 46-55. Pretoria.

Julie, C. (2006b). Mathematical Literacy: Myths, further inclusions and exclusions. *Pythagoras, 64*, 62-69.

Julie, C., & Mbekwa, M. (2005). What would Grade 8 to 10 learners prefer as context for mathematical literacy? The case study of Masilakele Secondary School. *Perspectives in Education*, *23*.

Kelly, A.V. (1999). *The curriculum. Theory and Practice 4th edition*. London: SAGE

Kress, G., Jewitt, C. & Tsatsarelis, C. (2000). Knowledge, identity, pedagogy. Pedagogic Discourse and the representational Environments of education in late Modernity. *Linguistics and education, 11*, 7-30.

Libarkin, J.C. & Kurdziel, J. (2002). Research Methodologies in Science Education: The qualitative-quantitative Debate. *Journal of Geoscience Education, 50*, 78-86.

Lubisi, C., Parker, B. & Wedekind, V. (1998). *Understanding Outcomes-based Education: Teaching and assessment in South Africa learning guide*. Cape Town: Oxford university Press.

Maier, E. (1991). Folk Mathematics in Harris, M. (Ed.). *School, Mathematics in work.* Basingstoke: Falmer Press.

Mbekwa, M. (2006). Teachers' views on mathematical literacy and their experiences as students of the course. *Pythagoras 63,* 22-29.

McNamee, M. and Bridges, D. (2002). *The Ethics of Educational Research*. UK: Blackwell Publishers.

Mouton, F. (1996). *Understanding social research*. Pretoria: Van Schaik.

Mtetwa, A.C. (2003). *Has it happened in Mpumalanga? An evaluation of implementation of Curriculum 2005. Unpublished M.A thesis*. Pretoria: University of Pretoria.

Mthethwa, T. M. (2007). *Teachers' views on the role of contexts in Mathematical Literacy. Unpublished M.Sc Thesis,* University of the Witwatersrand. Johannesburg.

Muday, V. (2004). Modelling of real-world problems is often that starting point for proof. *Pythagoras 60*, 36-43.

Murray, H. (2003). Word problems: A problem! *Pythagoras 58*, 39-41.

Naidoo, D., & Parker, D. (2005). The implications of mathematics teachers' identities and official mathematics discourses for democratic access to mathematics. *Perspectives in Education, 23*, March 2005.

Nicol, C & Crespo, S. (2005). Exploring mathematics in imaginative places: rethinking what counts as meaningful contexts for learning mathematics. *School science and mathematics, 105.*

Opie, C. (2004). *Doing Educational Research*. London: Sage.

Parker, D. (2006a). Official pedagogic identities from South African Policy-some implications for teacher education practice. *Pythagoras, 63*, 2-17.

Parker, D. (2006b) Grade 10-12 Mathematics curriculum reform in South Africa: A textual analysis of new national curriculum statements. *African Journal of Research in SMT Education, 10*, 59-73.

Potenza, E & Monyokolo, M. (1999). A destination without a Map: premature implementation of curriculum 2005? In J. Jansen and P. Christie (Eds.) *Changing Curriculum: Studies on Outcomes-based Education in South Africa*, 181 – 200. Juta and Co: South Africa.

Pugalee, D.K. (1999). Constructing a Model of Mathematical Literacy. *The Clearing House*, *73*, 19-22.

Rasool, M. (1999). Critical Responses to 'Why OBE Will Fail'. In J. Jansen & P. Christie (Eds.). *Changing Curriculum: Studies on Outcomes-based Education in South Africa,* 181 – 200. Juta and Co: South Africa.

Review Committee. (2000). *A South African Curriculum for the twenty first century. Report of the Review committee on curriculum 2005*. Pretoria.

Robitaille, D.F., McKnight, C.C., Schmidt, W.H., Britton, E.D., Raisen, S.A., & Nicol, C. (1993), TIMSS Monograph No. 1: Curriculum Frameworks for Mathematics and Science, Vancouver, BC: Pacific Educational Press.

Rogan, J. (2007). An uncertain harvest: a case study of implementation of innovation. *Journal of curriculum Studies, 39*, 97-121.

Sax, G. (1979). *Foundations of Educational Research*. USA: Prentice Hall PTR.

Schmidt, W. H., McKnight, Curtis, C., Valverde, R., Gilbert, A., Houang, R.T. & Wiley, D A. (1997). *Many Visions, Many Aims, Vol. 1: A Cross-National Investigation of Curricular Intentions in School Mathematics.* Dordrecht, Netherlands: Kluwer.

Schumacher, S and Macmillan, J.H. (1993). Research in education: A conceptual Introduction. New York: Harper Collins.

Sethole, G. (2004). Meaningful contexts or dead mock reality: which form will the everyday take? *Pythagoras 59*, 18-25.

Shulman, L.S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1-22.

Singh, P. (1997). *Review Essay: Basil Bernstein (1996). Symbolic Control and Identity: Theory, Research, Critique*. London, UK: Taylor and Frances. In British Journal of Sociology of Education, 18(1), pp.119-124.

Skovsmose, O (1994). Towards a critical Mathematics Education. *Educational Studies in Mathematics, 27*, 35-57.

Steen, L. A. (2001). The case for quantitative literacy. In National Council on Education and the Disciplines. In L. A. Steen (Eds*.), Mathematics and Democracy,* 1-22. Washington: The Mathematics Association of America.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage Publications, Inc.

Strauss, A. & Glaser, B. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago: Aldine.

Taylor, N. (1999). Curriculum 2005: Finding a Balance between School and Everyday

Knowledges. In N. Taylor & P. Vinjevold (Eds.). *Getting the Learning Right. Report of the Presidents Education Initiative Research Project*. Johannesburg: Joint Education Trust/Department of Education.

Taylor, N. & Vinjevold, P. (1999). *Getting Learning Right. Report of the President's Education Initiative Research Project.* Johannesburg: The Joint Education Trust.

Taylor, N.; Muller, J. & Vinjevold, P. (2003). *Getting schools Working. Research and Reform in South Africa.* Cape Town: Routledge Falmer.

Todd, A. & Mason, M. (2005). Enhancing learning in South African schools: Strategies beyond outcomes-based education. *International Journal of Educational Development, 25,* 221-235.

Tuckman, B.W. (1978). *Conducting Educational research*. Second edition. USA: Harcourt Brace Jovanovich, Inc.

Van Den HeuvelL-Panhuiven, M. (2005). The role of contexts in assessment problems in mathematics. *For the learning of mathematics, 25*.

Vandeyar, S. & Killen, R. (2007). Educators' conceptions and practice of classroom assessment in post-apartheid South Africa. *South African Journal of Education, 27*, 101-115.

Velupillai, V. (2007). *An investigation into how Mathematics educators teach the outcomes-based curriculum. Unpublished M Sc thesis*, *University of Pretoria.* Pretoria.

Venkat, H. (2007). Mathematical Literacy-mathematics and/or literacy: what is being sought? *Pythagoras, 66*, 76-84.

Venkatakrishnan, H. & Graven, M. (2006). Mathematical Literacy in South Africa and Functional Mathematics in England: A consideration of overlaps and contrasts. *Pythagoras, 64*, 14-28.

Verschaffel, L., De Corte, E. & Borghart, I. (1997). Pre-service teachers' conceptions and beliefs about the role of real-world knowledge in mathematical modelling of school word problems. *Learning and instruction*, 7, 339-359.

Vithal, R. & Bishop, A.J. (2006). Mathematical Literacy: A new literacy or a new mathematics? *Pythagoras*, 2-5.

Vithal, R. (2006). Developing Mathematical Literacy through project work: Ateacher/teaching perspective. Pythagoras, 66, 37-44.

Walsh, C.E. (1991). Literacy as Praxis: A framework and an introduction. In C.E. Walsh (Ed.), *Literacy as Praxis: Culture, language and pedagogy (pp.1-22).* New

Jersey: Ablex Publishing Corporation.

Walton, M. (2008). Is Mathematical Literacy sufficient for entry into a B Com Degree? *Proceedings of the Seventeenth National Congress of the Association for Mathematics Education of South Africa (AMESA) (pp. 280-287*). Port Elizabeth: AMESA.

Whang, W. (1996). The influence of English-Korean bilingualism in solving-Mathematics word problems. *Journal-Educational studies in mathematics*, *30*, 289-312.

Wilkinson, D. & Birmingham, P. (2003). *Using Research instruments. A guide for researchers.* London: Routledge Falmer.

Worchel, S. & Shebilske, W. (1989). *Psychology: Principles and applications. 3rd edition.* Englewood Cliffs, New Jersy: Prentce Hall.

Yin, R. (1994). *Case study research: Design and methods (2nd ed.).* Beverly Hills, CA: Sage Publishing.

Yoshida, H., Verschaffel, L. & De Corte, E. (1997). Realistic considerations in solving problematic word problems: Do Japanese and Belgian children have the same difficulties? *Learning and instruction*, 7, 329-338.

Zevenbergen, R., Sullivan, P. & Mousley, J. (2002). Contexts in mathematics education: Help? Hindrance? For whom? *Proceedings of the 3rd international MES conference* (pp. 1-9). Copenhagen: Centre for Research in Learning Mathematics.

APPENDICES

Appendix 1: Mathematical Literacy questionnaire

Mathematical Literacy Questionnaire

2008

Dear Math Lit. Teacher

Kindly complete this questionnaire as per instruction below.

Instruction

- This questionnaire consists of two parts, Part 1 and Part 2
- Part 1 is about your biographic information and professional, academic and teaching experiences. Part 2 is about your personal experiences of Mathematical Literacy.
- In Part 1 you are required to provide your biographic information.
- In Part 2, you are requested to choose the most appropriate option by marking a cross (**X**)

Note: All information provided will be kept confidential.

Math Lit Questionnaire MLQ001/08-page 2

PART 1: BIOGRAPHIC INFORMATION

		GENDER	**FEMALE**		**MALE**	

NAME OF THE SCHOOL		**CIRCUIT**	

TEACHING EXPERIENCE

SUBJECT	GRADE(S) TAUGHT	NUMBER OF YEARS
LANGUAGES		
LIFE ORIENTATION		
MATHEMATICS		
MATHEMATICAL LITERACY		
SCIENCE		
TECHNOLOGY		
SOCIAL SCIENCES (for example HISTORY)		
BIOLOGY		
AGRICULTURE		
ACCOUNTING		
ECONOMICS		
OTHER		

ACADEMIC EXPERIENCE

QUALIFICATIONS	Name of qualification	Majors/subjects
M	SENIOR CERTIFICATE	
M+3		
M+4		
M+5		
OTHER		

PROFESSIONAL DEVELOPMENT

WORKSHOPS ATTENDED	DURATION (DAYS OR MONTHS) OF THE WORKSHOPS
NCS MATHEMATICS	

NCS MATH LIT	
OTHER	

Mathematical Literacy Resources you have

Curriculum documents	Tick the one(s) you have
Math Lit NCS Policy document	
Math Lit assessment Guideline document	
Teacher Guide for Math Lit document	
NCS Overview document	
Learning Programme Guideline document(LPG)	
Exemplar papers (specify):	
Other district document (for Math Lit) (specify):	
Math Lit Text books(specify):	
Other resources (specify):	

Part 2. Mathematical Literacy related information

2.1 Mathematical Literacy: What is it?

Statement	Strongly Agree	Agree	Unsure	Disagree	Strongly disagree
1. Math Lit is driven by real life context.					
2. Math lit is an easy version of mathematics					
3. Math Lit was designed for those learners who are not capable of doing mathematics					
4. Math Lit is similar to what was called Math SG					
5. Learners who are not taking Math must do Mathematical Literacy.					
6. Math Lit has no clear career links after Grade 12					
7. People do not understand what Mathematical Literacy is.					
8. Math Lit is not an important subject.					
9. In Mathematical Literacy real Life contexts are more important and more emphasized than mathematics content					
10. In Mathematical Literacy both real life contexts and Math content are equally important.					

2.2 Mathematical Literacy: How to teach it?

Statement	Strongly Agree	Agree	Unsure	Disagree	Strongly disagree
1. Teaching Math Lit is easy					
2. Teaching Math Lit is like teaching Mathematics					
3. In Math Lit Learners must first be taught mathematics content and then taught to deal with real life contexts					

4. In Math Lit sometimes it is important that you teach only mathematics content.					
5. Teaching Math Lit is exciting and interesting					
6. In order to teach Math Lit you need a good background of Mathematics					
7. If you taught Mathematics in the FET then you can teach Math Lit.					
8. Special training to teach Math Lit is essential even if you were teaching Mathematics in the FET before.					
9. There are more challenges in teaching Math Lit than any subject.					
10 .Challenges of teaching Math Lit are similar to those in FET Mathematics					

2.3 Mathematical Literacy: Why are you teaching Mathematical Literacy?

I teach Mathematical Literacy because…

____

____

____

____

2.4 My experience of teaching Math Lit is............

____

____

____

____

____

INDICATION TO PARTICIPATE IN THE NEXT PHASE OF THE STUDY (please tick which is appropriate for you)

Willing to participate in the second phase of the study	**YES**	**NO**

Thank you for participation.

For more information call me at 0847600960 (c) or 043 704 7253(w)

Themba Mthethwa

Appendix 2: Interview protocol

Math Lit Interview MLI001/08

INTERVIEW PROTOCOL DATE: TIME:

Name of Interviewee: __________________________ Interview duration: 40 min
Interview method: Semi-structured interview
Focus question: What are teachers' interpretations of the intended Mathematical Literacy curriculum?
Question format: Open-ended questions
Response mode: Recorded by interviewer (Audio-tape)

Introduction

The purpose of this interview is for me to learn from you about your interpretations, understanding and teaching practices of the Mathematical Literacy curriculum. This will inform my PhD study which aims to understand how Mathematical literacy teachers interpret and implement the Mathematical literacy curriculum in FET schools. I am hoping that this study will contribute to supporting curriculum development and teacher development in this subject. This interview will last approximately 40 minutes. You are most welcomed to ask questions of clarity or raise concerns during the interview. The aim of this interaction is to understand your views on the subject under discussion. There are no expected right or wrong answers.

Questions

1. What is your understanding of Mathematical Literacy?

Probe: a) *What is it?*

b) How do you view the purpose, nature and scope of Mathematical Literacy?

2. According to Department of Education the purpose of Mathematical Literacy as a fundamental subject is to ensure that South African citizens become highly numerate consumers of mathematics. From your experience do you see Mathematical Literacy fulfilling this purpose?

Probe: How and/or why?

3. How do you find teaching Mathematical Literacy?

Probe: a) What do you consider to be challenges in implementing the Math Lit curriculum?

b) How do you manage these challenges?

c) What do you see as the positive aspects of teaching Math Lit??

4. How relevant do you find departmental curriculum documents (for Math Lit.) (such as NCS Grades 10-12 policy, assessment guideline, Learning Programme Guideline and The Teacher Guide) in your teaching of Math Lit?

Probe: a) How have you used these documents?(to plan teaching and assessment at the start of the year or on regular bases)

b) What do you find challenging in using these documents?

5. If you were involved in curriculum design for Mathematical Literacy, what would you like to change or to add in the current Math Lit curriculum?

Probe*: Why would you like to make such changes?*

6. Is there anything you would like to add? Anything you would like to share that hasn't been covered in the interview?

Thank you for participating in the interview and providing me the opportunity to learn from you. Your responses were very informative.

Appendix 3: Classroom teaching observation

Mathematical Literacy Observation MLO001/08

1. CLASSROOM OBSERVATION:

How the lesson is introduced.

____

____

____

_

Role of context in the lesson:

____

____

____

How the relationship between mathematical content and context unfold in the lesson.

____

____

____

Nature of learner participation and engagement

____

____

____

Nature of teacher's role in the lesson

Nature of teacher questioning

Teacher responses and feedback to learner's questions and responses.

***2. TEACHER REFLECTION AFTER A LESSON*:**

How is this lesson similar or different from other Math Lit lessons you have taught?

Some key reflections or insights gained during the lesson?

Appendix 4: Letter of permission – at district level

Wits school of Mathematics Education

Wits Education Campus
Johannesburg

LETTER OF PERMISSION
District Director
East London District Office

Dear Sir

I am seeking consent for Mathematical Literacy teachers in your District to participate in a research project that is part of my PhD program at the University of the Witwatersrand. The ***aim*** of the research is to understand how Mathematical Literacy teachers interpret and implement the Mathematical Literacy Curriculum in FET. The study will involve questionnaires, semi-structured interviews and classroom observations. Mathematical Literacy teachers will be asked to fill in a questionnaire thereafter eight teachers will be selected and requested to participate in the study.

The interviews will be reflective and will be based on individual views. With the teachers' permission, I would like to tape record conversations. Observation will involve myself as researcher observing classroom activities. I will not use teachers' names and school names when reporting on this research. The questionnaires, draft interview and observation schedules are attached for your information

It is envisaged that teachers participating in this research will benefit in some ways, including but not limited to, reflecting on their understanding of Mathematical Literacy and their classroom practice.

For further information, please contact me (Mr. Themba Mthethwa, at 0847600960/043 7047254 or by email mthethwat@science.pg.wits.ac.za/ tmmthethwa2002@yahoo.com. tmthethwa@ufh.ac.za

No 28 commissioner street, Fort Hare University. Faculty of Education, SISP – East London or my supervisor Prof M Graven 011 717 3411 mellony.graven@wits.ac.za

Thank you for your cooperation.

Yours Faithfully

Mr Themba Mthethwa

Appendix 5: Invitation letter to participate in a research project

Wits school of Mathematics Education
Wits Education Campus
Johannesburg

Dear Mathematical Literacy Teacher

I am Themba Mthethwa, I'm doing my PhD at Wits university my interest is on understanding how Mathematical Literacy teachers interpret and implement the Mathematical Literacy curriculum in FET. I would like to visit you at your school and explain my research and request that you fill in a questionnaire. Should you be willing to allow me to come and talk to you about this please contact me at 0847600960 or 043-704 7254 or by email mthethwat@science.pg.wits.ac.za/ tmmthethwa2002@yahoo.com. tmthethwa@ufh.ac.za

Thank you for your cooperation.

Yours Faithfully

Mr Themba Mthethwa

Appendix 6: Letter of permission at school level

Wits school of Mathematics Education
Wits Education Campus
Johannesburg

LETTER OF PERMISSION SCHOOL PRINCIPAL

East London District Office

Dear Sir/Madam

Following permission that has been granted by East London District office (see attached letter), I am seeking consent for Mathematical Literacy teachers in your school to participate in a research project that is part of my PhD program at the University of the Witwatersrand. The aim of the research is to understand how Mathematical Literacy teachers interpret and implement the Mathematical Literacy Curriculum in FET. The study will involve questionnaires, semi-structured interviews and classroom observations. Mathematical Literacy teachers will be asked to fill in a questionnaire thereafter eight teachers will be selected and requested to participate in the study. The interviews will be reflective and will be based on individual views. With the teachers' permission, I would like to tape record conversations. Observation will involve myself as researcher observing classroom activities. I will not use teachers' names and school name when reporting on this research. The questionnaires, draft interview and observation schedules are attached for your information. It is envisaged that teachers participating in this research will benefit in some ways, including but not limited to, reflecting on their understanding of Mathematical Literacy and their classroom practice.

For further information, please contact me (Mr. Themba Mthethwa, at 0847600960/043 7047254 or by email mthethwat@science.pg.wits.ac.za/ tmmthethwa2002@yahoo.com. tmthethwa@ufh.ac.za

No 28 commissioner street, Fort Hare University. Faculty of Education, SISP – East London or my supervisor Prof M Graven 011 717 3411 mellony.graven@wits.ac.za

Thank you for your cooperation.

Yours Faithfully

Mr Themba Mthethwa

Appendix 7: First letter of consent

Wits school of Mathematics Education
Wits Education Campus
Johannesburg

LETTER OF CONSENT MATHEMATICAL LITERACY TEACHER
East London District Office

Dear Sir/Madam

Thank you for your indication that you are willing to allow me to approach you and request your participation in my research study. As I said in my initial letter that I sent to your school the aim of my research is to understand how Mathematical Literacy teachers' interpret and implement the Mathematical Literacy Curriculum in FET. This research is part of my PhD studies at Wits University.

At this point I am seeking your consent to participate in Phase 1 of my research project. This phase involves gathering information in the form of a written questionnaire from all willing Mathematical Literacy teachers in the East London district. The aim of the research is to understand how Mathematical Literacy teachers interpret and implement the Mathematical Literacy Curriculum in FET.

The second phase of study will involve semi-structured interviews and classroom observations. Following phase 1 of my study, I will request a small number of teachers to participate.

Please feel free to discuss any concerns you have with me before signing the forms.

For further information, please contact me (Mr. Themba Mthethwa, at 0847600960/043 7047254 or by email mthethwat@science.pg.wits.ac.za/ tmmthethwa2002@yahoo.com. tmthethwa@ufh.ac.za

No 28 commissioner street, Fort Hare University. Faculty of Education, SISP – East London or my supervisor Prof M Graven 011 717 3411 mellony.graven@wits.ac.za

Thank you for your cooperation.

Yours Faithfully

Mr Themba Mthethwa

For Mathematical Literacy teacher:

I ____, hereby agree to participate in the questionnaire with Mr Themba M Mthethwa as explained in the attached letter.

I acknowledge that:

- the aims, methods, anticipated benefits and consequences of research have been explained to me.
-I voluntarily and freely give my consent to my participation in such a study.
- I understand that results will be used for research purposes and may be reported in academic journals
- I am free to withdraw my consent at any time during the study.

Signature ________________________________ Date ____/_____/______

Appendix 8: Second letter of consent

Wits school of Mathematics Education
Wits Education Campus
Johannesburg

LETTER OF CONSENT MATHEMATICAL LITERACY TEACHER

East London District Office

Dear Sir/Madam

Thank you for completing the questionnaire and for indicating willingness to participate in the second phase of my study. This phase involves classroom observation and interviews:

The interviews will be reflective and will be based on individual views. With your permission, I would like to tape record our conversation so as to capture the detail of what you share with me. Classroom observations will involve me observing your classroom teaching. These observations are in no way judgemental of your teaching but are included so that I can learn more about the way in which you are implementing the curriculum. I will not use your names nor your schools name when reporting on this research. The questionnaires, draft interview and observation schedules are attached for your information. If you are willing to participate in this next phase of the research please sign the attached consent forms.

Please feel free to discuss any concerns you have with me before signing the forms.

For further information, please contact me (Mr. Themba Mthethwa, at 0847600960/043 7047254 or by email mthethwat@science.pg.wits.ac.za/ tmmthethwa2002@yahoo.com. tmthethwa@ufh.ac.za

No 28 commissioner street, Fort Hare University. Faculty of Education, SISP – East London or my supervisor Prof M Graven 011 717 3411 mellony.graven@wits.ac.za

Thank you for your cooperation.

Yours Faithfully

Mr Themba Mthethwa

For Mathematical Literacy teacher:

I ______________________________________, hereby agree to participate in the interviews with Mr Themba M Mthethwa as explained in the attached letter.

I acknowledge that:

- the aims, methods, anticipated benefits and consequences of research have been explained to me.

-I voluntarily and freely give my consent to my participation in such a study.

- I understand that results will be used for research purposes and may be reported in academic journals

- I am free to withdraw my consent at any time during the study.

Signature ________________________________ Date ____/_____/______

For Mathematical Literacy teacher:

I ____, hereby agree that Mr Themba M Mthethwa can conduct pre arranged classroom observations in my classroom as explained in the attached letter.

I acknowledge that:

- the aims, methods, anticipated benefits and consequences of research have been explained to me.

-I voluntarily and freely give my consent to my participation in such a study.

- I understand that results will be used for research purposes and may be reported in academic journals

- I am free to withdraw my consent at any time during the study.

Signature ________________________________ Date ____/_____/______

Appendix 9: DoE Permission letter

06-09-08;10:09AM; ; # 1/ 1

Province of the Eastern Cape

DEPARTMENT OF EDUCATION
EAST LONDON DISTRICT OFFICE
Private Bag X 9007, EAST LONDON, 5200, SOUTH AFRICA

Reference	Enquiries	Telephone	Fax	E-mail	Date
Research	A Pillai	0836517498	043-7613440	anil@telkomsa.net	25/08/08

TO; EDUCATION DEVELOPMENT OFFICERS
PRINCIPALS
HOD- SCIENCE & MATHEMATICS

FROM: DCES MATHEMATICS & SCIENCE

SUBJECT: LETTER OF CONSENT

I would like to inform you that the district office has granted permission to Mr.Themba Mthethwa, a PhD student at Wits University in conducting a Mathematics literacy research project in selected FET schools in the district. The aim of the research is to understand how mathematical literacy teachers interpret and implement the intended curriculum in FET.It is our sincere hope that the teacher participation in this kind of research will benefit the teachers as well as the schools.

We therefore request the Principals of the participating schools to give the necessary support to Mr.Themba.

However I would like indicate that the research activities should not disturb Teaching and learning at school as well as other school activities.

Yours in Education

A PILLAI
Deputy Chief Education Specialist

DEPT. OF EDUCATION
ISEBE LEMFUNDO
2008 -09- 0 4
THE DISTRICT MANAGER
PRIVATE BAG X9007
EAST LONDON 5200

Appendix 10 : Teachers' responses on the questionnaires

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ACE Mathematical Literacy	25	41.7	41.7	41.7
	NO ACE Mathematical Literacy	35	58.3	58.3	100.0
	Total	**60**	**100.0**	**100.0**	

Teacher's qualifications

Teacher's Mathematics background

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Pure Math	48	80.0	80.0	80.0
	Mathematical Literacy	12	20.0	20.0	100.0
	Total	**60**	**100.0**	**100.0**	

(i) WHAT IS MATHEMATICAL LITERACY?

Question 1: Mathematical Literacy is driven by real life context

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	40	66.7	66.7	66.7
	Agree	19	31.7	31.7	98.3
	Unsure	1	1.7	1.7	100.0

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	40	66.7	66.7	66.7
	Agree	19	31.7	31.7	98.3
	Unsure	1	1.7	1.7	100.0
	Total	**60**	**100.0**	**100.0**	

Question 2: Mathematical Literacy is an easy version of Mathematics

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	9	15.0	15.0	15.0
	Agree	8	13.3	13.3	28.3
	Unsure	11	18.3	18.3	46.7
	Disagree	24	40.0	40.0	86.7
	strongly disagree	8	13.3	13.3	100.0
	Total	**60**	**100.0**	**100.0**	

Question 3: Mathematical Literacy for learners not capable of doing pure Mathematics

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	6	10.0	10.0	10.0
	Agree	20	33.3	33.3	43.3
	Unsure	12	20.0	20.0	63.3
	Disagree	19	31.7	31.7	95.0
	strongly disagree	3	5.0	5.0	100.0
	Total	60	100.0	100.0	

Question 4: Mathematical Literacy similar to SG Mathematics

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	2	3.3	3.4	3.4
	Agree	5	8.3	8.5	11.9

	Unsure	8	13.3	13.6	25.4
	Disagree	31	51.7	52.5	78.0
	strongly disagree	13	21.7	22.0	100.0
	Total	59	98.3	100.0	
Missing	System	1	1.7		
Total		**60**	**100.0**		

Question 5: Learners who are not taking Mathematics must do Mathematical Literacy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	26	43.3	43.3	43.3
	Agree	22	36.7	36.7	80.0
	Unsure	8	13.3	13.3	93.3
	Disagree	2	3.3	3.3	96.7
	strongly disagree	2	3.3	3.3	100.0
	Total	**60**	**100.0**	**100.0**	

.Question 6: Mathematical Literacy has no clear career links

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	1	1.7	1.7	1.7
	Agree	4	6.7	6.7	8.3
	Unsure	18	30.0	30.0	38.3
	Disagree	24	40.0	40.0	78.3
	strongly disagree	13	21.7	21.7	100.0
	Total	**60**	**100.0**	**100.0**	

Question 7: People do not understand what Mathematical Literacy is

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	8	13.3	13.6	13.6
	Agree	32	53.3	54.2	67.8

	Unsure	10	16.7	16.9	84.7
	Disagree	6	10.0	10.2	94.9
	strongly disagree	3	5.0	5.1	100.0
	Total	59	98.3	100.0	
Missing	System	1	1.7		
Total		60	100.0		

Question 8: Mathematical Literacy is not an important subject

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	1	1.7	1.7	1.7
	Unsure	2	3.3	3.3	5.0
	Disagree	30	50.0	50.0	55.0
	strongly disagree	27	45.0	45.0	100.0
	Total	60	100.0	100.0	

Question 9: In Mathematical Literacy real life contexts are more important than Mathematics content

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	strongly agree	24	40.0	40.7	40.7
	Agree	22	36.7	37.3	78.0
	Unsure	3	5.0	5.1	83.1
	Disagree	8	13.3	13.6	96.6
	strongly disagree	2	3.3	3.4	100.0
	Total	59	98.3	100.0	
Missing	System	1	1.7		
Total		60	100.0		

Question 10: In Mathematical Literacy both content and contexts are equally important.

	Frequency	**Percent**	**Valid Percent**	

Valid	strongly agree	22	36.7	36.7	
	Agree	30	50.0	50.0	
	Unsure	1	1.7	1.7	
	Disagree	6	10.0	10.0	98.3
	strongly disagree	1	1.7	1.7	100.0
	Total	60	100.0	100.0	

(ii) HOW MATHEMATICAL LITERACY IS TAUGHT?

Question 11 Teaching Mathematical Literacy is easy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	7	11.7	11.7	11.7
	Agree	9	15.0	15.0	26.7
	Unsure	2	3.3	3.3	30.0
	Disagree	31	51.7	51.7	81.7
	strongly disagree	11	18.3	18.3	100.0
	Total	60	100.0	100.0	

Question 12: Teaching Mathematical Literacy is like teaching Mathematics

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	6	10.0	10.3	10.3
	Agree	10	16.7	17.2	27.6
	Unsure	3	5.0	5.2	32.8
	Disagree	32	53.3	55.2	87.9
	strongly disagree	7	11.7	12.1	100.0
	Total	58	96.7	100.0	
Missing	System	2	3.3		
Total		60	100.0		

Question 13: In Mathematical Literacy learners must be taught content then contexts

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	strongly agree	16	26.7	26.7	26.7
	Agree	25	41.7	41.7	68.3
	Unsure	3	5.0	5.0	73.3
	Disagree	13	21.7	21.7	95.0
	strongly disagree	3	5.0	5.0	100.0
	Total	60	100.0	100.0	

Question 14: In Mathematical Literacy sometimes it is important to teach only Mathematics content

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	strongly agree	3	5.0	5.1	5.1
	Agree	14	23.3	23.7	28.8
	Unsure	7	11.7	11.9	40.7
	Disagree	28	46.7	47.5	88.1
	strongly disagree	7	11.7	11.9	100.0
	Total	59	98.3	100.0	
Missing	System	1	1.7		
Total		60	100.0		

Question 15: Teaching Mathematical Literacy is exciting and interesting

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	29	48.3	49.2	49.2
	Agree	24	40.0	40.7	89.8
	Unsure	1	1.7	1.7	91.5
	Disagree	5	8.3	8.5	100.0

	Total	59	98.3	100.0	
Missing	System	1	1.7		
Total		60	100.0		

Question 16: To teach Mathematical Literacy you need a good Mathematics background

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	18	30.0	30.0	30.0
	Agree	33	55.0	55.0	85.0
	Unsure	4	6.7	6.7	91.7
	Disagree	3	5.0	5.0	96.7
	strongly disagree	2	3.3	3.3	100.0
	Total	60	100.0	100.0	

Question 17: If you taught Mathematics before you can teach Mathematical Literacy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	16	26.7	27.1	27.1
	Agree	31	51.7	52.5	79.7
	Unsure	7	11.7	11.9	91.5
	Disagree	3	5.0	5.1	96.6
	strongly disagree	2	3.3	3.4	100.0
	Total	59	98.3	100.0	
Missing	System	1	1.7		
Total		60	100.0		

Question 18: Special training to teach Mathematical Literacy is essential even if you were teaching Mathematics in the FET

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	25	41.7	41.7	41.7
	Agree	20	33.3	33.3	75.0
	Unsure	1	1.7	1.7	76.7
	Disagree	11	18.3	18.3	95.0
	strongly disagree	3	5.0	5.0	100.0
	Total	60	100.0	100.0	

Question 19: There are more challenges in teaching Mathematical Literacy than any subject

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	15	25.0	25.0	25.0
	Agree	18	30.0	30.0	55.0
	Unsure	8	13.3	13.3	68.3
	Disagree	17	28.3	28.3	96.7
	strongly disagree	2	3.3	3.3	100.0
	Total	60	100.0	100.0	

Question 20: Challenges of teaching Mathematical Literacy are similar to those in FET Mathematics

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	strongly agree	4	6.7	6.7	6.7
	Agree	24	40.0	40.0	46.7
	Unsure	13	21.7	21.7	68.3
	Disagree	16	26.7	26.7	95.0
	strongly disagree	3	5.0	5.0	100.0
	Total	60	100.0	100.0	

Gender distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	21	35.0	35.0	35.0
	Female	39	65.0	65.0	100.0
	Total	60	100.0	100.0	

Mathematics background

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Pure Math	48	80.0	80.0	80.0
	MATHEMATICAL LITERACY	12	20.0	20.0	100.0
	Total	60	100.0	100.0	

Qualifications In MATHEMATICAL LITERACY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ACE MATHEMATICAL LITERACY	25	41.7	41.7	41.7

	No ACE MATHEMATICAL LITERACY	35	58.3	58.3	100.0
	Total	60	100.0	100.0	

Appendix 11: Qualitative data analysis

Teacher	Comments or Statements on/about Math Literacy	Key theme	Who
Teacher 1	Mathematical Literacy makes learner work place situation ready Is not soft kind of Mathematics	Nature of ML Purpose of ML	*Learners*
Teacher 2	Qualified to teach Love Mathematical Literacy It is a challenging subject Opens eyes I have learnt to economize, invest at the right bank	Academic qualification of a teacher Positive attitude of a teacher Nature of ML Teacher identity Personal gain	*Self*
Teacher 3	Was asked to teach I like it It is easier than Mathematics Learners like it Learners understand it Children love it Learners pass it except the lazy ones Learners find it easy	Decision making-who to teach ML Positive attitude of a teacher Positive attitude of the learners Nature of ML Learners' achievement in ML	*Learners*
Teacher 4	I like to help learners to solve problems Mathematics is one of my interesting areas It very nice It deals with real life context Learners are helped to manage their finances Mathematical Literacy puts a lot of confidence for life into learners	Teaching approach-pedagogical strategies Positive attitude of a teacher Nature of the subject Role of ML for learners	*Learners*
Teacher 5	It deals a lot with real life issues It is more interesting for learners Learners understand it Learners enjoy it Thought it is easy but it has also some challenges It must not be taken lightly Some learners still struggle	Nature of ML Learners positive attitude Learners' understanding and challenges Teacher change	*Learners* *Self*
Teacher 6	I have a passion in Mathematics and Mathematical Literacy	Positive attitude of a teacher	*Self* *Learners*

	I love subject that deals with numbers Students don't take Mathematical Literacy seriously	Learners negative responses	
Teacher 7	I like Mathematics I was trained as Mathematical Literacy teacher Math Lit is exciting and challenging	Positive attitude of a teacher Nature of ML Academic	*Self*
Teacher 8	I like to relate Mathematics to real life Ml is exciting	Teaching approach Nature of the subject/ML	*Self*
Teacher 9	I was trained as Mathematical Literacy teacher I like it I love Mathematical Literacy It helps me in my own life It has challenges	Academic Positive attitude of a teacher Personal gain	*Self*
Teacher 10	It prepares learners to be participative citizens, contributing workers, life-long learners and self managing person It helps learners in everyday life	Nature and purpose Ml	*ML* *Learners*
Teacher 11	Mat Lit is easy to teach than Math It is not a challenging subject It is a basic Mathematics For university admission learners have to learn Mathematics not Mathematical Literacy	Teaching Nature of the subject	*Self* *Learners* *ML*
Teacher 12	I find it more rewarding than pure Mathematics I find it more interesting and realistic I love challenges It is not SG Mathematics It is fascinating It prepares learners for real world even after matric, eg Hire purchase and Bonds	Self gain Positive attitude of a teacher Nature of ML Purpose of ML	*Self* *Learners* *ML*
Teacher 13	I am interested in numeracy-the one based on real life Mathematical Literacy can help learners in dealing with real life problems, eg finances Not all Learners can do Mathematical Literacy Learners must not do either math or	Positive attitude of a teacher Purpose of ML	*Learners* *Curriculum*

	math lit		
Teacher 14	I was told teach Mathematical Literacy Anybody with basic Mathematics can teach Mathematical Literacy without problem	Decision making Teaching	*School*
Teacher 15	I am qualified Mathematics teacher Attended NCS Mathematical Literacy workshops I enjoy teaching Mathematical Literacy Learners realize that Mathematical Literacy is useful in their daily life From my experience learners with good language and interpretation skill do achieve well in Mathematical Literacy Mathematical content is very basic No good Mathematical Literacy text books- preparation is challenging	Academic Professional development Learners achievements Challenges Resources	*Self* *Learners*
Teacher 16	I was asked to teach ML It is not as easy as teaching pure Mathematics	Decision making Teaching Staffing	*School*
Teacher 17	I did ACE ML I like ML ML is interesting ML deals with real life problems	Academic qualification of a teacher Positive attitude of a teacher Purpose	*Self*
Teacher 18	I have passion for numbers I like to teach ML Learners have a problem with the language	Positive attitude of a teacher Challenges in learning	*Self* *Learners*
Teacher 19	ML enable learners who were previously disadvantaged to access Mathematics Students still have attitudes in ML	Opportunity to do mathematics	*Learners*
Teacher 20	I enjoy teaching ML ML is a very good subject to teach It deals with real life and everyday situations	Positive attitude of a teacher Nature Purpose	*Self* *ML*
Teacher 21	I enjoy teaching ML ML is challenging for learners because of language	Positive attitude of a teacher Challenges	*Self* *Learners*
Teacher 22	There is a shortage of ML teachers then I had to teach it	Decision making	*Self*
Teacher 23	I like ML ML helps learners to budget	Positive attitude of a teacher	*Learners* *Self*

	ML Creates jobs for themselves eg dress making and Plumbing	Purpose	
Teacher 24	I was teaching Mathematics before I opted to teach ML I really enjoy teaching ML Teachers can generate interest to the learners ML provides a chance for learners who do not have a potential to do Mathematics ML is important	Positive attitude of a teacher Purpose of ML	*Self* *Learners*
Teacher 25	I was curious to see what the content deals with ML is enjoyable ML is a basic skill needed by everybody including Math Learners ML prepares the learner for dealing with real-life situations	Self motivated Positive attitude of a teacher	*Self* *Learners*
Teacher 26	It is essential that SA students have to be Mathematically literate Related to real life and everyday activities ML is relevant to modern and technological world. ML is not a subject to side-step pure Mathematics but a compulsory subject that everyone should have. ML is a symbol of true citizenship	Purpose Nature of the subject	*ML*
Teacher 27	I did ACE ML ML is easy for learners Learners understand ML It is not easy to teach ML Math background is required to teach ML It is important to undergo ML training	Academic qualification of a teacher Teaching Learners' understanding	*Self* *Learners*
Teacher 28	Learners lack basic numeracy I love teaching ML I also teach Mathematics ML makes it easier for me because it deals with Mathematics principle put in a practical context	Positive attitude of a teacher Teaching	*Self*
Teacher 29	ML is one of my major subjects I teach ML in order to equip the learners to solve our day to day problems	Academic Problem solving	*Self*

	I teach ML to eliminate the bad element that Mathematics is the arena for few It is difficult to teach Learners lack basics ML is time consuming when coming to teaching and learning		
Teacher 30	It is interesting and challenging It deals with real life situations I am also learning to mange my finances and tax ML helps learners to contribute in their communities Learners experience problems in interpreting word sums into mathematical equations due to the language Learners struggle to understand questions Teachers need to involve learners practically in classes	Nature of ML Self gain Learners' achievements Challenges Teaching	*Self* *Learners*
Teacher 31	I was teaching Mathematics before I am now feeling very comfortable and enjoying teaching ML	Positive attitude of a teacher Teacher change	*Self*
Teacher 32	I like ML It deals with real life situations Learners sometimes experience difficulties to understand some concepts	Positive attitude of a teacher Challenges	*Self* *Learners*
Teacher 33	I love teaching ML It is a subject driven by real life	Teaching Positive attitude of a teacher Nature of ML	
Teacher 34	Most people look down upon Ml I love ML ML assist learners to develop numeracy skills Learners struggle to have calculators Learners do not want to do corrections and homework Learners struggle to understand language In ML it is difficult to differentiate between Paper1 and Paper 2 topics	Nature of ML Purpose Challenges Classroom	*Others* *Learners*

Teacher 35	ML develop logical thinking in learners ML prepares learners for real life situations, even after schooling Learners cannot relate the concepts to real life situations Language is a real problem to learners-it can make them loose interest	Purpose Challenges	*Learners*
Teacher 36	ML develops critical thinking, numeracy skills, logical thinking in learners Language is a problem	Language Purpose	*Learners*
Teacher 37	ML is exciting subject A challenge is that some learners and educators have negative attitude toward ML Most learners lack Mathematics background Language is a problem	Nature of ML Challenge-learner attitudes and background language	*Learners*
Teacher 38	I was appointed to teach ML	Staffing	*School*
Teacher 39	I was asked to teach Ml	Staffing	
Teacher 40	ML can be applied to real life situation ML –educational for parents as well, Learners learn ML to help their parents at home Learners find it challenging and interesting	Nature of ML	*Learners*
Teacher 41	ML is not abstract as Mathematics It is real-life situation Context used should be of the learners' real life In examinations, contexts used are not familiar to the learners	Nature of ML Teaching	*Learners*
Teacher 42	I do not have Math background Doing Mathematics was my dream, now it is fulfilled through ML Learners from urban areas do better in ML than those from rural Some learners have attitudes towards ML	Self gain	*Self* *Learners*
Teacher 43	I did ACE ML It is interesting Language is a barrier Lack of resources ML equips learners to solve real-life	Challenges Language, Resources Academic qualification of a teacher	*Self* *Learners*

	problems		
Teacher 44	I got a post I have good Math background	Self gain	*Self*
Teacher 45	ML caters for the learners who cannot cope with Mathematics ML is a hands-on learning Area Learners enjoy it	Purpose and aim	*Learners*
Teacher 46	I find it interesting It is challenging-to get learners to find link between content and real life contexts One has to find common grounds between content and real life context	Self gain	
Teacher 47	Great demands of ML in our school Many learners choose it It is exciting It is interesting and it is important that everyone to be mathematical literate Learners must be able to read and write in order to understand ML	Purpose	*Learners*
Teacher 48	Exciting, challenging, informing and is based on real life situations	Nature of the subject	*Subject*
Teacher 49	I was trained Some learners have a negative attitudes towards mathematics related topics	Academic/professional development Attitude	*self* *Learners*
Teacher 50	I like it I like challenges	Self	*Self*
Teacher 51	I have the love of working with numbers You have to be patient when teaching ML because some learners don't like numbers Mathematical Language and English can be a problem for learners	Challenges Language ,	*Self* *Learners*
Teacher 52	I want to empower learners who are not good in Mathematics My learners are more interested in ML-it involves real life	Teaching	*Learners*
Teacher 53	No one was available to teach ML Initially history students were not	Teaching and learning Staffing	*Self and learners*

	confident to do ML-but later they achieved good results		
Teacher 54	I like Mathematics and ML Teaching ML gives me an opportunity to help the learners in all learning spheres Learners in Grade 10 struggle a bit as compared to Grade 12 learners	Self and teaching	*Self and learners*
Teacher 55	I did ACE ML I have a lot of knowledge	Self Academic qualification of a teacher	*Self*
Teacher 56	It is relevant to our daily life Language is a barrier	Challenges – language	
Teacher 57	There was no teacher to teach it I did Ace ML I love the subject The learners have a problem to understand the language of instruction Some learners have a problem to understand a context Most learners in Grade 10 do not have basic mathematics skills	Self Challenges- language, Academic qualification of a teacher Staffing	*Self and learners*
Teacher 58	We have less teachers at our school Three years	Staffing	*Self* *School*
Teacher 59	I didn't do mathematics in tertiary or standard 10 I like mathematical literacy Learners are doing well English is a barrier in townships Learners struggle to interpret some words	Mathematics background, Challenges-language	*Self* *Learners*
Teacher 60	I want to guide and lead learners to develop problem solving skills to help learners communicate to see learners enjoying Mathematics eradicate fears of Mathematics from learners	Broad perspective Purpose and aim of the subject	*Learners*

Appendix 12: Interview transcripts

Interview duration: 40 min

Interview method: Semi-structured interview

Focus question: 1. What are teachers' interpretations of the intended Mathematical Literacy curriculum?

Focus question: 2. How do teachers implement Mathematical Literacy in Grades 10 – 12

Question format: Open-ended questions

Response mode: Recorded by interviewer (Audio-tape)

Introduction

The purpose of this interview is for me to learn from you about your interpretations, understanding and teaching practices of the Mathematical Literacy curriculum. This will inform my PhD study which aims to understand how Mathematical literacy teachers interpret and implement the Mathematical literacy curriculum in FET schools. I am hoping that this study will contribute to supporting curriculum development and teacher development in this subject. This interview will last approximately 40 minutes. You are most welcomed to ask questions of clarity or raise concerns during the interview. The aim of this interaction is to understand your views on the subject under discussion. There are no expected right or wrong answers.

Interview with Khumalo

Themba: *What is your understanding of Mathematical Literacy?*

Probe: *What is it?*

Khumalo: I don't know where to start but I would say this ML to me is a subject introduced in our curriculum, basically which equip learners with mathematical knowledge that can be applied to everyday life.

Probe: *and what is its purpose?*

Khumalo: Basically, I should think, the purpose is.. Since Mathematics it is and it has been part of our day life, every day we need background knowledge of mathematical application. I think then the DoE has decided to teach it formally where all learners will be equipped, so as to equip the future citizens, as we know that learners are the future citizens. So they need the background, they need knowledge, ability to use the mathematical knowledge.

Themba: *According to Department of Education the purpose of Mathematical Literacy as a fundamental subject is to ensure that South African citizens become highly numerate consumers of mathematics. From your experience do you see Mathematical Literacy fulfilling this purpose?*

Probe: How and/or why?

Khumalo: As of now, we are almost there. We are almost there; we are on the right track. I can't confidently say we are saving the purpose, eeh, because we still have got a lot to deal with. There are still some learners with a negative attitude. Some learners confuse ML with Mathematics. Some learners had negative attitude towards Mathematics so that also applies in Mathematical literacy . The reason I am saying this that we are almost there is because now we can see the learners' attitude is now changing. You can now see learners are eager to use calculators. Their numeracy levels are improving. They can now work difficult mathematical problems. I can say we are not 100%

Probe: *does the curriculum per se have any potential to equip the learners?*

Khumalo: For me, it does have a potential [to ensure that South African citizens become highly numerate consumers of mathematics] even if you look at the topics that form part of the curriculum, this are relevant topics, real life related topics.

Probe: *Like what?*

Khumalo: for example, if you look at Learning Outcome 3, Space, shape and measurement-all these sections that are included, they are life related. Even the examples or scenarios we are using, if we talk of areas, you talk of the floor that needs to be tiled, the learners, talk of the wall that needs to be painted. So they are really relevant to me.

Themba: *How do you find teaching Mathematical Literacy?*

Probe: *What do you consider to be challenges in implementing the Math Lit curriculum? How do you manage these challenges?*

Khumalo: Ya, when come to the challenge to teaching it is difficult to find the relevant teaching strategies. For instance, you find yourself going back to the traditional style where you stand in front of the class and just talk, talk and talk. Even though we know that that should not happen. We as teachers we suppose to guide the learners. This is because of the lack of maximum participation from the learners. You end up deliberating everything to the learners, asking questions. Which suppose to be the first part of the lesson.

Probe: *you said there is something lacking from the learners?*

Khumalo: They lack max participation in class. For instance, if you guide them with questions you might end up not reaching the stage you wanted to reach with your lesson. So that forces us sometimes to go to traditional methods.

Probe: *have you experienced any problem with math background of the learners?*

Khumalo: Ya that has been a biggest question, as to where to start, do you start with a content or context. My belief is you teach content within context, because for me you have to use what they have already learnt to get what they need to learn. The content should be taught within the context.

Probe: *where do you see a great challenge amongst these three Grades?*

Khumalo: For me the challenge is greater in Grade 10. Grade 10 learners are from mathematics class, they are from the GET which makes it difficult for them- with ML there is a Language as a challenge. It means as a teacher you need to break language barrier and then introduce the subject which is ML. you need to use mathematics as a stepping stone to introduce ML. At the same time you mustn't forget the language that it is a problem even if you are trying to create a scenario for them you, you are trying to give them examples-you need to, sometimes translate to it, to bring them on board. So the class experiencing most problems is Grade 10.

Probe: *Is this problem of a Language only occurs in ML?*

Khumalo: Ya language is a problem in general, but the reason I cite language as problem in Ml is because if you look at ML, yes they need a basic math knowledge but they first need to interpret what is presented to them. So they can't be able to use basic mathematical knowledge without the proper understanding of what is required.

Themba: *What do you see as the positive aspects of teaching Math Lit?*

Khumalo: for me, when it come to LO 3, I might appear mentioning LO 3 now and again, for me everything that is in class, something that assist me in teaching I use box of chalk, I use walls as resources for my lesson. So you do not find it difficult to get teaching resources for the lesson. There is one thing positive about the subject. And if you bring the subject to context. Sometimes you even refer learner back to their rural areas to refer to RONDERVIL and you can then talk about volumes and cylinder etcetera you can bring the bottle of water in class to teach

Themba: *How relevant do you find departmental curriculum documents (for Math Lit.) (such as NCS Grades 10-12 policy, assessment guideline, Learning Programme Guideline and The Teacher Guide) in your teaching of Math Lit?*

Probe: *How have you used these documents? (to plan teaching and assessment at the start of the year or on regular bases);* : *What do you find challenging in using these documents?*

Khumalo: In the past it was very time consuming to plan for the class, for NCS class. This year they have decided with the lesson plans. In the past two years we used to sit down with the LPG, AG all documents to plan. You were to use all these documents, and you were to familiarise yourself with all these documents. But now they have made our work very easy, they supplied us with the lesson plan; you just have to modify the lesson plan. They supply us with the pace setters, work schedule, they supply us with everything. For us is just to modify what has been supplied and take it to the class.

Probe: *If you take the lesson plans that have been supplied by the Government without modifying is there any problem? How ready are these lesson plans?*

Khumalo: for me I think a lesson plan should be a personal document; it should be developed by the individual. You need to adapt it to your situation for instance, if you are talking about the teacher who is teaching in rural area, urban area, semi-urban areas, those they will have diff contexts, hence you need to modify the lesson to suit the context. The set of learners as well. You can teach the same lesson at Grade 12a and 12b but you need to adjust the lesson to suit the level of the learners. There is no way that you can just use these lesson plans as they are.

Probe: *What now do you find challenging in the use of policy documents?*

Khumalo: things are better now; I cannot say there are no challenges. Because we are still short of support material, you have to group the learners to use one textbook. Mentioning the textbook, we have different textbooks and most of these textbook are not informed by policies, they do not translate what is in our work schedules. In order to cover your work schedule you need to use various textbooks. These textbooks are not available to the learners, they are only available to the teachers. You work with 100 learners only to find that you have 10 text books. In any learning the most important resource is a scientific calculator, but you will find that in a class of 30 learners you find that there are only 3 learners with calculators. Then they struggle to get it. Some of the learners cannot afford to buy calculators and mathematical set. I can say this is the one of the challenges. I won't say this is the Departmental problem but it is a challenge because we are dealing with the learners of different socio-economical background.

Themba: *If you were involved in curriculum design for Mathematical Literacy, what would you like to change or to add in the current Math Lit curriculum?*

Probe: *Why would you like to make such changes?*

Khumalo: for me I would go straight to LO4 data handling. I think there is too much work there. Well stats is ok but when you go to quartiles etcetera this need to be cut off. The purpose is not to low the standard of ML but to bring what is needed by the learners for real life. We need to stick to the topics that the learners will need in the real life. Otherwise other topics are ok, because trig section was long taken out which was included in the early year.

Probe: Are you Happy with that?

Khumalo: yes, I am happy. One important thing that we must know, we are equipping these learners fit in the modern world. This ml is not designed for learners who want to continue with math in high education. So I am happy.

Themba: *if people say ML is not important subject and should be removed from the curriculum - what would be your comment?*

Khumalo: NO I would strongly disagree with that, one thing I should say is the fact that, it is the one of the most important subjects. Because there are many people have majored in Mathematics but still they are not Mathematical Literate. For example, there people who can sit down and work out those mathematical equations and formulas but they have difficulties to take that into the real life situation. They can't. Another examples, we have got people who have majored in Mathematics but who still continue to debt themselves, they sign bonds, they sign higher purchase agreements without using their Mathematics to inform their decision. Ml is one of the important subjects. If it is implemented and sustained correctly, it will bring good results in our country. Even the present down turn in our economy it can help.

Themba: *in short can you tell me what you have observed or experienced since you started teaching ML?*

Khumalo: you know, at first when the Ml was introduced every teacher thought he/she can teach ML. ML was perceived as the easiest subject that can be done by everyone. Secondly, teachers channelled all those learners who were not doing well in mathematics to do ML. coming to classroom; I was faced with the challenge of (negative) attitude from the learners. Most learners perceived ML as mathematics, one of the difficult subjects, a subject that can be done by specific learners who are clever. That was their perception.

When I started teaching then, I started to show them the good side of ML. I analyzed our daily situations where I told them that there is no need to have negative attitude towards ML- because you use ML every day. If you take a taxi and you sit in the front seat, you have to give change to the passengers. You have to use basic operations of Mathematics.

I managed to win their hearts, everyone then was willing to participate in class. We shared our experiences, talking about the use of mathematics in general.

The first assignment I gave them- I asked them to identify the use of mathematics in their everyday life. When they came back, I managed to boost their egos. They felt ready to be part of my class. As a result their enthusiasm was there to those learners until they passed their Grade 12. This is evident since I got 91.4% pass in Grade 12 last year even though I was given those learners who were considered incompetent in Mathematics. I would say it serves the purpose. And basically when it comes to teaching and attitude of the learners , if you as a teacher try by all means to break that attitude, try to make the subject accessible to all learners try to motivate the learners to feel that they are part of the lesson with you.

Probe : *what kind of attitude you are referring to?*

Khumalo: basically, the negative attitude is the fact that learners still perceive ML as Mathematics, and we know that most learners perceive Mathematics as a difficult subject. In my class I always correct my learners when they say “it is a Mathematics period” I say to them it is not Mathematics period but ML period. ML is not Mathematics. I hear some learners saying: “i will never pass this subject(ML). That is the attitude i am talking about. So as teachers we need to break that fear, because it is a fear from the learners, we need to try to motivate them to see that it is accessible subject, and the subject with the good intent, because once they know the purpose of the subject they will form part of whatever is happening in the classroom.

Themba: *Is there anything you would like to add? Anything you would like to share that hasn't been covered in the interview?*

Khumalo: ya, as of now we as ML teachers we really not sure where we belong. There are teachers who teach only Ml and those who teach both Ml and Mathematics. As of now those teachers teaching both Ml and Mathematics are well recognized

Thank you for participating in the interview and providing me the opportunity to learn from you. Your responses were very informative.

Interview with Susan

Interview duration: 40 min

Interview method: Semi-structured interview

Focus question: 1. What are teachers' interpretations of the intended Mathematical Literacy curriculum?

Focus question: 2. How do teachers implement Mathematical Literacy in Grades 10-12

Question format: Open-ended questions

Response mode: Recorded by interviewer (Audio-tape)

Introduction

The purpose of this interview is for me to learn from you about your interpretations, understanding and teaching practices of the Mathematical Literacy curriculum. This will inform my PhD study which aims to understand how Mathematical literacy teachers interpret and implement the Mathematical literacy curriculum in FET schools. I am hoping that this study will contribute to supporting curriculum development and teacher development in this subject. This interview will last approximately 40 minutes. You are most welcomed to ask questions of clarity or raise concerns during the interview. The aim of this interaction is to understand your views on the subject under discussion. There are no expected right or wrong answers

Themba: what is your understanding of Mathematical Literacy?

Susan: Mathematic Literacy is a Mathematics that is used in contexts where by learners are expected to know how to calculate. Therefore they need to know their concepts and whatever they have to apply the way they are going to apply; I think it is everything that deals with Mathematics

Themba: What do you think is the purpose and scope?

Susan: The purpose of this mathematics literacy since we are coming from the back ground of apartheid now there were learners who were doing the NATED 550 then those learners where given the chance that they cannot do mathematics, they can choose not to do it or choose to do it. Now that there is that gap between that generation in this world the government felt that people are mathematically illiterate so they had to introduce Mathematical Literacy so that those people who didn't have the chance of doing Mathematics because they think it is too difficult for them, now they are going to do Mathematical Literacy but it is going to apply where the knowledge of Mathematics in the real life situation

Themba: From your experience, do you think Mathematical Literacy fulfils its purpose?

Susan: Yes it does fulfil this purpose because now if we are looking at the aims of teaching Mathematical Literacy we need to meet those learners to be self managed, now if they know how they are going to conduct themselves when they go out of the world, they are working, they won't need these '*Mashonisa'* (short loans),they know which banks they are going to use for getting the loan and they will minimise the process of getting to the bank for loans because they have to save, they are going to do the budgeting, they need to have the budget because while you do fail to utilise your money because you didn't budget properly so if you can follow the correct budgeting strategies then you are not going to follow that. I have got so many learners who have come out of the system now. They were doing Mathematics Literacy they are using that Mathematical Literacy knowledge at work. They are calculating, for instance the other one is working at *BUILD IT*, now what they are doing is they are calculating each and everything there, people are coming there to buy material, they know how to calculate the costs of the material that is needed, even the quantity of the material that is needed for the building there because they will bring them the building plans and they are able to interpret the building plans. In the plan the scale is used and they have to convert it so that they know how much material is needed for the building so they are referred to my learners and i it is working. Also to be a citizen, we are talking about census that is coming next year. Who is going to do that? You are going to interpret that you have to collect data you have to do that, so those people they need that, so that you have to contribute in the society you are in. So the purpose of this Mathematic literacy is going to fulfil this one if they do that Mathematical literacy but the problem is that our learners do not have enough Mathematical knowledge from Primary upwards, when they get to FET they should come with some knowledge with them but it is lacking and we are building on that.

Themba: How do you find teaching Mathematical Literacy, including the challenges in teaching it?

Susan: It is fascinating because the learners deal with what is actually done every day because each and every day these learners are engage in buying and selling, they are engage in cooking, they know how much quantity is needed ,so it is more practical than Mathematics. I feel it is better but its needs somebody who has got insight (the learner) and also even the teacher because you will find that if I am talking about a Kilometre you will find that the learner does not have a picture on how big the kilometre is, even a Metre, they must know how long is Metre they can estimate because they have to learn on how to estimate there.

Probe: What are the challenges in teaching the subject, from your experience?

Susan: My first challenge is Language because Mathematical Literacy must be in context, now they have to be given a certain context and in that scenario and than interpret whatever they have to do and than there are key words that they need to take care of them, if they do not take care of those words then they miss the problem. for instance if there is 30% increase , let say you say somebody was earning R1000 and then you got 5% increase what they will do is to calculate that 5% of R1000 and then its ends there, they wont include that one in that salary ,so those are the technical things that we need to do and also if there is a session which it does with the map work, they do not like that one, in LO3 they do not like it at all because they have to deal with bearing and when dealing with bearing, you have to measure angles and then you find that somewhere down the line they never measured any angles and they do not understand angles then its directions, as well so there is that geography which is there now they do not understand it , it's a lot.

Probe: You also mentioned the issue of mathematics background. How does it impact in the learning of Mathematical Literacy?

It does impact because it is very important that they have a good background of Mathematics because you are teaching Mathematics in context so that means that Mathematics which is the context; which is needed there they have to apply it, so if they don't have it they won't have the chance of getting solutions. So in my experience I have observed that most learners lack in the mathematical Literacy background which is a real problem for them especially if you take fractions, when you are teaching in FET you do not expect a child who has passed Grade 9 not to know how to add, subtract, multiply and divide fractions because you know those basic operations were dealt with in the primary level and in Grade 8 and 9.

Themba: What is the positive aspect of teaching Mathematical Literacy?

Susan: Learners like it, when they understand it they will master because they master some of the sections for example paper one because it does not need more reasoning it is more calculations, if you have shown them how to calculate, they will know how to calculate but when you have to ask the reasons they do not want to think, that is why they say paper two is very difficult.

Themba: How do you find the policy documents of Mathematical Literacy in your teaching?

Susan: They are helpful because you have to be guided with something but the problem now with it, what we are having is the policy document. The Policy document was written long ago it needs to be at revived-there must be a revision of this one because in that policy document there will be trigonometry, Pythagoras is not there, you will find that the learners were required to calculate the value of x using the formula $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ it is not in Mathematical Literacy but it is in mathematics so a lot a has to be taken out even the texts books now they were written based on the policy document and then that why now the teachers do not even know which section to teach and which section not to teach .

Themba: do you think some mathematical formulae and topics which mathematical should be removed?

Susan: Yes some topics must be removed because they are misleading because you will find that Most of the teachers will teach Trigonometry where else the learners go to the exams there is no trigonometry. Then if now we are telling them that this section is not there they will say how to know it because it is thee in the policy document now i am guided by the policy document not by somebody else so it is you against the policy document.

Themba: Do you find some topics irrelevant in ML?

Susan: Yes take for instance Pythagoras, when you are calculating sometimes you find that there is something that is challenging so now you have to enclose the Pythagoras Theorem.

Themba: do you think trigonometry should be included?

Susan: Yes I think trigonometry must be included because you need to use those values when you are calculating something, take for instance you are not given the another side, lets say one side and there is an angle it is easy to get that side so now if you are not using this trigonometry you are stuck so you have to. I think we can include a little bit of it few sections because when we were trained we've heard a little bit of this trigonometry and then even the Cosine, the Sin rules were there and that's all.

Susan: Those teachers who were trained succeeded because this was part of our programme.

Themba: Do you think one who has good Mathematics background needs any training for ML?

Susan: To my own view you have to undergo a training because I was a Mathematics teacher before I became a Mathematic Literacy teacher so what you find is that when you are dealing with Mathematics everything is clear, the instructions are clear for instance if they say divide ,Factorise, do this, they instruct you so you know what you are going to do but now with Mathematic Literacy you have to find out which operations you are going to use, it is not specified so you must know how you are going to apply it so now its needs more understanding of what you have but you need to have more of Mathematic background as well as how to apply it practically.

Themba: Any difference between mathematics and mathematical literacy teaching?

Susan: The problem with Mathematics is that it is theoretically but Mathematical Literacy is practical now I can see that there is a big difference between these two subjects because whatever I received and acquired in Mathematics it was not easy for me to apply practical now for Mathematic Literacy I have to use that information. I would be handling it because of content but now when it comes to how I teach it in the contextual of it than I would be having a problem because if now you are looking at somebody who is a Mathematical teacher and has got to set even a paper you will find that they are tempted to direct these learners because Mathematics is straight forward and Mathematical Literacy is not straight forward because you have to get those scenarios so that the learner must know how to go about because it is there to solve the real life problem it is not just as easy as that Mathematics.

Themba: any challenges in ML?

Susan: Yes there is a challenge because if now we have to plan, we are planning a lot because you start with the overall one but you have to do the work......and then the lesson plans but you find that these lesson plans have to change everyday due to the different scenarios because you cannot say that you are going to stick on the same one and then even the teacher guide is for different people so you have to change the way you are going to focus and then tattle this one.

Themba: What don't you like in the present curriculum?

Susan: What I do not like in the present curriculum is the first part of calculating, it is there in paper One, they will always give you the direction but in paper Two it is not there; and that is the section of simplifying-its a lot of simplification but I think they are encouraging these learners to get more marks. The problem with them is that when they get to Mathematical Literacy they have to apply that knowledge, this one is simply calculations you just press the calculator and then it does the everything for you but when you have to apply its another thing its, its not the same application so that's how these differ.

Themba: if context is not included do you think ML can still exist?

Susan: Its wont be Mathematical Literacy because its Routine working, its that challenging, these learners have to solve real life problems, it's not solving the problem if you are calculating 1+1 you are not solving this one you must know how to calculate it, let's say if you want to buy material if you know you have got One Metre you know that you are going to buy One Metre or Two Metre without waste so this is 1+1 is meaningless.

Themba: is content knowledge needed in ML?

Susan: Yes because it is basic calculations that is LO1

When you get to FET that section should be done and then should be given a little time, not that much time because those learners have been calculating, engaging Mathematics from Grade 1 up to Grade 9 so I do not think there could be any problem if they have got good foundation, the problem is foundation, then when you are in Grade 10 you just cant go and teach 1+1 or 1x2, they don't know how to calculate that so they want to get calculators an calculate that one , if you say to a learner 3x2 then he will look for a calculate and then calculate.

Themba: What would be your response if one says ML is irrelevant and needs to be removed from the curriculum?

Susan: No I do not agree with that because if you are talking about a learner even if the learner is still at school that learner is still going to use Mathematical Literacy and even when the are out of school they will also use it so I do not understand why they say its a waste but what needs to be done is to include Mathematical Literacy.... because it is not there even when comparing learners who are doing Accounting and Mathematics and learners who are doing Accounting and Mathematical Literacy are excelling and that is what I have observed in all these schools even if you ask those teachers on How do the learners perform you will find that those who are doing Mathematical Literacy are performing better because they are use to these big figures and those who are doing Mathematics are not use to handling big figures.

Themba: Is any difference in performance amongst the groups of learners?

Susan: Yes and those who are doing Accounting are performing better in Accounting than those who are doing Mathematics that is why I do not understand when they say they are not going to take somebody who has done Mathematical Literacy for Accounting, I seriously do not understand.

Themba: How the learners respond to ML?

Susan: If you give them a paper they would say no we don't want to. There must be because for Medicine they say they need Mathematics but I Think they can include some of the stuff which is there in Mathematical Literacy there in Mathematics.

Themba: How do you view assessment in ML?

Susan: Assessment is okay, we need people who have got Mathematical Literacy to access these learners because you find that sometimes those people are tempted to include Mathematics, not Mathematical Literacy I mean the examiners (Nationally and Provincially).

So we as people have done this one and we have to develop the papers and set these papers for Lower Grades like Grade 10 because I think there is a lot of challenge for those teachers in Grade 10. Most of them they did not do the Mathematical Literacy in some schools because there is only one teacher who was trained and that is the main challenge now you find that it is Grade 10, 11and 12 and then the school is huge you find that most teachers are needed there but there is one Specialist. So we need to have more teachers who are trained now for Grade 10 they will just take anybody who can teach. There was even this morning the paper was just a Mathematics paper no Scenarios, no information, nothing!!!!!

Themba: Who provides a support to ML teachers?

Susan: We are supporting our self in district level; you find that there are no subject advisors who have done Mathematical Literacy so that is the problem.

Themba: what is the nature of support you get?

Susan: .They are employing people who have got Mathematics instead of Mathematical Literacy now when there is any implementation of Mathematics let's say they going to have workshop they will call a teacher who has done Mathematical Literacy because they cannot So even the structure of the Department needs to be reviewed

Themba: how do you see the future of ML?

Susan: I see it is growing and if more people can do the subjects even the Universities taking into consideration that they need to include it there in their curriculum because its ends somewhere. I do not see that much after Grade 12 which more serious now because where do we take these teachers now, they just throw them outside the system so I want it to e included.

Interview with Alfred

INTERVIEW PROTOCOL DATE: TIME:

Interview duration: 40 min

Interview method: Semi-structured interview

Focus question: What are teachers' interpretations of the intended Mathematical Literacy curriculum?

Question format: Open-ended questions

Response mode: Recorded by interviewer (Audio-tape)

Introduction

Themba: The purpose of this interview is for me to learn from you about your interpretations, understanding and teaching practices of the Mathematical Literacy curriculum. This will inform my PhD study which aims to understand how Mathematical literacy teachers interpret and implement the Mathematical literacy curriculum in FET schools. I am hoping that this study will contribute to supporting curriculum development and teacher development in this subject. This interview will last approximately 40 minutes. You are most welcomed to ask questions of clarity or raise concerns during the interview. The aim of this interaction is to understand your views on the subject under discussion. There are no expected right or wrong answers.

Questions

Themba: What is your understanding of Mathematical Literacy?

Probe: a) What is it?

Alfred: Best of my knowledge and understanding mathematical literacy, I could link Mathematical literacy to at where by basic knowledge in everyday usage of mathematic is being exposed to our learners so that they cannot go out to the world becoming mathematical literal in mathematics

b) How do you view the purpose, nature and scope of Mathematical Literacy?

Alfred: The scope of it is narrowed to the extent that they will be equipped with everyday usage of that concept in their lives other in the industry, or market places or become entrepreneurs that basic mathematical literacy is exposed to these learners

Themba: According to Department of Education the purpose of Mathematical Literacy as a fundamental subject is to ensure that South African citizens become highly numerate consumers of mathematics. From your experience do you see Mathematical Literacy fulfilling this purpose?

Probe: How and/or why?

Alfred: Actually to some extend yes, some extend no, depends to the quality of learners that we have, some of them close their minds to mathematics because previously if they are in Grade 10 they drop mathematics completely so they come with the knowledge that "I'm going to do mathematics anywhere" but with this new introduction they are all forced to do some amount of mathematics and some of them are not really mathematical product, our level...............they have got that motion that they cannot perceive mathematics in any form, therefore the purpose of making them highly numerical sumacs of mathematic to me personally is not the best way to put it, but to make more to use mathematics in everyday life should be more applicable so that the content of material should be little relaxed not to test them on knowledge but to test them on the skills using mathematical literacy in daily lives, although the idea sound sweets but is actually not practical in our system.

Probe: You just highlighted that testing them the skills rather than the knowledge. Do you think it is not happening right now in exams? It's that necessary to look at the skills of using Mathematical Literacy or looking at the content?

Alfred: No I think that the interest or emphasis is more on the acquisition of knowledge than deep understanding of Mathematical Literacy that would impact to the community of our learners so instead of making [though/Do] the set up of question free scenarios' those scenarios that are questioned then we can't leave for this kids to communicate the knowledge and scenarios which are sort of practical aspect of it therefore , it should be the practical which be expanded to think of all sectors of the community of the learner population by looking at urban areas where there are exposed to then the mean urban area where there are exposed to and typical structure where they seems to formulating asking the questions, that is why I emphasize that there must be a lot of emphasis on skill how to apply this mathematics in their own community than testing how much they've absorbed from the text book or school day by the teachers.

Themba: How do you find teaching Mathematical Literacy? Any challenges?

Probe: a) What do you consider to be challenges in implementing the Math Lit curriculum?

Alfred: Yes, there are quite number of challenges not limited to Eastern Cape, not that I'm in Eastern Cape that I'm talking about Eastern Cape. When the NCS for mathematical literacy was going to be introduced and our teachers who were already employed, we done like this language teachers who are going to be assess where, how to be re-skill and come and teach this mathematical literacy, Therefore this teachers came in and went through the program, but the time they use to cover this program was really very short two years to re-skill a language teacher to become a mathematics teacher in two years was quite difficult, so this teachers come in their classroom with limited understanding of mathematical literacy. And they going to teach this learners, because they themselves they don't understand mathematical literacy; it became difficult for them to relate the book work to the practical environment to the learners. So, learners again perceive mathematical literacy as an abstract, suddenly they were perceiving mathematics they are not sure so, that bring mathematical literacy to the ground level doesn't exist in our school and even those mathematics teachers, mathematics teachers who have been recruited to teach mathematical literacy are scared on doing, when he felt that his degree is been brought for mathematics to come and teach Mathematics Literacy without understanding the fact that the mathematical literacy is part of mathematics but is at lower level to make mathematics accessible to the level of our learners. So, generally there are so many challenges right from the teacher to the learners' perception of maths emphasis.

One, is the attitude of the learners towards the subject area, some of them are very negative towards maths lit. Because they felt that they assume that they are not going to use this ML any where in their lives, and some feel that they are being forced to do ML, so, that is the attitude, I have told the boy that they have perceptions towards the learning area that they are not going to use it or they are being forced to do it and they have to do it because they need to write the final exam in maths and mathematic literacy.

It does, it does a strongly reflect in their performance because if they are listening to you when you are teaching them they close their minds to it, and really refuse to understand, they refuse to understand that impact on their performance in the assessment, now sometimes we give them work, instead of doing independently and get it wrong and doing correction, they prefer to copy the work from a friend so that they will please you as a teacher. But when we get to the final assessment, learners are struggling they don't they don't do well at all.

May be to make a follow up, this negative attitude does it go through cut across the Grades or is just Grade ten? When they are in Grade eleven and twelve are okay

It cuts across the Grades, all the Grades, I mean is not all of them, some of them are very keen to learn it because they feel they can use it, others who have close mind continuing without perception so, they get to the final Grade, Grade 12

Secondly: as a teacher sometimes you get demoralized if you put in your maximum to make the maths to look so friendly, so, I mean practical indicates and the reception you get they look at you in volumes as if what you are doing you just making a drama for the whole.............So, it demoralize you as a teacher. Secondly you as a teacher you teach something explain the best and they claimed they understand then the next moment you ask them what and this you just change and twist the little bite to final the example of conceptual understanding. The question on the same issue they refused to answer it and thirdly the kinds don't contribute in class, that's one thing I find little bite disturbing they believe in teachers who talk and talk and talk and give exercise instead of giving.........like soccer. I believe mathematical literacy should be more discussions. When you m introducing a topic as a teacher then you get exchange, I mean discussion from the learners to enhance the conceptual understanding that you are looking for, so that the kinds will go out with a clear mind, what the learning area

b) How do you manage these challenges?

Alfred: Is quite difficult to manage, and what I try sometimes to do, is to into, on my part as a teacher I tried to...........write it I don't do according to what the NCS says I assume at the beginning of the topic that my kids know very little about that topic. So I take it from the sweeping, I take it from the ground level and build it up and make them aware that at ground level will be very interesting and very sweet and very easy but as we go up there must be more attention because we are building from the ground level upwards, so, sometimes it works, but not all of them get the understanding from basic although I might have done it, but still shall go through the learning area in build up. And secondly I try to make work more research entity where I give them the topic and go out and find out about the topic they do the presentation in class. Everybody come to do short presentation of what he/she has found out. So it become like a drama so to.............that both that they create in the classroom thinking that is more of theory work than practical work.

And thirdly I tried to introduce other teachers like a team work, where the kids don't only listen to one particular teacher, teaching always.........I call teacher A to come and teach this particular topic, teacher B to come and teach this particular topic, so I could see that the kids have variety of teachers to listen to, and those who encourages them so, hard.

Themba: You drawn from maths lit. Teachers or just ordinary maths teachers?

Alfred:I drawn mostly from Mathematical Literacy teachers.

c) What do you see as the positive aspects of teaching Math Lit??

Alfred: Hey initially when I was asked to, I offered to teach mathematical literacy, I felt little "reluctant" because I thought we were teaching higher Grade maths so long we are suddenly going to teach mathematical literacy. When you I are looking through the books" ah!! This is not challenging to me" i cannot crack/crap my brain. But to be honest with you mathematical literacy is very enjoyable, I really enjoy teaching mathematical literacy at the moment. There are many things I take for granted but others reflect in maths literacy curriculum. I think about, I also learn as I teach, learn and apply those concept...... is working so this I think there is got a lot of positive sides, that's all, and those learners who passed it go out and say "no the subject is very easy" surprisingly you get a learner who never thought of doing mathematics, doing mathematics and passing and telling others "subject is very interesting" is quite encouraging as well towards our learners and teachers in the learning area.

Themba: How relevant do you find departmental curriculum documents (for Math Lit.) (such as NCS Grades 10-12 policy, assessment guideline, Learning Programme Guideline and The Teacher Guide) in your teaching of Math Lit?

Probe: a) How have you used these documents?(to plan teaching and assessment at the start of the year or on regular bases)

Alfred: Ya, the the the documents are quite good there are okey, i will say they are very good they are right, aiem!! Especially if I made it clear to my teachers for example that I work with, I don't accept the lesson plan from the department because I don't buy a cook, cooked material and implement, I prefer to do my own lesson plan. So I take all this document with me when I'm preparing my lesson plan before the...

Themba: Is there anything you would like to add, thing that you would like to share that has not been not covered in this interview?

Alfred: Yes, eeeh, I have got one concern which I think it will be more appropriate to share here, is that teachers are always advised to attend w/s in Mathematical Literacy, now, instead of building the content knowledge of these teachers, that is not done by the Department of Education, they rather teach them the NCS [curricula related issues]. And it is not very easy to get the teacher who has limited scope in content knowledge to come and teach Mathematical Literacy content. I think, because i was involved in pure mathematics at university, teaching pure mathematics at the university that is why I have a better understanding of Mathematical Literacy.

Thank you for participating in the interview and providing me the opportunity to learn from you. Your responses were very informative.

Interview with Bongani

INTERVIEW PROTOCOL DATE: TIME:

Interview duration: 40 min

Interview method: Semi-structured interview

Focus question: What are teachers' interpretations of the intended Mathematical Literacy curriculum?

Question format: Open-ended questions

Response mode: Recorded by interviewer (Audio-tape)

Introduction

Themba: The purpose of this interview is for me to learn from you about your interpretations, understanding and teaching practices of the Mathematical Literacy curriculum. This will inform my PhD study which aims to understand how Mathematical literacy teachers interpret and implement the Mathematical literacy curriculum in FET schools. I am hoping that this study will contribute to supporting curriculum development and teacher development in this subject. This interview will last 40 minutes. You are most welcomed to ask questions of clarity or raise concerns during the interview. The aim of this interaction is to understand your views on the subject under discussion. There are no expected right or wrong answers.

Questions

Themba: What is your understanding of Mathematics Literacy?

a) What is it?

b) How do you view the purpose, nature and scope of Mathematics Literacy?

Answer:

Bongani: Before 1994 we had Math only and Math was divided into HG and SG. I think ML was introduced because there were learners who did not understand Math well. There were learners who were faster to understand Math better the others. For other learners it was difficult to understand and interpret whatever they learnt. Now we have pure Math and ML, Ml is there but the level is not the same as pure Math. To me , ML is more hands-on "learning area"- because what we do, since I have been involved in teaching ML- I have found that ML is more relevant to everyday situation. For example, each and every lesson I teach, I relate it to what happens to daily life. It is not abstract. What I can say about learners understand it because it is practical in way.

Themba: According to Department of Education the purpose of Mathematical Literacy as a fundamental subject is to ensure that South African citizens become highly numerate consumers of Mathematics.

From your experience do you see Mathematical Literacy fulfilling the purpose?

Themba:: How and / why?

Bongani : The purpose is to make learners to relate what they learn in class and make it relevant to what is happening outside the classroom. In that way, ML is a living learning area.

Themba: Now from the learners that you have just interacted with that you are teaching. Do you see them growing gradually to a level where we can consider them as highly numerate consumers of Mathematics?

Answer:

Bongani : Exactly, I will say yes. As I said before ML is related to what is happening in daily life. It means that whenever a learner studies ML-if she wants to open business, she knows the strategy to use to ensure that her business can relate theory and practical part of it. I think it fulfils purpose. We must not depend on seeking jobs but we must create jobs. I like business field-ML prepares learners to be successful in business.

Themba: How do you find teaching Mathematical Literacy?

Probe: What do you consider to be challenges in implementing Math Lit curriculum?

Bongani : It was not easy for me to teach ML. To me, I thought ML undermines our learners' ability in Math. At first, I had a negative attitude towards it. Then it happened that I had to teach it. At first time it was not easy to teach. I saw it being similar to Arithmetic. I did not find it okay. I did not think it was relevant for the future of the learners. Also on the other hand, learners were running away from pure Maths to do ML because they had a perception that ML is easier than pure Maths. I was considering what the child who want to be in future. The child needs best symbols in ML in order to pursue further studies and high institutions.

But now I understand it- I found it easy, this is fine and is good for learners because now we relate it to daily life and it is so practically to learners.

Themba: What I want to know is their attitude. What attitudes have you observed from learners that you are teaching?

Answer:

Bongani : Generally the learners enjoy it. Generally they enjoy it.

Themba: You mentioned that there are some challenges in implementing, can you just take me through and how do you manage these challenges that you have just highlighted?

Bongani : Ya ya, one , the key is that I make them (learners) to understand that there is a future in ML. Secondly, learners know that their life is around it. If they enjoy it they gonna make it.I also develop confidence. Learners do not understand at the same level. I give them chances to those who do not understand. I give the extra times. Some of these learners do not ask questions in class because they are shy. During the one-on-one sessions I find that these learners do have potential to succeed in ML.

Themba: Besides that, what do you see as positive aspects of teaching Mathematical Literacy? What is interesting and exciting?

Bongani: Well.., the most important thing I like… I find myself answering questions from learners. Like in case of exchange rates- I find that learners come and say, "sir, we saw in the news bulletin that the rand to Dollar is that and that… what is happening to currency? Why it is like that? And so on.. So to me it means learners enjoy it then followed it. Not only the currencies, sometimes they bring graphs from newspapers and ask if I can help them interpret Mathematically? To me, it means learners have developed Mathematical thinking.

Themba: I understand that Department has provided the schools with curriculum documents. How do you find Department documents such as policy document, assessment guide, learners' program guide, teachers' guide, all those documents that are provided at schools in your teaching of Mathematical Literacy?

Bongani: Sir those documents, I think what is contained there is 100% good because the vision and idea is okay for our learners. It is very good. The challenge is to improve-I thank the DoE must provide us with more LTSM. As I indicated earlier, this subject requires LTSM. Like in Science, there are Science Labs. If DoE can supply us with tools then we can do well.

Themba: What is LTSM?

Bongani: 3D object like triangular object etcetera.

Themba: Do you use DoE documents in your planning and teaching?

Bongani: Yes especially Assessment Guide Document (AG). What I believe is that this document guides me on what learners must learn and know in particular level. My planning is based on assessment guidelines. It gives me a direction.

Themba: Do you find challenges in using these documents?

Bongani: For now, as I indicated that use more assessment guide and I think the time frame is a challenge. I fall behind because I do not want to leave learners behind for sake of finishing the syllabus.

Themba: Tell me, if you were involved in the curriculum design for Mathematical Literacy, what would you like to change or add in the current Mathematical Literacy curriculum?

Bongani: Well, generally- I cannot say I can add or take something out of the current curriculum. I trust those people who designed the curriculum. Well, I consider only Assessment Guideline document the most. It is the one I use, the one I enjoy the most. Maybe if I can consult other documents probably I can comment. The current curriculum satisfies me.

Themba: I have seen one of the policies there is trigonometry section which is now not taught, it is not examinable. What would your comment?

Bongani: yes learners need trigonometry. They need to know it. It part of their future. If one wants to be a builder trigonometry is required. Trigonometry is the section that we need in both Math and ML. I think it should be included in the curriculum.

Themba: Is there anything you would like to add? Anything you would like to share that hasn't been covered in the interview?

Bongani: Generally, I can just say most of us we have undergone a short session or workshop of ML training. Some of us expressed challenges and problems in teaching ML. for me I think, if possible, we need twice or once per term training at local cluster and district. This will help us to discuss and plan for the term the section we will cover. This can help us to network and we may even set the same paper thus keep the standard.

Themba: if you were involved in the curriculum design for Mathematical Literacy, what would you like to change or add in the current Mathematical Literacy curriculum?

Bongani: Eeh, most of the things that are there are relevant. I would be happy if it could be more functional than it is right now. That is more contextualised as much as possible than it is now so that is when they get out of school they will be able to really identify what they learnt from school.

Probe: What is your view on such topics as trigonometry and linear programming?

Bongani: With trigonometry I do believe that Trig is quiet bit difficult for learners but the elementary sections like ratios can be taught. I once did it with my Grade 11 when ML was introduced but only to fine that in the following year we were told that these sections are then out of syllabus. They can do the elementary sections it won't harm. I found once text book X very useful in regard, it provided them with some skills.

Interview with Myeza

INTERVIEW PROTOCOL DATE: TIME:

Interview duration: 40 min

Interview method: Semi-structured interview

Focus question: What are teachers' interpretations of the intended Mathematical Literacy curriculum?

Question format: Open-ended questions

Response mode: Recorded by interviewer (Audio-tape)

Introduction

The purpose of this interview is for me to learn from you about your interpretations, understanding and teaching practices of the Mathematical Literacy curriculum. This will inform my PhD study which aims to understand how Mathematical literacy teachers interpret and implement the Mathematical literacy curriculum in FET schools. I am hoping that this study will contribute to supporting curriculum development and teacher development in this subject. This interview will last approximately 40 minutes. You are most welcomed to ask questions of clarity or raise concerns during the interview. The aim of this interaction is to understand your views on the subject under discussion. There are no expected right or wrong answers.

Questions

Themba: How do you view the purpose, nature and scope of Mathematical Literacy?

Myeza: yah when we, when we think of it, what comes to my mind is that, the kind of Mathematics that is, and style that is.. presented for learners to interact with. Is ahh some kind of functional or practical approach kind approach that us there with it. And is real life situation, it is quiet… it comes handy and is easy like to teach because of that.

Themba: When looking at to Departmental documents the purpose of Mathematical Literacy as fundamental subject is to ensure that South African citizens become highly numerate consumers of Mathematics. From your experience do you see Mathematical literacy fulfilling the purpose?

Probe: How and / Why?

Myeza: yah definitely it does…! And and fortunately the kind of Mathematics that it, is not coming to the fore for the first time, it has been there as what used to be called Functional Mathematics…to do with Economics. When you look at the structure and syllabus of it.. it can reach even to your lowest kind of artisans and people, skills skilled people. No matter how low their skills are because when you look at it, there is something to do with plumbing, angles, counting, town planning etcetera, things that are done mainly by people, semi-skilled are able to be catered here.

Themba: How do you find teaching Mathematical Literacy?

Myeza: yaaaah the challenges that are there in teaching the subject, one is the attitude of learners, and eeeh I do not know if I should say the stigmatisation, but the attitude they have towards numbers, Mathematics is there, so they have a phobia. That anything that has to do with numbers, shapes and other things is not for them- it is something difficult for them to understand. So first, that is it.

Probe: What do you mean by attitude?

Myeza: Yaaah some negative attitude and also …like there there I would say they have inferiority complex when it comes to challenges that might arise and looking at numbers themselves, is the phobia I can put it like that.. and also that one given schools and societies, your socio economic situations, you find that we have, we fall short in terms of getting the support or being given the support that we need for learners just to generally to be able to cope in school situation and needs of the school, so there is no backup kind of background.. or backing that is there, we need from the government or even from their homes, even the teachers at times you find out that morale is high, or maybe you find that some teachers at some teaching the subject they do not have Mathematical background, even themselves they are not, I mean not sure as to what suppose to be happening here.

Themba: How do you manage these challenges?:

Myeza: Eeh, definitely as a teacher you have to improvise.. you make to use of what you have. You know .. and go around and try to get some material. But at times you donot succeed. Hence I say you make do what you have to teach the kids as much as possible, drill them, and do all kind of things, give them extra lessons, even getting people from outside to do that, even empowering yourself make sure that you go to workshops, do same especial courses, like as I was used to do ACE programmes at Rhodes and UPE, so that is the situation, that is how try to deal with challenges.

Themba: Have you done ACE in Math Lit programme?

Myeza: Yah yah, Math programme but not Math Lit programme per se. somebody in the school did. As a learner I did Functional Math some years back but changed to pure Mathematics so I know the ins and outs of the subject. I have taught Mathematics at GET phase before Math Lit was introduced. { '' I know inns and outs of the subject''}

Themba: What motivated you to teach Math Lit?

Myeza: It is because I once taught Functional Maths. In the past there were two classes, one that was Math and one that was not doing Mathematics at all. We decided to introduce some kind of Mathematics that is softer than pure Math its self; that was functional maths for the class that was not doing Math. That was early 90's. I was the one who was teaching that Mathematics. When ML was introduced in 2006 I came on board and teach it.

Probe: How do you feel about teaching Math Lit?
Myeza: I feel so exited but for my learners its quiet challenging. There is a problem that I have observed from the learners. It seems that there is a gap between Grade 9 and 10 classes. They just change, either there is a gap or there is no gap, it is a stage they reach.

Probe: What gap?
Myeza: The gap in content. But though I do not think so because at times I teach Grade 9 Maths content and Grade 10 Math Lit and ML content is soften than Grade 9. So you find learners very confused or at times you find them having no time to do work, or study. {you find that what I teach in Grade 9 Math class also teach in Grade 10 Math class but with soften content}

Probe: Why?
Myeza: Unfortunately I am the one who teaches them in Grade 9, so I know for sure that I taught them everything in Grade 9. For this year a soccer ball project on hexagon and pentagons, your 2D's and 3D's kind of things. So I was doing with Grade 9. The Grade 10 requested that I also do that with them. I gladly did it with them because it is the same kind of curriculum and content because we do polygons with Grade 10 and we do 3D's. they have to identify solids, faces, edges and vertices and do that fomula F+V-P=2 as a concept.

So exactly the same content I do with Grade 9 I do with Grade 10. I think the problem has to do with social and developmental stages and peer pressure. Learner do not find time to study and practice.

Themba: What do you consider as positive aspects of teaching ML?
Myeza: Teaching ML is revelation every day. Is a revelation in the sense that you see staff that you teach now and say, stuff that you were not aware of some years ago. You find that you get to a chapter dealing with angles and say you can design a soccer field or netball field, something you never thought you could. The excitement that the learners find when you find when you do practical work, you find that it helps learners. At times you find that learners will do all kinds all kinds of jobs in a location.. like we were doing “the right angled triangle”, it was bases on Nelson Mandela bridge structure and design. Looking their faces when we were doing that, it was so easy and they were so excited.

Probe: You are teaching both Grade 9 and 10 Mathematics and Math Lit respectively, do you use different approaches?
Myeza: As I was saying.. there isn’t much difference. If you deal with Graphs is the same stuff, if you are dealing with Geometry same stuff. Maybe in financial Math there is slightly change because in Grade 10 is deeper. And even Graphs are more contextualised according to various contexts that they are going to use where as in Grade 9 is just pure Maths.

Themba: How relevant are Dept documents in teaching ML?
Myeza: They are quiet relevant because at times it is like, they are good in benchmarking you. They provide information about the required level. Some topics are the same but you have to pick up a notch a bit for a certain class, you know, because there more aspects you have to bring in, in terms of your assessment standards and LO’s. So, they really do guide you, so that wouldn’t be doing the same thing you did in Grade 8 for Grade 10 learners.
You know that there is appoint where you have to up the standards some bit. So they also really help you even in terms of pacing yourself as to when you should be doing a particular section, at what time you should be doing some and time to finish particular section.

Themba: Thank you for participating in the interview and providing me the opportunity to learn from you. Your responses were very informative.

Interview with JABU

Interview duration: 40 min

Interview method: Semi-structured interview

Focus question: What are teachers' interpretations of the intended Mathematical Literacy curriculum?

Question format: Open-ended questions

Response mode: Recorded by interviewer (Audio-tape)

Introduction

Mthethwa: The purpose of this interview is for me to learn from you about your interpretations, understanding and teaching practices of the Mathematical Literacy curriculum. This will inform my PhD study which aims to understand how Mathematical literacy teachers interpret and implement the Mathematical literacy curriculum in FET schools. I am hoping that this study will contribute to supporting curriculum development and teacher development in this subject. This interview will last approximately 40 minutes. You are most welcomed to ask questions of clarity or raise concerns during the interview. The aim of this interaction is to understand your views on the subject under discussion. There are no expected right or wrong answers.

Questions

Mthethwa: What is your understanding of Mathematical Literacy?

Probe: a) What is it?

b) How do you view the purpose, nature and scope of Mathematical Literacy?

Jabu: My understanding of Mathematical Literacy is a subject, is the Mathematics in real life. Is a practical subject in that it assists learners not only to know numbers but they must know what they are doing practically.

Themba: How do you view the purpose, nature and scope of Mathematical Literacy?

Jabu: The purpose of Mathematical Literacy is to make the learners mathematical aware. It also assists them to assist others when they leave the school (out of school). The problem in the school environment the learners are doing the subject for the sake of answering questions in the exams.

Themba: What are your experiences of teaching Mathematical Literacy?

Jabu: What I find it interesting is that I do have a good background of mathematics because I was teaching Mathematics in the FET (in Grades 10 & 11) before I taught Mathematical

Literacy. Learners are not practising it in the real life. And I see it when I ask them some questions. If you ask them a question their answer will be too short but when you probe them-you can see that ooh, this learner does have information or understanding. But he/she does not relate it to his/her real life situation. For example – if you take an example of making tea. The child knows that in each cup of tea you add three teaspoons of sugar. When you ask in a classroom: What is the ratio of 1 cup of tea and sugar? They cannot understand that because they do not relate it to real life situation. But, if you say make a cup of tea they will know how much sugar must be added.

Themba: How do you find the departmental documents/policies of Mathematical Literacy?

Jabu: Firstly I must thank the department for year programme the dept has provided us with. The programme has been well arranged by dept and also in the learning programme, it assists us how we can use some material we find in our schools. The Guidelines also assists us to know exactly what is expected at the end. E.g. LO1 – deals with numbers, it assists us to know what area to be covered in Grades 10, 11 and 12. It also helps us not to overdo some sections. E.g. not to do Grade 11 work in Grade 10, or vice visa. The subject statement tells us broadly about the subject, what is expected from the learners after learning the subject and what the educators should

Themba: How do you use the departmental policies?

Jabu: I teach from Grade 10 to 12. I have a Teacher guide document. Every time when you teach you must have context. Sometimes learners do not understand context used hence you must go to their level... you as a teacher you need then to go back to various textbooks available.

Themba: How do you teach Mathematical Literacy?

Jabu: If my topic is about investments, I give them information about investment, formulas, taxes and how to calculate thereafter when they understand. I then ask the school to provide transport. They go to different insurance companies or the banks in the nearby. They ask about different interests these banks charge. They find out about different accounts they need to know. After that I allow them to come back to ask me some questions about what they have found. I then ask them to make a summary of what they have experienced.

Even myself when I teach I find that the learners do not understand the lesson because of the content. I then lower myself because this is not Mathematics it is Mathematical Literacy.

Teachers must be aware that learners are afraid of mathematics. The Mathematics teachers usually focus on content and ignore context, even some textbooks also focus on content

Themba: Thank you for participating in the interview and providing me the opportunity to learn from you. Your responses were very informative.

Interview with GEORGE

Interview duration: 40 min

Interview method: Semi-structured interview

Focus question: What are teachers' interpretations of the intended Mathematical Literacy curriculum?

Question format: Open-ended questions

Response mode: Recorded by interviewer (Audio-tape)

Introduction

Themba: The purpose of this interview is for me to learn from you about your interpretations, understanding and teaching practices of the Mathematical Literacy curriculum. This will inform my PhD study which aims to understand how Mathematical Literacy teachers interpret and implement the Mathematical literacy curriculum in FET schools. I am hoping that this study will contribute to supporting curriculum development and teacher development in this subject. This interview will last approximately 40 minutes. You are most welcomed to ask questions of clarity or raise concerns during the interview. The aim of this interaction is to understand your views on the subject under discussion. There are no expected right or wrong answers.

Questions

Themba: What is your understanding of Mathematical Literacy?

Probe: a) What is it?

b) How do you view the purpose, nature and scope of Mathematical Literacy?

GEORGE: I look at Mathematical Literacy as some aspect, that aspect of Mathematics that prepare learners for real life situations, it helps them to know about any dealings with situations that they come into contact with, it deals with practical hence life like the goods divide by the number of the amount of tax invoice they will have on the receipt, how to exchange when they come to the market or how to deal with general transactions about ideally numeracy at this and all those things. So Mathematical Literacy basically prepares the learners for real life situations, how to calculate the distance and all those things which are about their life situation, how to interact with those things.

Themba: According to Department of Education the purpose of Mathematical Literacy as a fundamental subject is to ensure that South African citizens become highly numerate consumers of mathematics. From your experience do you see Mathematical Literacy fulfilling this purpose?

Probe: How and/or why?

GEORGE Ya, definitely, definitely, it is fulfilling that purpose when you look at the content and all those things we are doing at school with learners definitely it will make them high numerate consumers of mathematics. It's definitely fulfilling that purpose.

Themba: Now from the learners that you have just interacted with that you are teaching. Do you see them growing gradually to a level where we can consider them as highly numerate consumers of Mathematics?

GEORGE: Yes, sure they are because from the experience.......interacting with them in classes, their willingness and their enthusiasm to learn the subject show that they are getting there but you know there are other things that were not you know when you talk to them you could see that they love the subject, they love to do it somehow................but definitely there are things that at times school again............their determination to the work so they are some challenges that when you talk to them you face or when you are teaching them you encounter.

Themba: How do you find teaching Mathematical Literacy?

Probe: a) What do you consider to be challenges in implementing the Math Lit curriculum?

GEORGE I look at it like, the challenges on how to get teachers and the material that, the materials that are there. I think they are not that problem because the department has supply the material that is needed for the subject and the teachers are well equipped to introduce it but the challenges that we are facing the most were with the learners, you know education is in phases, so if a learner does not go through one phase well it affect the next phase and the foundation of the subject was the major problem I was facing in class because at Grade 10 where I am teaching I expect the learners to have learn how to do simple addition of fractions and subtraction of fraction but you could see that at that level most of them don't know how to go about that ...... so it makes it very difficult for you to build upon that one and to move in accordance with the syllabus that you are working with because you cannot be just running them through, you have to take your time to let them understand one concept before you move on to another concept so that is affecting me so much because I have not been able to cove the syllabus that I am suppose to cover for this particular term. I have not been able to cover because the pace of the learners, their slowness is very slow so it means it is very difficult to cover all the syllabus. The department is expecting you to cover the syllabus before the end of the term so if you don't do it there are problems, so the tests are compiled to sometime just rush them through but there is this problem of happening to understand one concept from all the syllabus. The other challenges that we are facing, where we are working there are socio-economic problems around that area, so that affects the learners. You give them work, they will come to school the next day and you see that they have not done the work. Some of them have to walk a long distance, so it is affecting their performance in class. These are the challenges we are facing, you give them work and you see them find it difficult to go and do them, so these are the problems we are facing at school.

Themba: What I want, their attitude. What attitudes have you observed from the learners that you are teaching?

GEORGE: They love it because this year when given the number of subjects they want to do, the most of the learners opted to do Mathematical literacy, even those who repeated last year said they love to do it that means the attitude is ,they love to do the subject but as I said there are some interest to what they love to do, they love doing it and sometimes when you give them work and interacting with certain groups you see their participation, their attitude, the attitude is you know. In every situation there are very few learners who cause problems, who don't like it, who see maths as something so difficult and something abstract but we tell them the purpose for maths literacy is about them to be competent in numeracy so some are getting there and are catching the idea, it is there.

Themba: You mentioned that there some challenges in implementing, can u just take through and how do you manage this challenges that you have just highlighted?

GEORGE: Ya, the challenges, there are some that is within the range to solve and some that are not within our scope to solve. Like the classroom situation where I can cite an example of one particular girl I was teaching in my class. From the first day I started teaching se was not interested in the maths literacy. She was always so reluctant not even participating in the lesson we do. So I saw that no, she does not have interest in the subject. I got closer to them; I have grouped them in a class around five per table. Every time there is work given, I will have time to explain and I will go to them one on one or one one basis and now this girl is having interest in the subject. She is one of the girls who always come to me with a problem "Sir I was doing this one at home but I could not, How to do it?" So having a personal interaction with one on one is also helping but I said we have a mandate to cover some aspect of syllabus so that is a problem because if I go 1 on 1 with them is helping them in solving the problem but the question is what time can I have for that problem. I was trying to organise even extra classes after school but that one was not successful because most of the learners come from long distances with transport so if you are keeping one class, the other learners who are going with the same transport will be willing to go home , so they have to leave with them. So organising extra classes becomes very difficult to organise with them. So I decided on things I was trying to you know to help them. A lot of exercises, lot of homework so that they can go home and they can also do it but at times there is this situation most of them not doing at home so this are the solution I am trying to come up with just to let them come into contact with the subject and have love for it, that what I am trying to do to help them.

Themba: Besides that, what do you see as a positive aspect of teaching Mathematical literacy? What is it that is interesting and exciting?

GEORGE: Ya, it is lovely and it's interesting. It's interesting, at time you get a teacher to understand the real-life situation more apart from the fact that you are a teacher, you will not be someone who know all things. As you teach along, it helps you to know more about those things you see around and it's very interesting, it's very lovely. This year there was an assignment I gave to them about water meter, meter readings and hence me as a teacher I have to go to the municipality to make enquiries about the bills, how they prepare their bills and so it's very interesting, very lovely it helps you to know and the learners to know how to read the meter when there is water, how much water have they consumed for that particular month. So it is very interesting, it's something that you enjoy doing.

Themba: Before you taught Mathematical Literacy, when you were told that now you are going to teach mathematical literacy. Have you seen yourself changing from one attitude to another attitude as you engaged on the subject?

GEORGE: Definitely, definitely because I did pure Maths so when I got the post it was about Mathematical literacy. I thought no Mathematical literacy is for people who are not that intelligent, there is that perception that Mathematical literacy is for people who are not good, academically good so to say because those who are good will do pure Maths so those who are not that good will be shifted to do Mathematical literacy but I have seen that that perception is wrong because in Mathematical literacy what is involved even those who are doing pure Maths should learn Mathematical literacy as well because pure Maths is so abstract, there are lot of abstract terms but Mathematical literacy is about real life situations, things you see and all those things. I have changed from one thing that Mathematical literacy is for people who are dull, it's not true. It's for all people, all learners.......... I have changed that Mathematical literacy is for people who are not good; it's a wrong perception that most people have. It's wrong.

Themba: I understand that the department has provided schools with curriculum documents. How relevant do you find the department documents such as policy document, assessment guideline, learner program guideline, teacher guideline, all those documents that are provided at schools in your teaching of Mathematical Literacy?

GEORGE: Ya, it helps you, on its own is a resource for you to teach the subject and it helps in a way that.... it to present a common task because at the end of the day if you are writing a common task it comes from the department is the whole system which is going to do so. It help to guide you as a teacher , which direction to go, at which pace are you to go, the assessment for instance , how they have to be assessed and what is expected of you every term. So those policy documents that are there help the teacher a lot. It does not give room for each teacher to do things on their own, you get up next day and I am going to class I am going to do what I think I should do, no. There is something that you have to go in according to and those documents are prepared inline the needs of South African citizens, the learners who are upcoming. It is a good document that is helping the teachers and implementing all those things that the government want to achieve when it comes to education. So, it is in line with...you know..........

Themba: But what do you find challenging in using these documents?

GEORGE : Ya, actually I have not.., I have not, I was looking at no the.., at times I look at the number of maybe assessments or number of tasks that are supposed to be done in a particular term. You know like in Maths Literacy they are suppose to have 1 assignment , maybe next term project and all that, you look at it this way that the policy is there I should do this thing at this time but at times as the classroom teacher, you have been there you know how things works. Do you need to have 1 assignment, do you need more than 1, and do you need maybe 3 assignments in a term based on what you have found, but the department is saying we want 1 assignment in this term, so we are restricted to that 1 alone, it does not give room for the teacher to express feelings and most teachers say if the department want 1 assignment then I will do 1 assignment because that is what they are looking for, even if they can do 2, they will just do that 1asssignment and that will be the end of it. So in as much positive aspect of it.....the teacher on a particular guidelines, what you know suppose to.... The document in itself, I don't see much wrong with it but maybe some of the assessment thing that we have to be going through is what I think I have problem with.

Themba:: So, in your case if they say they want 2 assignments, do you go with that 2 assignment only?
GEORGE : ya, I go strictly with that.

Themba: Or you can do 3

GEORGE: I go strictly with that because there is other ......, most teachers are not teaching 1 area so there is a lot of work load on us and there are certain things that are expected of you. So you go to class and the class and the class no, there are too many in that classroom so you have to according to what they are saying you know, these policies are there they have made them so well but as I said it is the teacher who is in the classroom, maybe they made this policies taking into consideration the number of learners in a class but there are some schools, in my school for instance you go to a class and the number of learners in the class is more than what the department is making the document at, there should be suppose to be 35 learners or 40 learners, you go to a class and there are 50 in a class. So it affect what the policy was set to achieve somehow you can't do more the number expected.
Themba: Tell me, if you were involved in the curriculum design for Mathematical literacy, what would you like to change or to add in the current Mathematical literacy curriculum?

GEORGE: In fact that one, I...I have not ....to think of what to change in the curriculum that they have implemented. There, I don't have, i have not done much thoroughly study of something that need to be changed in there.
Themba: maybe if I can just make an example, I have seen one of the policies there is a trigonometry section which is now not taught, it is not examinable. What would be your comment?
GEORGE Ya, I see that one, I think, I think ah.., that's not that one I know, I think Pythagoras theorem is most of there is a .... but it's not examinable like you said trigonometry. So those aspect of syllabus that is not examinable, definitely if something is not examinable, why should you even bring it in the first place, but on the other way you look at it if that document is not examinable, does it any.....on the learner, is it well relevant to the learner in today's world? There are two aspect to this one, those things that are not

examinable, that you don't bring them in the exams, are they relevant to the child in today's world, so you look at it, is..... as much as the teacher is because of time frame, you want it to be out of the syllabus because it is not examinable. You ask yourself, is it relevant to the learner, that aspect of it, if there was there is enough time to cover that one too, would it be it be relevant to the learner? So if it would be relevant to the learner I don't see why it changed from there but the question is do teachers have enough time to cover all those areas and some of those things, so is a very ...thing I can't say let it be changed from the syllabus because if they don't examine on them, you know there is one mistake that at times we make as educators and policy makers, we think of the examinations, the examinations but educations is not about exams, education is is about equipping the individual for life, so if you think of exams, exams, exams alone, what about the real life situation, how is it going to help them. So we should not think of just writing exams, exam questions just write exam, pass and go. After writing exams there is more to life after exams, after Grade 12 there is more to life so if it is not examinable and will be good in real life situation, I think it should be there if there is enough time.

Themba: So if somebody suggests that this trigonometry should be brought be brought in the syllabus again, what would be your comment?

GEORGE: Ya, it is welcomed, I think if not even examinable, just say say I want to go and treat that. If it's not examinable but it can help the learners, fine it should be there.

Themba: Tell me briefly, about your involvement in Mathematical literacy including the informal in-service programme that you have gone through in Mathematical literacy. How did it help you in teaching Mathematical literacy?

GEORGE: In fact, as I just said I was into maths so the NCS programs I attended were all in Maths as for Mathematical Literacy I have not go for any in-service training to date but almost of the in-service training I attended for the NCS programme in Maths. But you know when I move from my former school to this kind of school I am teaching, they were Maths teachers who were handling those areas. So they were in in need, there were no Mathematical literacy teacher the other time so I had to move in there to assist them so I think this is my first year of getting to know more about Mathematical Literacy and so forth, so i was, so looking at my training in NCS there was Maths, pure maths.... you know a teacher should be dynamic, so she would be able to ......, so I am just getting to it, how it works.

Themba: Is there anything you would like to add? Anything you would like to share that hasn't been covered in the interview?

GEORGE: Ya, there are lot of issues that are affecting teaching of mathematical literacy in the schools that did not come across but I think i mentioned some of them but there is one problem that if the government can look at it you know, the policies, the documents.........everything is there, they are good, the teachers do their moderation, they do all those things that are there but there is one thing we did not dwell much in the interview. It's about the learner, the person who is learning. If I will come to class 24/7 but the learner whose suppose to study is not there around the day.........
The policy makers should also look at the learner in question. Are the learners responsive, are they prepared to learn, do they have their mindset in learning? You know that is what is the first difference in the model c schools and those schools that are public schools. There is much difference because the learner, their discipline level is a major.......affecting the teaching of the subject. You know, they believe they have the right not to even do the homework. They do what they like and it's affecting the learning of this particular subject because you cannot rely on what the teacher say in class alone to perfect mathematics in general. So the learners we give them homework to do, you find that they will come to class the next day and they have not done the homework and you can't discipline them, you can't punish them, you know so all those things affects.......Another thing you go to class you give them work, in a class of about 40, you see about only 5 or 6 who don't have calculators. So they have to be going around borrowing , saying Sir can we go to the next class to borrow calculator, so you end up spending about 10 to 5 minutes, sorry 10to 15 minutes learners chasing other learners in the other classes to come and work. Mathematical instruments and mathematical cassettes all those things are little problems that we are facing in the classroom. You have been doing something and you don't have a simple instrument to let you construct something like teaching of pie charts or something. Even a pair of compass to construct a circle, they don't have it. You know, all those things are the problems we are facing. They need a mathematical calculator their weight but they don't have it and because of poverty levels in our public schools, it's very difficult for, you know them to have it. So it's another problem that we do face at classroom, basically that is on the part of the learner, so these are some of the things, major problems that we are facing.

Themba: How they can be.......

GEORGE: The, the other problem is that, I don't know government has got its own budget constrain...... if those, they are providing them with books, lots of textbooks are there for them. Even the textbooks, I must say they are not enough in most cases....my school for instance, not all of them got textbooks this year when we give them. So I think the Principal made another arrangement to get more books. So that's it. If the government can provide those things, mathematical cassettes, calculators for these learners to equip them how to use calculators ie calculating figures... It will be very helpful because most of these scientific calculators...These learners will come up to come and even use them, you know most of them will be working in these shops, they calculate so they are needed, so if the government can provide these things for them. I think it would help as in the classroom because it destruct my lesson a lot if they have to move to the next classes to look for calculators, it's not right. So if the government can do something about it, to provide it for the schools too. For the ones we have I think its Grade 12 who mostly use them, very few calculators we have in schools. The Grade twelve's when they are going to write exams, they will come for them after that day they bring them back. When look at situation some have, we have calculators of about 40 in the school; about 6 classes are having mathematics subject or lessons at the same time. If one teacher should go for them and 1 class is using, what happens to the rest of the classes? So if that one can be done then I think it will be fine for them. Basically, these are the things that need to be done. That what I...........

Themba: What would be your comment or your view? Any teacher who have not gone through the formal training in mathematics at higher institution but has done maths maybe up to matric, do you think he can cope with mathematical literacy? A teacher who has done other subjects maybe biology.....languages and now is interested in teaching mathematical literacy without any formal training in mathematics.

GEORGE: No, it will not work. It's not right, if you use the word formal training where you are going to train somebody, at least you need the basics, you need the foundation, you need to have done something with it before you can do it. No, no anybody at all can get up and say no I can go and teach but you said something that if somebody has gone through the matric, definitely yes, ya he should be able to teach it. If you have the... , the level if...you look at the NCS programme and the content of the mathematics that they are doing in Grade 12 now, you should be teach mathematical literacy because that one is bit higher than the mathematical literacy. Somebody who has been able to go through that one successfully and have attended NCS programme, you know those programmes workshop on this one, should be able to teach because.... So if you have passed your maths and attended workshops on mathematical literacy, definitely you should be able to handle it if only you were good in mathematics in Grade 12, you should be able to equip people to learn it. Even though.....lack of teacher in the classroom, and if the few ones are leaving, very few teachers will have classrooms , most of them out of the class so it's good if you can equip people , train them, they can be back to class and help, why not they should be able to help because you see, you give some of them the learners in Grade 10 class work or homework, they go to the house , they get in touch with those in Grade 12 to assist them so why not, why can't they teach.....they should be able to teach.

Themba: And if somebody comment and say you know mathematical literacy is useless, we should phase it out and leave the pure maths for every learner.

GEORGE: It will never be a good suggestion or idea. That means that person does not know what is interesting in the Mathematical Literacy because if you know what is in the mathematical literacy you would not say that we should phase it out. If you phase it out, what happens to those who would say no, we cannot do the pure maths, what happens to them? Then they become incompetence with numeracy entirely, basic calculations they can do it because they will end up not doing the maths at all, but each learner need to know something about numeracy, so you cannot phase it out, definitely they need it, they need it it can never be phased out because their competence level, you look at them, most of them cannot do the pure maths so if you are saying that you are going to take the mathematical literacy out....they will come out of the schools does not know anything about maths at all, can't do simple calculations, can't do simple calculations and its very good, it's very good.

Themba: Thank you for participating in the interview and providing me the opportunity to learn from you. Your responses were very informative.