

UNIVERSITY OF FORT HARE

**PEDAGOGICAL EXPERIENCES OF EDUCATORS
IMPLEMENTING MATHEMATICAL LITERACY IN
THREE FET COLLEGES**

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**Thesis submitted in fulfilment of the requirements
for the MEd degree in the Faculty of Education at the
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DECLARATION

I declare that the content of this thesis is my own work and that all sources have been acknowledged by a complete reference list.

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Date

ABSTRACT

The Department of Education was tasked by Government and the Department of Labour to develop learning programmes which would provide skills to learners. The National Certificate Vocational (NCV) programmes were developed, which provided an alternative to completing a National Senior Certificate (NSC). The NC(V) programmes consist of seven subjects of which Mathematical Literacy is offered as a fundamental subject.

The NC(V) programmes were officially implemented in 2007 using the FET College sector as a vehicle. FET College educators had to be skilled and re-skilled to teach the various new subjects. One of the new subjects at the time was Mathematical Literacy. Selected educators were provided with a short course to prepare themselves for the implementation of Mathematical Literacy.

This study is aimed at investigating the pedagogical experiences of educators who were, and are still part, of the implementation of Mathematical Literacy in the FET College sector. A phenomenological approach was followed in order to capture the lived experiences of the educators. Three educators were selected from different FET colleges within the Eastern Cape Province. A qualitative research was done, making use of interviews.

The research found that educators have divergent pedagogical experiences. They make use of different strategies to implement teaching and learning within their classrooms. Though there are good experiences, the research has managed to point out that there are some frustrations too. Recommendations are made with regard to teaching and learning strategies, as well as the emerging trends that surfaced during the research.

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CHAPTER 1

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 INTRODUCTION

In this chapter a brief overview of the history of Further Education and Training Colleges (FET Colleges) in South Africa is presented. The focus is on the role of the new curriculum, especially Mathematical Literacy, and how it is being implemented in FET Colleges. The demands of teaching Mathematical Literacy and how FET College educators can prepare themselves for these demands are also highlighted.

The research question(s) are stated and the significance and rationale of the study are presented.

1.2 BACKGROUND TO THE STUDY

1.2.1 FET College Education in South Africa: A Historical Perspective

According to Gamble (2003:7) the need for technical vocation in South Africa originated in the late 1800's. The need was sparked by industrial development such as mining, harbours and the railways. Both the general education and technical education system in South Africa evolved from British systems.

According to the *English Technical Instruction Act* of 1889 technical education was limited to the instruction of science and art applicable to industry (Layton, 1984:21-35). The same author mentions that the emphasis, however, was not on teaching the practice of any trade, industry or employment. The reason for this was that industry was loath to share their trade secrets with the public education system and consequently a science based technical education was instituted in South Africa. Industry provided the context-specific work experience, while the colleges provided the theory content of the apprenticeship (Gamble, 2003:20). Thus, technical colleges became educational institutions that were embedded in the work-based apprenticeship system.

Due to the system of Apartheid, the black population was marginalized and prevented from becoming artisans (South Africa, 2001:3-4). It was not the *Apprentice Act* of 1922 that directly excluded the black population, but rather the educational requirements. Apprentices were expected to have attended trade schools, most of which were inaccessible to the black majority (Lewis, 1984 and South Africa, 2001:3-4). As a result, the majority population was denied access, not just to the technical education system, but also to the Mathematics curriculum offered.

During the 1960's and 1970's, the low numbers of skilled black workers, resulting from apartheid policies and job reservation, became a large threat to economic growth. Employers were offered incentives to relocate their businesses to rural border areas, the so-called "homelands" (South Africa, 2001). It was during this time that black workers were recruited to do the jobs that were traditionally reserved for white workers. Yet, the black populace was still largely excluded from access to vocational education and training (South Africa, 2001). However, with the promulgation of the *Manpower Training Act of 1981*, the restrictions of blacks to vocational education and training were lifted, allowing them access. This led to the establishment of most of the existing technical colleges today (Gamble, 2003:13).

1.2.2 Rationale for Establishing FET Colleges

Skills shortages in the labour market and industry in South Africa is a major reason for the establishment of FET Colleges. The Accelerated Shared Growth Initiative of South Africa (ASGISA) has identified that the lack of skills and basic/fundamental knowledge leads to a higher unemployment rate. Furthermore, where employment is available, there is a lack of suitably qualified applicants. Subsequently, FET Colleges have been tasked by government to meet the demands of the labour market and industry, leading to the development of the National Certificate: Vocational programmes, also known as NC(V), which were implemented in 2007 (Hall, 2005).

1.2.3 The FET College Curriculum

I have been an educator in the Sport Department at Buffalo City Public Further Education and Training (FET) College in East London, South Africa, since 2000. The college, originally called East London Technical College, provided tuition in the National Education Department Report 550 programmes (NATED 550), as well as other diploma courses such as Art and Sport Management and Coaching. Since 2004, the diploma programmes, and specifically the NATED 550 programmes, have been phased out to make space for the newly developed National Certificate (Vocational) programmes. These programmes were developed as a joint initiative between the Department of Labour and the Department of Education to address the desperate skills shortages that are being experienced at present in South Africa (South Africa, 2001; Gamble, 2003:33).

There is a stark contrast between the current college curriculum and the old curriculum. In addition to contrasts between the old and new college curriculum, there are also differences between FET Schools and FET College curricula (Young, 2006).

Education reform in South Africa since 1994 has resulted in the introduction of a new curriculum. The reforms, which were mostly curriculum-related, were meant to purge the apartheid curriculum of racially offensive and outdated content (Jansen, 1997). The most comprehensive reform has been the introduction of Curriculum 2005, an outcomes-based education approach designed to be more learner centred (Zafar, 2004; Brown, 2003; Sibiquashe, 2005).

Curriculum 2005 comprised eight learning areas, each with its own specific and unique features. One of the key design features of the curriculum was that each learning area had to be linked to other fields of knowledge. Mathematical Literacy was a major addition as a learning field in the curriculum. The learning fields of the curriculum included the following: Languages, Literacy and Communication, Mathematical Literacy, Mathematics and Mathematical Sciences, Natural Sciences, Technology, Human and Social Sciences, Arts and Culture, Life Orientation and Economic and Management Sciences (Heinemann, 2005).

The design features were many and complex, however, within five years of its introduction, Curriculum 2005 was revised. Asmal (2002) maintained that the curriculum as a whole had to be made more understandable for effective classroom use. This included the Mathematical Literacy aspect of the curriculum. There was confusion about progression and integration between the grades (Chisholm, 2003). Furthermore, a number of teachers were unable to cope with the demands of the new technology, such as data projectors and computer-based programmes. Some were so stressed out and occupied about implementing the new design features, that they did not spend enough time teaching. Some were so overwhelmed that they became de-motivated.

The curriculum review process led to a Revised National Curriculum Statement (RNCS) for Grades R – 9, which was approved and accepted as policy in 2002. In May 2002 the Revised Curriculum statement (RNCS) was released for Grades R – 9. In October of the same year the Draft National Curriculum Statement Grades 10 – 12 (Schools) was released. Full implementation occurred in 2004 (Zafar, 2004). The RNCS is not a new curriculum, but a modified C2005 (South Africa, 2002; Government Gazette, 23406, Vol. 443).

One of the key developments of the curriculum review was that a smaller number of learning areas with a clearer structure, written in simpler language, was recommended. While the eight learning areas in the revised Grade R - 9 curriculum were maintained, their names were changed. The new nomenclature became Languages, Mathematics, Natural Sciences, Social Sciences, Economic and Management Sciences, Technology, Life Orientation and Arts and Culture (Chisholm, 2003).

An interesting issue to note is that Mathematical Literacy is not included in the Grade R - 9 curriculum. In other words, Mathematical Literacy is only part of the Grade 10 – 12 or the FET band of the school system. The National Curriculum Statement (NCS) for Grades 10 – 12 (General) are based on the twelve Organising Fields of the National Qualifications Framework (NQF) for organising and registration purposes (Oxford University Press, 2006). In the FET programme, Mathematical

Literacy is within the Physical, Mathematical, Computer and Life Sciences organizing field of learning (See Table 1.1).

Table 1.1: Organising fields of learning and related subjects

ORGANISING FIELDS OF LEARNING	SUBJECTS
Languages	Languages (fundamental)
Agriculture and Nature Conservation	Agricultural Management Practices; Agricultural Sciences; Agricultural Technology
Culture and Art	Dance Studies; Design; Dramatic Arts; Music; Visual Arts
Business, Commerce and Management Sciences	Accounting; Business Studies; Economics
Communication Studies and Language	All official languages and a number of non-official languages
Manufacturing, Engineering and Technology	Civil Technology; Electrical Technology; Mechanical Technology; Engineering Graphics and Design
Human and Social Sciences	Religious Studies; Geography; History; Life Orientation
Physical, Mathematical, Computer and Life Sciences	Computer Applications Technology; Information Technology; Life Sciences; Mathematical Literacy; Mathematics and Physical Sciences.
Services	Consumer Studies; Hospitality Studies; Tourism

Oxford University Press (2006)

The NC(V) programmes, implemented in 2007 in FET Colleges comprised the following learning areas: Management, Marketing, Tourism, Information Technology and Computer Science, Electrical Infrastructure and Construction, Finance, Economics and Accounting, Civil Engineering Construction, Manufacturing and Assembly, Engineering and Related Design, Fabrication and Extraction, Primary Agriculture, Office administration and Hospitality (Le Roux, Grinker and Van der Westhuizen, 2007).

FET Colleges have been tasked by government to meet the demands of the labour market and industry, leading to the development of the NC(V) programmes which were implemented in 2007. The NC(V) programmes consist of seven subjects, four vocational and three fundamental. The fundamental subjects, compulsory for all programmes, are English First Additional Language, Life Orientation and a choice between Mathematical Literacy and Mathematics. The vocational subjects depend on which programme a learner is enrolled for. The programmes are offered on Level 2, 3, and 4, which is an equivalent to Grade 10 to 12 offered in mainstream schools (Le Roux, Grinker and Van der Westhuizen, 2007). Mathematical Literacy is one of the three fundamental subjects offered.

1.2.4 The College curriculum and Mathematical Literacy

Mathematical Literacy was introduced against the background of poor Mathematics performance among South African learners (Blaine, 2005; Brombacher, 2006; Christiansen, 2007; Graven and Venkat, 2008; OECD, 2003 and Mavuagara-Shava, 2005).

Since 2006 it has become compulsory for learners to study one mathematical related subject until Grade 12. Mathematics is compulsory up until Grade 9 and after that learners have a choice between Mathematics and Mathematical Literacy. This is a concerted effort from the DoE to improve the mathematical ability of not only a select few, but the general population of South Africa (Venkat, 2007). Mathematical Literacy was introduced to specifically address mathematical awareness and

everyday issues such as personal finance, engagement with statistical information and a positive contribution to modern life (Blaine, 2005).

Mathematical Literacy is offered as a fundamental subject in the learning programmes being offered at FET Colleges. Programmes are vocational in nature and consist of three fundamental and four core (vocational) modules. The fundamental subjects are Life Orientation, English First Additional Language and a choice between Mathematics and Mathematical Literacy (South Africa, 2007b).

Mathematical Literacy is not a scaled down version of Mathematics, but is a subject in its own right (Prentice, 2006). It is a learning area that applies mathematical principles in everyday, real-life situations. Learners are encouraged to develop their confidence in thinking along numerical terms to interpret, analyse and solve real-life problems in different contexts (South Africa, 2007b).

The topics that are covered in Mathematical Literacy are very similar to the Learning Outcomes of Mathematics, but there is a big emphasis on finance (South Africa, 2007a; South Africa, 2007b). It seems that the Assessment Standards of Mathematical Literacy concentrates on three aspects as follows: Managing situations and solving problems in everyday life; developing logical thought processes; and evaluating information critically (South Africa, 2006b).

However, according to Morris (1981:161) "... mathematics pervades the whole environment and every individual encounters the use of mathematics in three broad contexts:

- in the context of his private life,
- in the context of his working life, and
- In the wider context of the social, economic and political life of the country of which he is a citizen.

Mathematical Literacy is aimed at creating self-managing individuals, contributing workers, lifelong learners and critical citizens in the modern world and our developing democracy (South Africa, 2006a). A self-managing individual should be able to cope with financial issues such as hire purchase, accounts, bonds and

investments. They should also be able to interpret maps, follow timetables and calculate areas and volumes they encounter on a daily basis.

A contributing worker should be able to deal with work-related formulas, statistical charts, pay slips, schedules and understand instructions with numerical components.

Participating citizens can interpret graphs, statistics and numerical information placed in the media and thus form an opinion of their own (South Africa, 2006a). In addition, the rationale is that a contributing worker and participating citizen is a great asset to the economy of the country.

According to the Department of Education Learning Programme Guidelines for Mathematical Literacy (South Africa, 2007c:8) the following abilities are developed through Mathematical Literacy teaching:

- i. The ability to use basic mathematics to solve problems encountered in everyday life and in work situations. This means that workers can be more effective in work situations because they are able to solve problems in a logical way.
- ii. The ability to understand information represented in mathematical ways. This means that citizens could interpret statistical information in for example newspapers.
- iii. The ability to engage critically with mathematically based arguments encountered in daily life. This means that citizens can engage critically with information that affects them directly, for example wage negotiations.
- iv. The ability to communicate mathematically. This means that a person can express himself using numbers, for example reading bank statements.

The expectations conveyed by the Department of Education (South Africa, 2007c) suggest that learners have to develop certain critical and developmental outcomes such as developing logical thought processes and analytical ability. In addition, they need to solve problems in a systematic way and evaluate information critically. Learners have to become confident in the use of numbers in such a way that they can manage their finances in a meaningful manner.

1.2.5 Demands of teaching Mathematical Literacy

According to the Mathematical Literacy Subject Guidelines (South Africa, 2007b:12) educators should meet minimum requirements in order to teach Mathematical Literacy. Educators should have a minimum of Grade 12 Mathematics, but preferably more. A diploma or degree in education, as well as training in outcomes-based education is compulsory. In addition, educators should also be qualified assessors and moderators. It would also be advisable for educators to display enthusiasm for the subject. Mbekwa (2006) suggests that, for various reasons, not all of these criteria are being met at the moment.

Recently there has also been raging debates amongst educators, college managers and the Department of Education regarding the high failure rate amongst Mathematical Literacy learners in FET Colleges. According to the statistics from the DoE (South Africa, 2008:1-5) a total of 27878 learners were enrolled in Mathematical Literacy Level 2. Of the students who wrote, 31.16% passed. The average for this group was 24.85%. On level 3 there were 5745 learners enrolled of which 57.80% passed with an average of 32.95%.

At the moment there is a lot of accusations being made and blaming going on to explain why learners are underperforming to such an extent. Questions have been raised about the preparedness, dedication and ability of educators. The NC(V) programmes require educators to be experts in their field of teaching (Zafar, 2004). Most educators in the FET Colleges came from industry and do not hold a professional teaching qualification. One of the biggest demands of teaching Mathematical Literacy is to become suitably qualified to teach the subject.

1.2.6 Preparation of FET College educators

Ukeje (2000) claims that education is so powerful that “it can heal, it can kill; it can build or tear apart; it can lift up or impoverish”. Omoregie (2006) claims that the future of any nation depends on the quality of its education system, which in turn

depends on the quality of teachers. Professional development, or preparation of educators, is therefore an essential activity to ensure that educators can stay abreast of developments in teaching in order to improve the quality of the education system.

According to Young (2006), the professional development of Further Education and Training (FET) College staff has been and is still neglected. The generally low status of FET Colleges, the absence of links between universities and FET Colleges and the recruitment approach of FET staff have been listed as some of the possible reasons why the neglect still continues.

The process of NC(V) implementation was extremely stressful for educators (Sibuqashe, 2005). Suddenly educators were faced with teaching new subjects. There were new concepts such as portfolios of evidence and new curriculum statements. On top of that educators were tasked to follow a new approach of teaching, namely Outcomes-based Education (OBE). In the past educators made use of lecture style when teaching, but with OBE the lecture style had to change to more of a facilitation style (Jansen, 1997). Most educators were re-skilled to teach the new subjects, one of which was Mathematical Literacy. Little, if any, attention was given to utilizing OBE as an approach in the classroom (Sibuqashe, 2005).

Mbekwa (2006) wrote an interesting paper on the qualifications of in-service teachers who undertook an Advanced Certificate in Education (ACE) in Mathematical Literacy at The University of the Western Cape. Of the 20 respondents of the questionnaire there were 10 teachers whose highest qualification in Mathematics was Grade 12 or lower. At least seven of them had a teaching background that was not related to Mathematics at all, such as Afrikaans, Geography, Needle Work etc.

Being involved with the implementation process from the onset, I realized that the same trend was followed in the selection of lecturers for re-skilling in Mathematical Literacy in my college. Rather than placing an emphasis on previous Mathematical experience in order to re-skill lecturers to teach Mathematical Literacy, the focus was on who would be willing to be re-skilled.

The National DoE conducted orientation training for FET College educators during the period October to November 2006. The duration of these training sessions were 1 week per programme. Colleges were to take responsibility for re-skilling and up-skilling their own staff.

It is the responsibility of the educators to familiarize themselves with the curriculum documents of Mathematical Literacy in order to empower themselves to produce the type of learners that are envisaged. By empowering themselves within the new curriculum, they would be able to supply learners with a meaningful context in which they can excel as participating and contributing citizens in their own environments. Professional development and preparation of educators are therefore an integral part of ensuring effective teaching and learning in the FET sector.

Failure to institute professional development for FET staff will result in:

- i. FET Colleges being unable to keep pace with the rapid and far-reaching changes in the nature of work.
- ii. The inability to address problems within the composition of their workforce, especially related to age and gender.
- iii. The failure to turn their commitments of developing partnerships into sufficiently good practice.
- iv. The continuous feeling that FET programmes and training are inferior.
- v. FET Colleges being unable to produce learners that can become participating members in society.
- vi. The deterioration of the FET system as FET Colleges struggle to retain staff. (McGrath and Palmer, 2004)

1.3 FORMULATION OF THE RESEARCH PROBLEM

During previous studies I was extremely surprised to find that although there was some research available on Mathematical Literacy implementation in Secondary Schools (see, Christiansen, 2006; Graven and Venkat, 2007) there was very little

research that was directly related to the implementation of Mathematical Literacy in FET Colleges. It soon became apparent that the secondary school and FET sectors have significant differences in areas such as curriculum, types of learners and available resources.

From personal experience teaching Mathematical Literacy, I found that insufficient training in the subject, the lack of Mathematical Literacy textbooks, and insufficient foundational mathematical knowledge of the learners, as well as “drowning in the administrative whirlpool” created by the new programmes were a major part of the everyday work life of the teacher.

A gap exists in research available on how educators deal with the implementation of Mathematical Literacy, specifically their pedagogical experiences within the classroom.

1.4 RESEARCH QUESTIONS

Having outlined the research problem, the main research question for investigation is:

How do educators, responsible for implementing the Mathematical Literacy curriculum in FET Colleges, experience the pedagogical process?

Being a qualitative study, only one key question has been posed in this research. The expectation, however, is that a phenomenological reflection on the educators’ pedagogical experiences in implementing the Mathematical Literacy curriculum will allow the teachers to describe the varied dimensions of their experiences which will include

- teaching,
- assessing
- and resource management.

1.5 THE PURPOSE OF THE STUDY

The purpose of the study is to investigate and understand the pedagogical experiences of educators in the implementation of the Mathematical Literacy curriculum in selected FET Colleges in the Eastern Cape Province.

1.6 SIGNIFICANCE OF THE STUDY

The research will attempt to inform Mathematical Literacy educators of the pedagogical experiences of colleagues implementing the Mathematical Literacy curriculum in their respective colleges. Some of the experiences that come to light could inform future policies within the subject field and also serve as an informative body of knowledge to guide other Mathematical Literacy educators within their own classrooms.

Depending on the experiences of respondents within the research, a clearer understanding could be gained with regards to the demands that are expected of Mathematical Literacy educators and the teaching strategies that could be employed within the classroom.

1.7 RATIONALE OF THE STUDY

As an educator I have a duty and responsibility to make a contribution in the educational sector where I am working. It is therefore important to participate in the process of developing literature resources that can be of assistance in understanding and successful implementation of Mathematical Literacy curriculum in the FET College sector.

I have experienced my own challenges and successes with the implementation process of Mathematical Literacy in my own College. Often I would wonder what my

colleagues in the other colleges are doing to cope and ensure smooth implementation of the subject in their colleges.

During inter-college interactions it was almost a relief to realize that my colleagues faced the same challenges as I, but it was even more interesting to listen to what they are doing to cope during the implementation process. It has always been my view that educators should have the opportunity to share their experiences, and more specifically the educators who are working in the FET College sector.

In my previous academic studies it became evident that a small body of knowledge existed with regard to implementation of new subjects in the FET College sector. It happened continuously that we were tasked to conduct research or present an assignment that would speak directly to the FET College sector. Time and again I would find information based on FET Schools, but I struggled to source adequate information based on the FET College sector. It is therefore that I feel compelled to conduct my research in a field where I feel I can make a positive contribution.

1.8 DEFINITION OF KEY CONCEPTS

1.8.1 Pedagogic experiences

The concept of pedagogy is derived from the Greek word "paid," meaning child plus "agogos," meaning leading (Knowles, 1990). Pedagogy is therefore defined as the art and science of teaching.

In contrast the concept experience refers to the nature of events something or someone has undergone (Neill, 2004). Experiences can include behaviour and emotions and refers to an accumulated product.

Based on these theoretical definitions, pedagogical experiences in this study refer to the accumulated product of the art and science of teaching. It includes a range of practices in the teaching and learning process such as assessments and lesson preparation.

1.8.2 Educators

For the sake of this research, educators refer to the implementers of the Mathematical Literacy curriculum.

1.8.3 Mathematical Literacy

Mathematical literacy is defined in the Programme for International Student Assessment (PISA) as “the capacity to identify, understand and engage in mathematics, and to make well-founded judgements about the role that mathematics plays in an individual’s current and future private life, occupational life, social life with peers and relatives, and life as a constructive, concerned and reflective citizen” (OECD, 2003:24).

The DoE (South Africa, 2006a; South Africa, 2006b; South Africa, 2007b) defines Mathematical Literacy as a subject that will help learners to think quantitatively, spatially and critically and will enable them to deal with mathematical information in real-life contexts.

In this research Mathematical Literacy is referred to as a subject that is being taught at FET Colleges.

1.8.4 Implementation

As a concept, implementation is the carrying out, execution, or practice of a plan, a method, or any design for doing something. As such, implementation is the action that must follow any preliminary thinking in order for something to actually happen (Cook, 1995).

Fullan (1991) argues that successful implementation is directly related to the willingness of teachers to facilitate and sustain change. In this research the emphasis will be on how the implementation of Mathematical Literacy influenced teaching in class.

For any implementation to be truly successful, teachers have to be involved in all stages of implementation, this includes:

- i. Building awareness and sharing the vision of change
- ii. Assisting in developing the new curriculum
- iii. Implementing the new curriculum and teaching practice in their classrooms
- iv. Reflections upon classroom practice
- v. Continue to learn and grow while the implementation process is being refined (Cook, 1995).

1.8.5 FET College

Within the National Qualifications Framework, Further Education and Training (FET) emerges as a priority in the development of the youth. It is believed that provision of quality, relevant and well-managed education leads to the development of youth and the communities as a whole. The Department of Education White Paper (1998) recognized the FET as being situated at the intersection of a wide range of government policies, which are critical to the construction of the new South African society.

The FET sector is regarded as the allocator of life chances and it offers both initial and second chance opportunities to young people and adults. The White Paper also notes that FET institutions would enable many young people to pursue post compulsory education in FET institutions where flexibility, programme diversity and other support services are able to support an open learning environment. A successful FET system would provide diversified programmes offering knowledge, skills, attitudes and values that South Africans require as individuals and citizens, as lifelong learners and as economically productive members of society (Hoppers, 2000: 10).

The following table indicates where FET Colleges fit into The National Qualifications Framework (South Africa, 2002):

Table 1.2 The Levels, Bands and Fields of the NQF (SA, 2002)

LEVELS	8	HIGHER EDUCATION 12 FIELDS		HET
	7			
	6			
	5			
	4	FURTHER EDUCATION 12 FIELDS		FET
	3			
	2			
	1			
GRADES	9	SENIOR	ABET	GET
	8	8 LEARNING PROGRAMMES	LEVEL 4	
	7		ABET	
	6	INTERMEDIATE	LEVEL 3	
	5			
	4	5 LEARNING PROGRAMMES	ABET	
	3	FOUNDATION	LEVEL 2	
	2	3 LEARNING PROGRAMMES		
	1		ABET (Adult Based Education and Training)	
	R			
		EARLY CHILDHOOD DEVELOPMENT		
			LEVEL 1	

FET Schools offer grade 10 – 12 academic qualifications, whereas FET Colleges offer vocational programmes on level 2 – 4. After successfully completing level 4 in colleges or grade 12 in schools, learners can then further their studies in Higher Education institutions.

1.9 PARADIGMATIC PERSPECTIVES

Paradigm is derived from the Greek word “paradeiknyai” which literally means to show side by side. It creates the idea that there is a pattern of thought or a mental picture being formed in order to view the world in a particular way (Guba and Lincoln, 1994)

Henning, van Rensburg and Smit (2004) see a paradigm as a theory or hypothesis, creating a framework in which we can define the world around us. A paradigm will therefore shape beliefs and create understanding of how things are connected. This world view will influence personal behaviour, professional practice and determine what position is being taken within a research situation.

The paradigm will be determined by answering the following questions (Guba and Lincoln, 1994):

- i. The ontological question i.e. the nature and form of the reality
- ii. The epistemological question i.e. the basic belief about what can be known
- iii. The methodological question i.e. how the researcher will go about finding out what can be known.

1.9.1 Methodological Perspective

Methodological perspectives are driven by the question of how we can gain knowledge about the world. It means that a theoretically informed approach has to be articulated to inform the production of data (Ellen, 1984).

In this research the researcher will make use of an interpretivist approach. Interpretivists have a relativist ontology, meaning that the reality as we know it will be constructed through social and experiential meanings and understanding. There is also a transactional or subjectivist epistemology, assuming that we cannot separate ourselves from what we already know. Both the researcher and research subject are

linked by the fact that they understand that the world they live in will be central in the way that they understand themselves and the others within that world (Angen, 2000).

Interviewing and observation are the qualitative methods mostly used in an interpretive approach. The methods allow for adequate dialogue between the researcher and research subject in order to collaborate for the construction of a meaningful reality. Meanings are generally formed throughout the research process (Guba and Lincoln, 1994).

1.9.2 Theoretical Perspectives

The theoretical perspectives of the researcher will be informed by:

- i. The Norms and Standards of Educators
- ii. Social Constructivist Theory of Lev Vygotsky
- iii. Communities of practice (Wenger, 1998)

According to the Norms and Standards of Educators (South Africa, 2000) one of the seven roles of an educator is to be a “scholar, researcher and a lifelong learner”. In an environment where new subjects and policies are implemented, the educator becomes a learner once again. In this type of new environment he/she will have experiences and reflections as seen through the eyes of a learner. As the ‘learner educator’ gains experience he will then be able to fulfill other roles such as being an interpreter of the curriculum and subject specialist, in essence becoming a mentor for new educators in the field.

The Norms and Standards of Educators (South Africa, 2000) also states that educators are implementers of the curriculum and class managers. This means that educators will use certain strategies for teaching and learning in their classrooms, leading to the formation of unique pedagogical experiences. Managing classrooms can refer to different aspects such as assessments, resource management and even discipline.

For my theoretical framework I drew largely upon the social constructivist perspective of Lev Vygotsky. I especially attempted to highlight how this perspective aims to develop educators within their own environment in order to contribute positively with the ongoing process of Mathematical Literacy implementation.

I focused on OBE as an approach of curriculum implementation. I explored the educational path of how the OBE approach came into being in the education system in South Africa and how it influenced the implementation of Mathematical Literacy in the FET colleges, contributing to the experiences and reflections of the educators.

Implementation of new programmes and subjects lends itself to forming new communities of practice (Wenger, 1998), i.e. a community of Mathematical Literacy educators. I will elaborate further on this issue in Chapter 2.

1.9.3 Assumptions about humans

Kies (1995) argues that assumptions are ideas or beliefs that we believe to be true. These assumptions are often based on no or very little evidence. He states that we can make assumptions about everyday situations arising within our lives. Kies uses the example of traveling in a car and approaching an intersection. When the traffic light is red we assume that a driver would stop, and in most cases it would be true, but on occasion we might be wrong.

It is my belief that the social context in which people are active will influence them to act in a particular manner. People are motivated by their surroundings and the environment in which they function. Humans are adaptable and will change the way in which they do things if they feel that it would be to their benefit.

In short, teachers will adapt how and what they teach if they feel that it would be to the benefit of not only themselves, but to their learners. The social context will determine how they will adapt teaching a relatively new subject and which methods they will employ to encourage their learners.

1.10 DIVISION OF CHAPTERS

Chapter 1: Introduction and background of the study

Chapter one contains an overview of the research to be conducted. It touches on the rationale, context and formulation of the research questions.

Chapter 2: Literature review

Chapter two contains a detailed literature review on the implementation of the National Certificate (Vocational) programme, and specifically Mathematical Literacy in FET schools.

Chapter 3: Research Design and Methodology

Chapter three describes the research design and methodology chosen for this research. In the process, attention was also given to research ethics and how to ensure validity and trustworthiness of the results. This chapter includes discussion on data collection, sampling strategies and data analysis.

Chapter 4: Findings of the Research Data

Chapter four focuses on presenting the findings of the data that was collected from the interviews with the respondents. The researcher attempted to identify possible patterns, trends and themes.

Chapter 5: Data Analysis and Recommendations

Chapter five focuses on data analysis. Once more the researcher attempted to identify possible patterns, trends and themes. The researcher, also a Mathematical Literacy educator in a FET College, made contributions by referring to personal

experiences. The conclusion and the limitations of the research were considered in order to make recommendations for further research.

1.11 CONCLUSION

In this chapter the researcher sketched a background of FET education, the reform that took place and the resulting changes that ensued as a result.

The demands of teaching Mathematical Literacy was discussed, as well as how educators can prepare themselves for teaching the subject

The basic questions were identified and a brief glance was given to the paradigmatic perspectives that were prevalent in this research.

Chapter 2 focuses on the theoretical framework and Mathematical Literacy within the FET College sector.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Mathematical Literacy is not a scaled down version of Mathematics, but is a subject in its own right (Prentice, 2006). It is a subject that applies mathematical principles in everyday, real-life situations (South Africa, 2007b). Learners are encouraged to develop their confidence in thinking along numerical terms to interpret, analyse and solve real-life problems in different contexts (South Africa, 2007a; Graven and Venkat, 2008 and Brombacher 2006).

Teachers have divergent views on what they think Mathematical Literacy entails. Some tend to think that Mathematical Literacy is a watered-down form of Mathematics, whilst others believe that it is a different, but still difficult, subject (see, Mbekwa, 2006; Christiansen, 2006 and 2007; Graven and Venkat, 2007; Julie, 2006; Prentice, 2006; Venkat, 2007). Teachers that took part in the ACE¹ (Mathematical Literacy) programme at various institutions in the Western Cape² felt that it was a very difficult subject (Mbekwa, 2006).

It is important that teachers who have to teach Mathematical Literacy would have to be trained in order to be prepared to cope with the requirements of the subject. In the case of implementing the subject in schools, it seems that the DoE did not place adequate emphasis on the training of Mathematical Literacy teachers before actual implementation took place (Mbekwa, 2006). Effective teaching and learning depends on teachers who understand and can teach learners to understand (SAUVCA, 2003). Educators have to be trained to facilitate learning, rather than just teaching (Romberg, 2001).

Research in schools also indicates that there are different approaches used by teachers in teaching Mathematical Literacy (Graven and Venkat, 2007). Some follow a more mathematical approach, while others follow a more literacy approach

¹ Advanced Certificate in Education

² Universities of the Western Cape (UWC), Cape Town (UCT), Stellenbosch (US) and Cape Peninsula University of Technology (CPUT)

(Graven and Venkat, 2007; Venkat, 2007; Julie, 2006; Mavuagara-Shava, 2005). There was also a difference between teachers who teach in a context-driven approach as opposed to a content-driven approach (Venkat and Graven, 2007). It seems that there are different resources available for educators to assist them in creating scenarios for teaching Mathematical literacy, but that they still have to work with updated material drawn from the environment. This approach ensures that activities are current and authentic (South Africa, 2007a; Graven and Venkat, 2007; Mavuagara-Shava, 2005) and that learners can identify with the contexts.

In my research I focused on the lived experiences of the college educators with regards to their teaching strategies/approaches, available resources, their general preparedness for implementation and other areas that may be of interest.

2.2 THEORETICAL FRAMEWORK

The theoretical framework was formed by briefly discussing the Norms and Standards of Educators (South Africa, 2000), the Social Constructivist Theory by Lev Vygotsky and looking at Communities of Practice by Wenger (1998).

2.2.1 Norms and Standards of Educators

As mentioned in Chapter 1.9.2 (p.19) in the Norms and Standards of Educators (South Africa, 2000), one of the seven roles of an educator is to be a “scholar, researcher and a lifelong learner”. In an environment where new subjects and policies are implemented, the educator becomes a learner once again. In this type of new environment he will have experiences and reflections as seen through the eyes of a learner. As the ‘learner educator’ gains experience he/she will then be able to fulfil other roles such as being an interpreter of the curriculum and subject specialist, in essence becoming a mentor for new educators in the field.

The Norms and Standards of Educators also states that educators are implementers of the curriculum and class managers. These are two key concepts that are further investigated and discussed in this chapter.

2.2.2 A Social Constructivist Perspective

I drew largely upon the social constructivist perspective of Lev Vygotsky. I attempted to highlight how this perspective aims to develop educators within their own environment in order to contribute positively with the ongoing process of Mathematical Literacy implementation.

Lev Vygotsky (1896 – 1934) was a Russian psychologist who developed the Social Development Theory which later extended into the Social Constructivist Theory. He based his theory on the connections between individuals and their experiences and interactions within their different socio-cultural contexts (Crawford, 1996).

The main ideas in Vygotsky's theory, as seen in Crawford (1996), are based upon:

- The fundamental role of social interaction. Unlike other theorists before him who believed that development precedes learning, he believed that social learning were a prerequisite to development.
- A More Knowledgeable Other (MKO) who can guide an individual to construct meaningful learning. A MKO can be a teacher, sibling or even a peer, as long as this person is more knowledgeable.
- The Zone of Proximal Development (ZPD). The ZPD is the distance between what a learner knows and the knowledge that the MKO has to their disposal. Within this space learning can be constructed.

Vygotsky also believed that individuals will better learn skills and gain knowledge that they would find useful to themselves. Knowledge and newly learnt skills would therefore be influenced by a learner's social and specifically familial environment.

In this research the researcher focuses on how the educator becomes a “learner” again when they are confronted by introducing new subject matter and also how they cope with exploring new territories.

Some educators were involved from the start of Mathematical Literacy implementation in 2007 and had considerably less support (MKO) than an educator who became involved at a later stage. Educators that started teaching Mathematical Literacy in 2007 had an opportunity to attend a once-off workshop presented by the Department of Education. The duration of the workshop was five days. These educators subsequently had to workshop and support educators that were unable to attend the workshop or started teaching the subject at a later stage. In this way “new” educators had the opportunity to learn from the “old” or experienced educators. The experienced educators acted as a “more knowledgeable other” to the inexperienced educators.

2.2.3 Communities of Practice

A Community of Practice (CoP) describes a group of people who share common interests, crafts and/or profession. These communities can be formed naturally because of the commonality present or can specifically develop in order to reach a goal e.g. gaining knowledge in a specified field (Lave and Wenger, 1991).

Implementation of new programmes and subjects lends itself to forming new communities of practice i.e. a community of Mathematical Literacy educators.

Wenger (1998) explains that a CoP consists out of three interrelated terms, namely:

- i. Mutual engagement

Mutual engagement refers to the collaborative relationships that the members of the community develop. The members form a social entity that identifies them with the group. In the Mathematical Literacy community the educators form relationships working with one another as if in a team.

ii. Joint enterprise

A shared understanding is created through the interaction by the members of the community. The joint enterprise can be renegotiated by the members and is also referred to as the “domain” of the community.

iii. Shared repertoire

The community can produce communal resources. The resources are then utilized in the pursuit of their joint enterprise. The repertoire can include literal or symbolic meanings. In the Mathematical Literacy community it can mean the joint resources that have been developed over the last four years in order to facilitate the subject in a user friendly manner. In my College, for instance, the educators work together to develop worksheets. Some educators even share resources with educators from other Colleges.

Communities of practice can increase organizational performance in four areas (Lesser and Storck, 2001:836):

- i. Decreasing the learning curve of new employees. In my College there had been quite a big influx of new educators in the last four years. Established educators can make the integration process smoother and assist the new educators to adapt quickly in a new environment.
- ii. New knowledge and information does not have to be developed on an ongoing basis, rather existing information can be passed on between members of the community.
- iii. New ideas can be generated.
- iv. Higher responsiveness to changing client needs, or in the case of education, the learners' needs.

Successful Communities of Practice can ensure that educators can become more effective and efficient. Studies have shown that co-workers spend up to a third of

their time looking for information and are five times more likely to ask a co-worker for help (Davenport and Prusak, 2000). Sveiby and Simon (2002) also concedes that seasoned colleagues are more likely to collaborate, which fosters the spirit of the community.

2.3 MATHEMATICAL LITERACY IN PERSPECTIVE

Mathematical Literacy was first introduced into the FET band of schools in January 2006. Mathematical Literacy is seen as a substitute for learners who do not want to do Mathematics. The FET phase includes Grade 10-12 and caters for the age group 15-18 years (Venkat, 2007). In 2007 Mathematical Literacy was introduced into FET Colleges as a fundamental subject as part of the National Certificate (Vocational) programmes (Hall, 2005).

2.3.1 Nature of Mathematical Literacy Teaching

Julie (2006) states that a continuum exist that defines Mathematical Literacy. On the one end it states that Mathematical Literacy is seen as entry into Mathematics, whereas on the other end of the continuum it is seen as a means to interact with mathematical installations in society.

Kilpatrick (2001) introduced the term “Mathematical Proficiency” and argues that it provides entry into Mathematics. His term rests on five strands, namely conceptual understanding, procedural fluency, strategic competence, adaptive reasoning and productive reasoning.

Skovsmose (1994), on the other hand, coined the term “Mathemacy”. Mathemacy is seen as a competency which enables learners to re-interpret their reality and react to it.

Mathematical Literacy is defined in the Programme for International Student Assessment (PISA) as “the capacity to identify, understand and engage in mathematics, and to make well-founded judgements about the role that mathematics plays in an individual’s current and future private life, occupational life, social life with peers and relatives, and life as a constructive, concerned and reflective citizen” (OECD, 2003:24).

The DoE (South Africa, 2006a; South Africa, 2007b) defines Mathematical Literacy as a subject that will help learners to think quantitatively, spatially and critically and will enable them to deal with mathematical information in real-life contexts.

2.3.2 Approaches to Mathematical Literacy teaching

2.3.2.1 Teacher-centred vs a learner-centred approach: A brief overview

Teacher-centred approach

A teacher-centred approach places the control for learning in the hands of the teacher. The teacher is primarily focused on the transmission of knowledge (Brown, 2003).

According to Musslewhite (2006), teacher-centred classes focus on the educator. Because this approach is curriculum driven, the educator does most of the talking and the learners listen. The educator chooses all topics of discussion, aiming at covering the curriculum and imparting knowledge.

Students work alone most of the time and the educator will monitor the learner to identify mistakes. The classroom is normally very quiet, requiring strict discipline, as the learners are not encouraged to interact with one another to facilitate learning.

Learners are judged according to how the other learners in the class are performing. In other words, the grade that the learner achieves, compared to the rest of the class, determines whether learning was successful or not.

Learner-centred approach

In learner-centred classrooms the learners, along with the guidance of the educator, have a choice of which topics they would like to learn about (Musslewhite, 2006). Educators facilitate learning, providing feedback and direction, rather than instructions.

Tomlinson (2000) claims that learner interests, background, styles of learning, set of beliefs and life circumstances dictate what learning will take place in a learner-centred classroom. He further suggested that the classroom is usually more active, as learners are encouraged to communicate with the educator, as well as with their fellow learners. The classroom is not a chaotic turmoil, but is guided by an informed educator. Learning is judged on the basis of achieving a goal. As learning is mostly experiential, the educator will set certain goals to be achieved. Thus, everyone should be able to achieve an A grade, as long as the goal has been achieved.

Strategies that are used in learner-centred classrooms are varied and can include problem-based learning, discovery methods, role plays, simulation, cooperative learning and student-produced responses (Musslewhite, 2006). It is clear to see that learners are more actively involved in a learner-centred classroom, an essential component in the NC(V) programmes.

2.3.2.2 Moving towards a learner-centred NC(V)

According to McCombs and Whisler (1997) there is overwhelming evidence that learners' motivation, learning, attitude and achievement are improved when exposed to a learner-centred environment. The authors also state that changes in our society ask all stakeholders in education to better meet the needs of learners. A shift in

mindset by all involved in education i.e. learners, educators, parents and administrators is necessary to achieve this.

Moving towards a learner-centred classroom will require that educators reconsider the types of activities that they create. More involvement from the learners is required, as they will be more willing to participate if they are learning about something of interest.

The layout of classrooms could also be altered to accommodate group orientated activities. Learner-centred classrooms require learners to be more interactive, which is also an essential requirement in the NC(V) programmes. It is also important to remember that the learners direct learning, but that the educator is there to facilitate effective learning.

Educators will need to prepare differently for their classes, as they will have to ensure that they thoroughly research the topics they are teaching. This will lead to lessons being current and applicable to the specific classes one is teaching. Planning will therefore have to be made well in advance, in order to ensure that there is enough time to research the topic effectively.

Educators might also have to adjust their teaching style. Most educators at FET level are used to a lecture-style, but with learner-centred classrooms the educator is not the centre of attention, but rather acts as a facilitator. As OBE is instrumental in learner-centred classrooms, problem-solving, critical thinking and discovery methods will be used more prominently (Musslewhite, 2006).

McCombs and Whisler (1997) stress that learners are unique and should be treated as such. By attending to their uniqueness, learners will take responsibility for their own learning. Learners learn best in a positive environment, where they can actively engage in creating their own understanding. Learners use their prior experiences and knowledge to gain new knowledge (Vygotsky, 1986). Learning is fundamentally a natural process, but will be enhanced when learners are engaged in a relevant and meaningful way.

Connecting life experiences to learning is also an important step in creating effective educational experiences. Again, this is another fundamental requirement for

teaching in the NC(V) programmes. Learners will be more engaging when learning is connected to real life situations (Musslewhite, 2006).

2.3.2.3 Multicultural Education

Multicultural Education is an emerging discipline aiming to create equal educational opportunities for learners from divergent racial, ethnic, social class and cultural groups. Learners must therefore acquire skills, knowledge and attitudes to interact, negotiate and communicate with people from diverse groups within a democratic society (Banks, 2001).

Zaslavsky (1996) intimates that multicultural education should help learners to develop positive self-concepts by exposing them to the history, culture and contributions from diverse groups that helped to shape the society we live in.

A very interesting Danish paper compiled by Alrø, Skovsmose and Valero (2005) state that conflict occurs frequently in a multicultural classroom. They maintain that conflict is a basic human condition and therefore includes potential for learning and development to take place. The conflicts can be related to family traditions, social structures, context of schooling, competencies in Mathematics, teacher background, learner background and planning and organization of teaching.

2.3.2.4 A Multicultural Approach to a Mathematical Literacy Classroom in a South African Context

The South African Schools Act (Act no. 37 of 1996) catalysed by the Bill of Rights and the South African Constitution, formalized the desegregation of schools in South Africa, and created the opportunity for learners from diverse cultural backgrounds to attend schools of their choice (Vandeyar and Killen, 2006).

According to Casey in Mavuagara-Shava (2005) a much deeper understanding of mathematics is gained by considering how mathematics arises and is used in various cultural settings. It is proposed that cultural settings, with their diverse human activities, embody functional mathematical literacy for people operating in those societies. Successful mathematical literacy is shaped when we take on board the understanding, reasoning, and mathematical thinking patterns prevalent in the society from which learners come.

Banks (2001) indicates that there are five dimensions to consider in a multicultural classroom. These five dimensions can be applied in the South African context and will be discussed very briefly:

a. Prejudice Reduction

Identify the racial attitudes of learners and how they could be modified by teaching. Teachers and educators both need to be sensitive to all cultures (Zaslavsky, 1996) and have to reduce prejudices that could be present. Even if one does not like or understand another person's culture, one can still respect their right to cultural expression.

One should not use descriptive language that can be offensive to a specific group (Zaslavsky, 1996). Conflict can occur in a multicultural classroom, but should be seen as an opportunity to learn and teach (Alrø, Skovsmose and Valero, 2005).

b. Empowering school culture and social structure

All ethnic and racial lines in the school systems should be included in order to create a school culture that empowers learners from all groups. This may include aspects such as language, learning styles, sexism and our expectations from our learners.

Customs and practices from different cultures must be respected by the different groups that are present in a classroom. No group's culture should be belittled (Vandeyar and Killen, 2006) and opportunities should be created for learners to express themselves in a cultural way without fear of being ridiculed. An example could be a cultural day in class where learners exchange recipes of food typically

from their cultures. The Mathematical Literacy angle would be the measurements and ingredients in the recipe and adapting it to larger or smaller groups (Ratio and proportion).

c. An equity pedagogy

Teaching styles could be matched with the learning styles of learners. In the South African context that could be quite hard, as it is difficult enough just to find suitably qualified teachers to teach Mathematical Literacy. What could be done, however, is for teachers to profile their learners in order to design lesson plans that will be inclusive of the differences.

Zaslavsky (1996) also mentions that sensitivity to the inherent differences could contribute to the success of facilitation in class, leading to a cohesive and inspiring class atmosphere. She also mentions that equity does not necessarily mean equality. This raises the point that learners must feel that they are treated as equals, otherwise feelings of inferiority and animosity may be experienced.

d. Content integration

A variety of examples and content can be used from different cultures and groups to illustrate concepts, generalizations and principles in their learning area. An example could be to look at the modern and traditional practice of paying Lobola (the price for a bride). As an added activity one can plan the budget of a traditional wedding.

e. The knowledge construction process

In different cultures the knowledge construction process might differ. This could be due to the differences in background and previous experiences. In the South African context, constructing knowledge can be especially hard when most learners are not being taught in their mother tongue. It is therefore of critical importance that there should be less reliance on textbooks and more emphasis on practical experiences (Rutherford and Ahlgren, 1989).

2.3.3 Andragogy and Pedagogy

Pedagogy is derived from the Greek word paidagogia: the word “paid” means child and “agogos” means leader. Thus, the word literally means to attend to or lead children (Hiemstra and Sisco, 1990). Some people also refer to this approach as didactic, traditional or teacher-directed.

Andragogy is a term that was popularized in 1968 by Knowles from Boston University. It was a word that was used to describe adult learning. Knowles conceded that andragogy and pedagogy can be used alongside one another, thereby allowing educators to use the model that suits a specific situation best (Knowles, 1990). The following table shows a comparison between pedagogy vs andragogy:

Table 2.1 Pedagogy vs Andragogy

	PEDAGOGICAL	ANDRAGOGICAL
Learner	Dependent upon teacher who decides what and how it is learnt. Teacher evaluates learning.	Learner self-directed and responsible for his own learning. Self-evaluation is a characteristic of this approach.
Role of learner's experience	Learner has little experience to use as resource for learning. Experience of teacher most influential	Learner brings experience as a resource to learning. Different experiences assure diversity in group.
Readiness to learn	Learners are told what they have to learn in order to advance to the next level	Ability to assess gaps of learning and that triggers a readiness to learn
Orientation to learning	Process of acquiring prescribed subject matter. Content units are sequenced.	Learners want to solve a problem or perform a task. Learners must have relevance to real life. Learning organized

		around life or work situations.
Motivation for learning	Primarily motivated by external pressures e.g. competition for grades and consequences of failure.	Internal motivators e.g. self esteem, recognition, better quality of life and self actualization.

Adapted from Knowles (1990)

Venkat (2007) mentioned that the FET phase is aimed at Grade 10 -12 learners that range between the ages of 15 – 18 years. This indicates that pedagogy would be the best way to approach teaching and learning.

The truth, however, is that the age distribution of learners in FET Colleges are different to those of FET Schools. In 2010 Buffalo City Public FET College in East London in the Eastern Cape Province enrolled 1002 learners at their John Knox Bokwe Campus and 1320 learners at their East London Campus. The following table shows the distribution of ages within each campus:

Table 2.2 Age distribution of Buffalo City College learners

	15 – 18 years		19 – 25 years		26 – 45 years	
	N	%	N	%	N	%
John Knox Bokwe Campus (1002 learners)	122	12	850	85	30	3
East London Campus (1320 learners)	192	15	1058	80	70	5

Adapted from Buffalo City Public FET College Statistics (2010)

The table clearly shows that only 12% of the learners at the John Knox Bokwe campus and 15% at the East London campus fall within the age category of 15 – 18 years. The bulk of the learners, 85% at the John Knox Bokwe campus and 80% at the East London campus, are between the ages of 19 – 25 years, traditionally thought to represent adult learners. Even though these statistics can move a teacher to use andragogic approaches, it is my experience that the majority of the learners are not self-directed and they bring little experience to class. There can be many reasons for this trend and one can only speculate at this time.

The question remains which approach should be followed in teaching and learning practices. It could well be advisable to use the two approaches in conjunction with each other, depending on the maturity of the adults.

2.3.4 Teaching and Assessment of Mathematical Literacy

2.3.4.1 Teaching

The NC(V) programmes require educators to be experts in their field of teaching (Zafar, 2004). Most educators in the FET Colleges come from industry and thus do not possess a professional teaching qualification. At our college, educators were informed late in 2006 that we will be implementing the NC(V) courses in 2007 and within a week we were sent on a week-long training session. It is asking much of a person to be trained for a week and expect them to understand all the aspects and elements of the NCS as well as the fundamentals of a new subject. There is a possibility that the DoE rushed the implementation process and therefore did not allocate adequate time for training to take place, hence the confusion about teaching, planning and assessment.

As the NCS is learner-centred, as opposed to teacher-centred, educators should be facilitators rather than teachers. This should enable learners to become critical thinkers.

Activities should therefore be planned well in advance to ensure effective progress for all learners, always keeping inclusivity in mind. Here it is important that the different types of intelligences are considered. The use of resources must make the activities more interesting and fun, providing time for discovery. In FET Colleges specifically, the Simulated Enterprise Venues (SIMS) will provide the learners to experience learning, rather than being passively taught. SIMS are classrooms where learners gain practical experience by simulating real life scenarios.

Educators have to become familiar with the new terminology being used in the NCS. At the moment some of the terminology is still confusing, but the more I use it, the more I get used to it.

It is important that educators review their own teaching by doing self-assessment. This will enable educators to improve on their teaching methodology. Peer assessments should also be encouraged as it can enrich an educator.

Educators should persist in professional development in order to stay up to date with the newest teaching methods. Networking with other educators is also an important support system. This means that holiday and private time will have to be sacrificed in order to train oneself.

2.3.4.2 Assessments

Educators should develop a **Programme of Assessment** for each grade or level they teach. Formal assessments should be done throughout the year to monitor progress. There should be a variety of assessments to demonstrate competency in each Assessment Standard. Assessments should be valid, fair, authentic and current. Assessments should indicate which LO's and AS's are being targeted (South Africa, 2006b).

The National Protocol of Assessment should be followed. This policy states the weighting of the assessments and the possible variety that should be included. Mathematical Literacy is assessed according to seven levels of competence.

The level descriptions or rating codes are explained in the following table:

Table 2.3 Level descriptors/Rating Code for Mathematical Literacy

RATING CODE	RATING	MARKS (%)
7	OUTSTANDING	80 – 100
6	MERITORIOUS	70 – 79
5	SUBSTANTIAL	60 – 69
4	ADEQUATE	50 – 59
3	MODERATE	40 – 49
2	ELEMENTARY	30 – 39
1	NOT ACHIEVED	0 – 29

DoE Assessment Guidelines for NCV (SA, 2006b)

The **assessments need to be recorded** on specified mark sheets. Reports have to be written after each test, assignment, project, etc and remedial interventions should be recommended

After assessments have been done, the educator can determine if **remedial interventions** are necessary. In the FET sector a learner is granted an opportunity for re-assessment if the educator deems it necessary.

Each learner must have a **Portfolio of Evidence (PoE)** where he/she keeps evidence of his/her assessments. A record of the assessments and remedial interventions are kept by the educator in a **Portfolio of Assessment (PoA)**.

The following criteria should also be remembered with regard to assessment:

- Assessment is continuous and should be used diagnostically

- Learners are assessed in relation to their own ability in order to create an opportunity for success
- Assessment can be formal or informal, depending on the situation
- Assessment should be contextualised and life-like
- The learner measures himself or herself against his/her own progress
- The learner takes responsibility for his/her own learning
- Assessment can be done individually or in groups (South Africa, 2006b).

It is imperative that records are kept up to date, so that all stakeholders (DoE, educator, learner and parents) can be informed on the progress of the learner. The formal writing of the reports after each assessment places an added administrative load on educators, but it does form part of an organized structure of teaching and learning.

The system also requires that educators should be qualified assessors in order to assess learners. This means that many educators in the FET Sector have to be trained again to become qualified assessors.

2.3.5 Why Mathematical Literacy teaching?

Mathematical Literacy was introduced to reach the 200 000 learners who leave school at the end of Grade 12 without Mathematics as a subject, but also to reach the 200 000 learners who leave Grade 12 having failed Mathematics (Christiansen, 2007).

The fact that South African learners perform dismally when compared to the Mathematical ability of learners from other countries underlined the fact that something drastic had to be done. There is evidence that points to adults who are mathematically incompetent being seriously disadvantaged with regard to employment possibilities (Brynnner and Parsons, 1997). From an economical and social viewpoint this could prove disastrous for South Africa.

The other reason why Mathematical Literacy was introduced was directed at overcoming the legacy of Apartheid. Mathematical Literacy was to give learners knowledge and competencies that would be in line with the overall intentions of the NCS which strives to improve living conditions, democracy and social justice (Christiansen, 2007).

2.4 MATHEMATICAL LITERACY IN FET COLLEGES VS MAINSTREAM FET SCHOOLS

The Learning Outcomes facilitate progression from General Education and Training (GET) to Further Education and Training (FET). From Grade R-9 learners are exposed to Mathematics and in the FET Band they have a choice between Mathematics and Mathematical Literacy. It is interesting to note that the Curriculum Documents for Mathematical Literacy in FET Schools and FET Colleges have marked differences.

The Learning Outcomes (FET Schools) are replaced by Topics (FET Colleges). The Topics are divided further into Subject Outcomes, which in turn has Assessment Standards with Learning Outcomes to be achieved.

Table 2.4 Comparing Learning Outcomes of Mathematical Content

The Learning Outcomes for Mathematics in the NCS Grades R-9 (GET)	The Learning Outcomes for Mathematical Literacy in the NCS Grade 10-12 (FET Schools)	The Topics for Mathematical Literacy in the NCS of the NC(V) in FET Colleges
LO 1: Numbers, operations and relationships	LO 1: Numbers and Operations applied in context	TOPIC 1: Numbers
LO 2: Patterns, Functions and Algebra	LO 2: Functional Relationships	TOPIC 2: Patterns and Relationships
LO 3: Space and Shape	LO 3: Shape, Space and Measurement	TOPIC 3: Finance
LO 4: Measurement	LO 4: Data Handling	TOPIC 4: Space, Shape and orientation
LO 5: Data Handling		TOPIC 5: Information communicated through numbers, graphs and tables

Adapted from DoE Curriculum Documents for Mathematical Literacy

At this stage it is important to emphasize that no new mathematical concepts are taught or introduced in Mathematical Literacy. The mathematical concepts taught from Grade R-9 are simply used to apply in real-life contexts.

The Learning Outcomes are very specific and provide learners with the opportunity to engage with situations that they will encounter in real life. If one takes the time to study the rest of the Assessment Guidelines, it is clear to see that all the Assessment Standards and Learning Outcomes address the three aims of

Mathematical Literacy. The Learning Outcomes are therefore inspired to produce responsible, self-managing and contributing citizens of South Africa.

I am of the opinion that to ensure that a learner can make the most of Mathematical Literacy as a subject, we have to ensure that the learner has adequate embedded knowledge. At the moment the lack of embedded knowledge seems to be our biggest obstacle, as learners have a very low level of competence with regards to mathematical concepts. Even though the Assessment Standards and Learning Outcomes have the ability to address the aims of Mathematical Literacy, a very low percentage of the learners are prepared for the subject. Many educators spend many hours struggling to eradicate the knowledge gap. This leaves less time for applying the content knowledge to real-life situations.

I think that Mathematical Literacy has the ability to uplift all citizens of our vibrant country. I sincerely believe that all learners should become mathematically literate, even learners who take Mathematics as a subject.

2.5 FET based Mathematical Literacy Practices

2.5.1 Lesson Planning in NC(V)

Before I can begin discussing the planning process I need to define some design features that will be encountered during discussion (Oxford University Press):

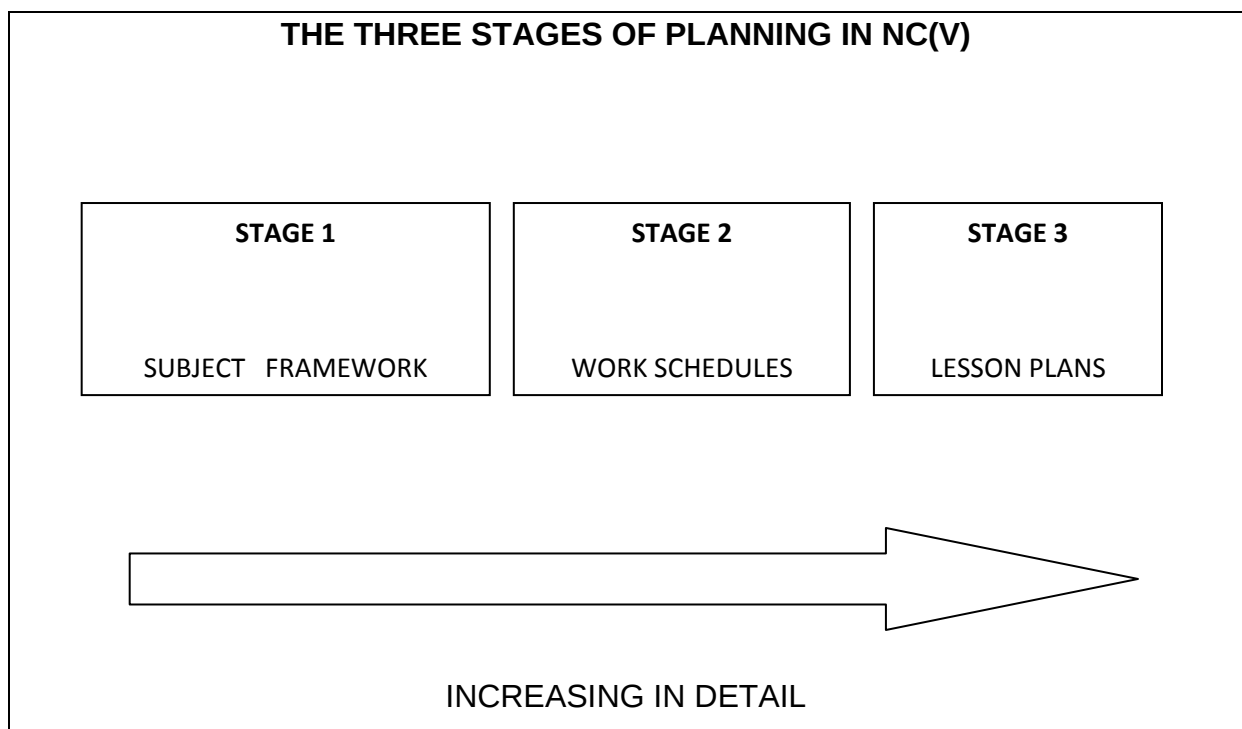
Critical Outcomes (CO's) and Developmental Outcomes (DO's) are broad lifelong outcomes that were developed based on the Constitution. Each of these describes the type of South African citizen the education sector hopes to produce. These outcomes include aspects such as life skills, communication, management of activities and information, working in groups and becoming responsible, contributing citizens of South Africa. The CO's and DO's should be reflected in teaching approaches and methodologies (South Africa, 2007b).

Learning Outcomes (LO's) are broad statements that assists in the achievement of the DO's and CO's. A Learning Outcome is a statement of an intended result of learning and teaching (South Africa, 2007b). The learning outcomes will stay the same for each grade, but each LO will be followed by a detailed statement of what level of performance needs to be achieved.

Assessment Standards (AS's) embodies the knowledge, skills and values that are required to achieve a specific LO. Assessment standards show progression from grade to grade, ranging from simple to complex. The assessment standards are different for each grade (South Africa, 2007b).

Planning is done in three stages, illustrated in the diagram below:

Diagram 1



STAGE 1: SUBJECT FRAMEWORK

The subject framework is basically a year plan of a specific subject in order to pace teaching and learning. Although there is no particular format that is recommended, this broad form of planning normally includes school terms, teaching weeks, holidays and other important dates (Oxford University Press, 2006).

The subject framework can be done according to phases. In the case of NC(V) the phase will span Level 2, 3 and 4.

The subject framework is normally on one page for the purpose of getting an immediate idea of what will happen during the year. The topic is mentioned in each week and gives a good overview of how teaching and learning will take place.

Planning can be done in advance as educators become more familiar with the curriculum. Educators also learn how to adjust to the pace of their learners during the year, thus planning has to be flexible and documents should be working documents.

STAGE 2: WORK SCHEDULE

The work schedule is a detailed year plan. Work schedules are derived from the year plan or subject framework. The schedule is subject specific and will indicate how teaching, learning and assessments will be sequenced and paced (Oxford University Press, 2006).

It is important that **time frames** are carefully considered when planning the work schedule. The schedule normally spans 36 – 40 weeks, depending on the duration of the school year.

The **learning outcomes and the assessment standards** that have to be achieved should be included and will determine how teaching, learning and assessment will take place. The **assessment methods and tools** should be indicated. This could include references to group, pair or individual work.

Resources are also listed in the schedule. This will help with the planning for each specific week or day when lesson planning takes place as some resources that have to be obtained may need special effort e.g. collecting newspapers or magazines.

STAGE 3: LESSON PLANS

Lesson plans are directly derived from the work schedule, but again, more detail is required. Lesson plans are not necessarily drawn up per period on the school timetable, but could stretch over more than one period or day. The following should be included in the lesson plan:

- Topic (Name of your lesson)
- Date
- Learning programme and level
- Time allocation (How much time is needed to complete the lesson)
- Learning Outcomes
- Assessment Standards
- Resources
- Links to previous and next lesson
- Expanded opportunities (for early finishers)
- Special needs
- Integration with other learning fields
- Assessment methods/tools
- Teacher activities (What the teacher has to do)
- Learner activities (What the learner has to do)
- Reflection (to re-plan or improve on lesson) [Oxford University Press, 2006]

Again, there is no set format, but it is advisable to include most of the elements included in the list above. The lesson plan is very detailed (Oxford University Press, 2006). It should be possible for a person to walk into your class and teach the class by looking at the lesson plan.

Planning should be flexible. One could even find oneself planning differently for different classes within the same subject. The planning for Tourism could therefore be different to planning for the Office Administration groups, focusing on different aspects that are more applicable in a specific Learning Programme.

It is imperative that enough detail should be included, especially in lesson planning. Good planning makes facilitation easier on the day and one's preparations will be much more thorough.

Planning should be revised and that can only be done if real reflection is done by the educator. In my experience teachers tend to do the same thing year after year without stopping to reflect on what happened. The reason for this is normally that they do not want to change.

Because planning can be so time-consuming it is advisable that planning should be done using a computer. This way it is easier to make changes for the next round of planning and one could even copy and paste the parts one wants to keep.

One can consult with educators in the same learning area in your school or college. It is good to hear ideas from everyone involved in that learning area. One could also consult outside of one's institution as this could give one some valuable ideas and assist in planning.

One can consult with learning programme educators to gain a better understanding of how one can integrate one's learning area with other learning areas.

2.5.2 Lesson Presentation and Strategies for Effective Teaching and Learning

Teaching Mathematical Literacy in FET Colleges is a relatively new experience and as already mentioned it is different to teaching Mathematics. This means that even though the same mathematical principles apply, different strategies for teaching can be explored.

The best way to improve teaching is to inquire into the effects of one's teaching on student learning ... The nature of teaching is context-related, uncertain and always improvable. Effective teaching refuses to take its effect on students for granted. It sees the relation between teaching and learning as problematic, uncertain and relative. Good teaching is open to change; it involves constantly trying to find out what the effects of instruction are on learning, and modifying that instruction in the light of evidence collected. (Ramsden 1992:102)

Mavuagara-Shava (2005:215) did an extensive study on didactical approaches in Mathematical Literacy teaching in Secondary and High Schools in Lesotho and concluded the following as effective strategies for teaching and learning:

- the use of extended projects and mathematical investigations as a didactical approach that enhances mathematical literacy in learners,
- mathematical modeling of real-life problems,
- use of real-life data in statistical problems,
- overt mathematical communication that includes both oral and written work,
- use of an open-ended, problem-solving approach to real-life problems with a little less seeking of particular solutions to particular contrived problems,
- use of a multiple approach to problem solving,
- less dependence on the textbook approach,
- matrix algebra to be set in real-life situations as a means of organising and analysing data, and
- connecting mathematical concepts and skills to other school subjects

In the following sections I have elaborated on some of the above-mentioned strategies, referring to other authors, and also added a few more strategies.

a. Use of Real-life Problems and Data

As Mathematical Literacy is aimed at creating self-managing individuals, contributing workers, lifelong learners and critical citizens in the modern world, learning should focus on local and personal contexts (Rutherford and Ahlgren, 1989).

Classroom activities should engage learners in a positive way. This means that educators should use contexts that are of interest to them e.g. Cellphone contracts, soccer logs, car purchases, personal budgets, aids statistics etc. Sometimes this means that the educator have to spend much more time on developing interesting activities.

Use of media like newspapers, magazines etc can be utilized to make learning and teaching more interesting. Always ensure that activities are relevant and current.

b. Use of a Problem Solving Approach

It is possible in Mathematical Literacy to pose a problem and then let the learners decide on how to solve it. The reason for this is that no new mathematics is acquired in Mathematical Literacy, but instead the principles learnt from grade R – 9 are enough to be used for problem solving from Level 2 – 4 in the FET curriculum.

It is imperative that learners realize that there is normally more than one way to solve a problem and learners should be encouraged to use their own way of thinking to solve a problem. (Mavuagara-Shava, 2005). Problems may be complex and sophisticated, which means that learners have to use lateral thinking skills to solve a problem.

Flexible thinking should be encouraged. The method of understanding should not be seen in a one-dimensional way. Learners learn and think in different ways and it is up to educators to facilitate the different styles of learning and understanding.

**c. Use of different Activities to cater for Different Learning Styles
(Rutherford and Ahlgren,1989)**

Students need to be engaged actively and the days of just writing a couple of tests are over. A variety of methods must be used to accommodate the multiple intelligences of the learners, such as group work, worksheets, assignments, projects, observations, class questions, lecturer, student and parent discussions, investigations or research, case studies, practical exercises, demonstrations, role-play, interviews, examinations, class tests, practical examinations, oral tests and open-book tests (South Africa, 2006b).

d. Supply Regular feedback (Gibbs et al, 2006)

Feedback forms an integral part of learning and teaching. Feedback provides the learner with an opportunity to gauge progression in learning. Regular feedback can motivate learners, especially if the feedback is positive.

Personalising feedback can encourage learners to achieve deeper learning. Feedback is more than just supplying correct answers, but should be suggestive and analytical (Rutherford and Ahlgren,1989).

e. Integrate with other Learning Areas

Linking learning areas can increase relevance and understanding among learners (Mavuagara-Shava, 2005). Mathematical literacy is relevant to all other learning areas and is especially relevant in the NC(V) programmes at the FET institutions e.g maps and timetables in Tourism, finance in Finance, Economics and Accounting etc.

Educators in the different learning areas should liaise in order to make learning more interactive. Learners should be encouraged to recognize mathematics in their own world and in different contexts (South Africa, 2006a; South Africa, 2006b).

f. Counteract Learning Anxieties (Rutherford and Ahlgren,1989)

Though it is not necessarily true in all cases, the perception is that most learners who do Mathematical Literacy are learners who encountered problems coping with Mathematics. They probably arrive in class with a huge amount of fear of failure and negativity. For this reason it is important to build on success. Deemphasize getting all the answers right and rather welcome curiosity, reward creativity and encourage a spirit of healthy questioning.

Working in groups can also be beneficial as learners might feel more confident and at ease working with their peers than on individual tasks. Sometimes learners understand the “language” of their peers better than any explanation the teacher can provide.

g. Provide Experience in Working with Technology and Tools (Rutherford and Ahlgren,1989)

By the time learners leave school or their educational institution, they should have experienced and mastered working with calculators, computers, measuring equipment and any other tools of their trade e.g. maps and timetables in Tourism.

Research has shown that interactive computer tutorials can significantly increase the progress and achievement of learners in different learning areas (Frith, Jaftha and Prince, 2004).

In an article in the FET College Times (Welgemoed and Bredenkamp, 2006) it is mentioned that the PLATO e-learning programme can reduce learning time by 40% and increase achievement by up to 30%. PLATO is a computer programme providing e-learning tutorials and assessments in English, Mathematics, Chemistry, Biology, Technology and Life and Career Skills.

h. Teacher Training in the Facilitation of Mathematical Literacy

The biggest challenge facing the delivery of Mathematical Literacy in the NCS is the lack of suitably qualified teachers. Effective teaching and learning depends on teachers who understand and can teach learners to understand (SAUVCA, 2003).

Educators have to be trained to facilitate learning, rather than just teaching (Romberg, 2001). Facilitation will help learners to discover for themselves, which is one of the aims of OBE. Straight-forward teaching all of the time will only encourage learners to sit back and wait to be spoon fed. Students need to be engaged actively at all times, encouraging interest and a thirst for knowledge.

2.5.3 Gender Issues in Mathematical Literacy teaching

The issue of gender in Mathematical Literacy can be approached in two ways. The first would be to research how the gender of the educator would influence teaching and learning. The second approach would include how to teach Mathematical literacy to different genders within the same class.

2.5.3.1 Male vs Female Educators

Male and females have been compared on numerous platforms and in various different fields. In order to achieve certain goals in the classroom, a teacher needs a versatile personality in order to cope with different situations (Farooqi, 2009). The aim would be to see which gender is more appropriate for teaching, while keeping an eye on the positive aspects of each gender.

Farooqi claims that there are a few characteristics that should be inherent in teachers, namely morals, an accurate knowledge of their subject matter, responsibility, communication, class control and personality.

a. Morality

Morality is not a gender related issue, as it is a personal matter to each and every educator. Morality could even be motivated by religious beliefs and those are certainly not gender related.

b. Knowledge of subject matter

Knowledge of subject matter is crucial in effective teaching and learning and should be inherent in every educator. In an informal study conducted by Farooqi he noticed an interesting trend where students believed that male educators were better informed with regard to subject matter. Female respondents had the view that female educators did not research their subject that well.

c. Responsibility

Here again, the issue is not really gender related. Each person has his/her own way of showing responsibility. These will depend on the environment they function in, coupled with enthusiasm. A person's personality would also determine how responsible such a person would be.

d. Communication

Communication is a fundamental skill in transferring knowledge to learners. It is also a determinant in discipline in class. In tertiary institutions it seemed that male teachers had better communication skills, whereas female teachers showed more tolerance and better communication skills in primary schools.

e. Personality

Personality will cover the entire existence of an educator. Farooqi's enquiry uncovered that college student thought that female teachers were either too polite or too harsh, struggling to find the middle ground. It was felt that male teachers coped better with divergent situations in the classroom, easily adjusting to change.

An interesting study by Hembree (1990) claims that women were more anxious when teaching Mathematics than their male counterparts. This anxiety can easily be passed on to learners and therefore influence their concept of Mathematics. This can in turn influence their Mathematical performance.

f. Class discipline

In general it seemed that men controlled their classes better than female educators. Males are more imposing and traditionally are more respected when it comes to discipline. This, however, does not mean that there are no female teachers that can handle discipline within their classes (Hembree,1990).

Looking at the points discussed above, it is better not to jump to any conclusions, but to rather concede that male and female educators are respectable, and capable in different ways. As it is there is currently a big shortage of male educators. One of the possible reasons can be the fact that the profession is not financially attractive anymore to a male breadwinner.

2.5.3.2 Gender differences amongst learners

According to Snyder and Tan (2005), boys and girls are equally successful at basic mathematical levels, but when it comes more complex reasoning the boys outperform the girls.

An extensive body of research has been developed and has subsequently uncovered cognitive gender differences (Halpern, 2000; Friedman, 1995; Frater, 2000; Casey, Nutall and Pezariz, 2001).

Table 2.5 Cognitive differences in boys and girls (Adapted from Halpern, 2000; Snyder and Tan, 2005; Casey, Nutall and Pezariz, 2001).

BOYS	GIRLS
Better at spatial relations	Better at verbal proficiency
More acute vision, but more likely to be colour blind	More acute hearing and more sensitive to loud sounds
React well to kinesthetic learning i.e. movement	Better able to read faces and body language
More likely to have a learning disability, but equal opportunity for dyscalculia (learning disability in mathematics)	Less likely to have a learning disability, but equal opportunity for dyscalculia (learning disability in mathematics)
Greater need for activity, more impulsive	Faster development of fine motor skills and better perceptual speed
Remember visual cues better	Remember placement of objects and words
Deal with stress with “fight-or-flight”	Deal with stress “tend-and-befriend”

According to James (2007) the implications for the classroom are:

- i. Do not talk to the blackboard. Boys normally gravitate towards the back of the class and this will not help them to hear well. Using bright colours will appeal to their acute sense of sight.

- ii. Step by step explanations will be beneficial for the girls as they are more verbally inclined.
- iii. Boys are attracted to movement, so the educator must move around at times to keep the attention.
- iv. Women will ask for help, whereas boys do not like to ask for assistance. In cases like this it will be advisable to group boys and girls together during activities.
- v. Active learning is beneficial for both genders, thus reality projects can be beneficial for teaching and learning.

It is evident that teaching mathematical content relies on much more than showing up in class to do a few problems and corrections. Each student brings a unique set of attributes to the class and the way that the teacher presents the material will have a bearing on the teaching and learning that takes place in the classroom. An understanding of gender cognitive differences can enhance the classroom experience for the learner as well as the educator.

2.5.4 Influence of school context

In this research the researcher will refer to school context by including rural and urban perspectives. "Rural" refers to areas that are not as densely populated e.g. less than 2500 people and over 50km away from an urban centre (Miller, 1993).

The *Education for All* study conducted in South Africa found that 46% of the population resides in rural areas (South Africa, 2000). Although people are flocking to urban areas due to various reasons, it still means that almost half the population of South Africa who needs education is residing in the rural areas.

The rural-urban divide is of great consequence as it affects the educational sector. It is believed that 75% of people living in poverty are living in the rural areas. When rural schools are compared to urban schools it is clear that there are imbalances present. These imbalances can be reflected in infrastructure, school resources,

availability of libraries and laboratories (HSRC, 1997). It does seem that rural schools/colleges form integral parts of local communities, providing basic training and skills (Wotherspoon, 1998) and making them extremely important vehicles in delivering quality education to all South Africans.

Though the rural areas are known for high poverty levels, the FET College sector have been granted R1.9 billion through the Recapitalization Fund (RECAP) to upgrade all FET College facilities. RECAP was extended to all Colleges and is strictly monitored to ensure that the funds are allocated wisely (Hammond, 2007). The RECAP funds are to be used to:

- train lecturers,
- upgrade information technology (IT) systems within the colleges,
- upgrade workshops, classrooms and resource centres
- upgrade campus sites and
- purchase learning and teaching support material (LTSM).

One of the functions of the RECAP fund is to attempt to lessen the gap between rural and urban colleges, providing learners from all walks of life an equal opportunity to quality education i.e. providing equity in teaching and learning. Herman and Klein (1996) argue that equity means providing opportunities for learners by making resources available, a supply of qualified educators to teach and access to instructional content and tools.

Even though it has been proven in various studies that the lack of resources should not affect the performance of learners (Arnold, 1995 and Vari, 1997), it could certainly affect the performance of teachers (Tshabalala, 2008).

A real challenge that is faced in rural schools is that they struggle to attract and retain qualified staff (Oakes and Lipton, 1990). The reason for the phenomenon is that teachers find urban areas much more attractive to teach in as they traditionally have better resources available and also provide better opportunities for progression. It is thus of utmost importance to ensure that qualified teachers are available to teach in urban, as well as rural areas.

2.5.5 Professional Development of Mathematical Literacy teachers

Most educators that will teach mathematical Literacy will have to be recruited from non-mathematical disciplines because there are simply not enough Mathematics teachers to teach both Mathematics and Mathematical Literacy (Mbekwa, 2006).

The educators that have to be trained will have to receive training in content knowledge as well as pedagogical content. It is important to know how to transfer the knowledge that they have in an effective manner.

2.5.5.1 The focus and benefits of professional development

The Centre for Educational Research and Innovation (CERI, 1998) defines professional development as any activity that develops an individual's skills, knowledge, expertise and other characteristics as a teacher or educator, including personal study and reflection, as well as formal and non-formal courses.

Dickie, Eccles, Fitzgerald and McDonald (2004) state that professional development for teachers focuses broadly on the following themes:

- *Pedagogical expertise*: being able to adapt to different teaching and learning strategies to cater for individual students and incorporating new approaches, such as mentoring, learner-centredness and self-directed learning.
- *Learner focus*: applying and supporting self-directed learning and to cater for individual learning differences, which would include multiple intelligences. The promotion of lifelong learning amongst participants should be encouraged.
- *Industry currency*: It is important to maintain knowledge of the technical aspects of the subject and balancing this with an understanding of generic employability skills. Training should always strive to retain validity, currency and reliability within industry.
- *Use of technology*: Educators should stay updated with regards to understanding new and emerging information and communication

technologies (ICT), especially those which allow practitioners to interact with learners in remote delivery settings (e-learning).

- *Client focus*: Fostering an understanding of relationship building and brokering skills, developing networks and partnerships with industry, customising training to client's needs and evaluating and monitoring outcomes.
- *Technical education system expertise*: Staying abreast of quality assurance systems, registration procedures (where applicable), government legislation and recognition of prior learning.
- *Personal qualities and attributes*: understanding personal attributes considered essential for technical education practitioners, such as 'passion for learning', communication skills and commitment to self-development and improvement.

When staff is continuously developing themselves, they become more productive, motivated and confident within themselves.

2.5.5.2 Models for the professional development in FET Colleges

Professional development is essential if educators want to stay updated with the requirements that are expected of them. This requires a range of skills in counseling, management and administrative duties, planning, conducting research and building partnerships (Cort, Harkonen and Volmari, 2004).

Young (2006) identifies four models, in terms of institutional location, for the professional education of FET College lecturers:

1. A National Institute model

Many European countries have their own National Institutes who are responsible for FET educator training and curriculum development. This approach is very successful in countries where there is a high level of expertise in the FET sector. He does warn that this model might alienate the FET sector from the rest of the educational community.

2. The College-based model

This model aims for FET Colleges to use their own initiative to develop programmes in vocational pedagogy. This will provide the colleges with the responsibility of developing their own teaching staff.

3. The University-based model

Most FET educators have professional qualifications, but lack the pedagogical knowledge. Universities can supply pedagogical expertise through their Education Departments.

4. The College/University partnership model

Colleges will take responsibility for specialist vocational training, whereas Universities will take responsibility for broad professional educational issues. By making use of this model, the expertise of the different sectors can be fully utilized.

2.5.5.3 Professional Development in African Countries

In my research it became evident that there are very few of the African countries that have a formal approach to professional development in the vocational sector. Most, if not all, countries were in the process of revitalizing their TVET (Technical and Vocational Education and Training) system, but not necessarily the training of their TVET staff.

NIGERIA

The National Board for Technical Education (NBTE) in Nigeria, along with UNESCO's (United Nations Educational, Scientific and Cultural Organisation) Section for Technical and Vocational Education is implementing a project that aims to uplift the quality of Vocational Education in Nigeria (UNESCO, 2002).

The project is a cost-sharing exercise to revise the curriculum for Secondary Technical Colleges and Post-Secondary Polytechnics. The project also includes establishing a new system of continuous professional development and training of technical staff. Project implementation started in February 2001 with national experts and UNESCO international consultants collaborating.

Seven Staff Development Centres (SDC's) were established in Federal Polytechnics (Nigerian TVET institutions) in each of the six geopolitical zones at Auchi, Bauchi, Bidi, Kaduna, Lagos and Nekede. One SDC was also established at the NBTE headquarters.

In August of 2001, a special course (Train the trainer) was organized in Kaduna to train technical educators, principals and heads of departments in the use of the new curriculum. This was a joint effort by UNESCO and the NBTE. From February to November 2002 the SDC's have been instrumental in providing training to 572 staff members from institutions all over Nigeria. The training comprised of 34 training workshops. The project aimed to have provided initial training to approximately 20% of Nigeria's TVET staff.

The ultimate aim is to make the SDC's self-sustaining and increase their training capacity (UNESCO, 2002).

Many of the educators were themselves trained at the Federal Polytechnics or they come from industry. They therefore lack the educational background. Most of the Universities in Nigeria offer some sort of education qualification, the most popular being the Nigeria Certificate of Education (NCE). The National Teachers' Institute (NTI) and the Schools of Education in Polytechnics are also providing teacher education and training. The NTI offers courses to upgrade unqualified teachers and they also make use of distance learning and long vacations to attend programmes (Omoregie, 2006).

In my research I did not find much information on Universities that provide vocational specific education. It seems that the University of Nigeria in Nsukka has a Vocational Teacher Education Department, but when I visited the website that page was still under construction. No other information was available on the Department.

It does seem that the Federal Polytechnics are planning to get involved in the training of their own staff in the future (Onjewu, 2005).

The aim of the Federal Government of Nigeria is to upgrade the quality of their education staff from pre-primary up to university level.

The strength of the Nigerian approach is:

- i. The use of international organizations, such as UNESCO, to assist in professional development.
- ii. Working with government to improve the quality of education.
- iii. Setting up specialized training centres to cope with a specialized area of education.
- iv. Planning to use the Vocational Institutions to provide training is a positive step.
- v. There is evidence that the Universities are coming on board to assist in providing VET specific educator training.

At the moment I cannot identify any weaknesses. In all my research it seemed that Nigeria was the most organized in trying to revitalize not only their TVET institutions, but also their lecturing staff.

BOTSWANA

Molebatsi (2000) states that of all the nations in the SADC (Southern African Development Community), Botswana appears to have a very low standard at all levels of education, especially Vocational Education and Training.

It seems that in the past there was sufficiently qualified staff to teach in vocational programmes, but since the 1990's there has been a gradual decline of skilled personnel. This phenomenon is due to donors withdrawing funds from Vocational Institutions.

Current teachers and managers come from a range of teaching and training organisations, such as Colleges of Education and Universities (BEd Degrees and Post Graduate Certificates), technical colleges, brigades, industrial training organizations and private institutional organizations (Kisenga and Frankland, 2000).

According to Masenge (2003), Botswana does have a Department of Vocational Education and Training (DVET), but it seems that they have not been too successful in their efficiency.

I was unable to unearth any evidence of TVET specific staff training, but I did find information on suggested models that could be used. Molebatsi (2000) called for a Regional Coordinating Centre who would assist in all aspects of TVET, but specifically in arranging staff development. The Centre would organize the priority of training programmes. He categorically states the Centre should not become an empire of its own, but co-operate with other facilities, government, providers and aid agencies. It must serve as a facilitator, not a dictator. The Centre should also work closely with the other SADC nations to share information, knowledge and expertise.

Molebatsi also agrees that instructors should be highly qualified in their trade, but also receive tertiary education on the art of educating.

The aim is thus to bring together government and non-government agencies involved in vocational training to set up long and short term goals for staff development.

The strengths are that they are looking to include different organizations to take responsibility for the training of staff and that they want to make use of the expertise of other SADC nations. The weakness is that it seems that there is a lot of talking, but not enough action.

The similarities include that:

- Both countries seem to have basic education programmes offered at Universities.
- Both are in the process of revitalizing the TVET sector and staff.

- They make use of information from outside sources, although Nigeria seems more pro-active.
- They understand that TVET should not isolate themselves from government, private sector and other interested parties.

The differences include:

- Nigeria is more organized, especially looking at the SDC's. The SDC's provide specialist vocational training.
- Nigeria makes use of international organizations to assist them.
- Botswana seen to struggle with funding, although it does seem that they will be receiving funding from government soon.

2.5.5.4 Recommended model for professional development in South African FET Colleges

According to Cort, Harkonen and Volmari (2004), VET practitioners' professional development is too important to be left to individual teacher's personal motivation and should be regular and compulsory.

Young (2006) proposes that Universities with strong departments in professional fields, such as engineering, collaborate with Colleges to form course teams to train vocational staff.

Already the leading Universities in South Africa are offering Education Courses that specialize in the FET band, such as the National Diploma in Education (NPDE), the Post-Graduate Certificate in Education (PGCE) and the some of the Advanced Certificates in Education (ACE).

Cort, Harkonen and Volmari (2004:27) suggest institutions should adopt professional development approaches that:

- are 'dualistic', integrating practice and on-the-job learning in the practitioner's classroom with theory

- are flexible and modular, to meet the different needs and backgrounds of practitioners
- encourage practitioners to reflect on their own teaching practice
- use the benefits of 'study circles' or 'communities of practice' involving professionals from different departments, disciplines or institutions
- use ICT to encourage active participation
- encourage distance learning (e-learning).

It seems that there is a concurrence that a Centre for Vocational Education should be established (Molebatsi, 2000; Kisenga and Frankland, 2000). This institution should work closely with government, industry, colleges and universities in order to make the most of the expertise of all the sectors. The institution should also conduct periodic needs assessment for courses, workshops and seminars. Programmes should be responsive to changes in the vocational sector (Kisenga and Frankland, 2000).

Molebatsi (2000) suggests that there should be close co-operation among the SADC nations to ensure that all vocational staff has access to quality training institutions and programmes.

Based on my research it seemed that the countries which had international support from organisations such as UNESCO, were better supported and directed in staff development. It would therefore be advisable for South Africa to forge strong international and organisational links where possible.

Mounting a coherent programme of professional development will require a coordinated national response, with all sectors providing knowledge from their various fields of expertise.

2.5.5.5 Implications of non-existent professional education

As mentioned before in Chapter 1.2.6 (p.11), failure to institute professional development for FET staff will result in:

- i. FET Colleges being unable to keep pace with the rapid and far-reaching changes in the nature of work.
- ii. The inability to address problems within the composition of their workforce, especially related to age and gender.
- iii. The failure to turn their commitments of developing partnerships into sufficiently good practice.
- iv. The continuous feeling that FET programmes and training are inferior.
- v. FET Colleges being unable to produce learners that can come become participating members in society.
- vi. The deterioration of the FET system as FET Colleges struggle to retain staff. (McGrath and Palmer, 2004)

2.6 CONCLUSION

In this chapter I focused on providing a theoretical framework for the research. In the process I provided a literature review that explained what Mathematical Literacy is and also the approaches to teaching the subject. I specifically highlighted FET based Mathematical Literacy practices that can influence teaching and learning.

In Chapter 3 I am discussing the research design and methodology that I used within my research. The chapter details how the data was collected in a valid and trustworthy way and how ethical considerations were taken into account during the research.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

This chapter provides a detailed description of the research approach and research design that I followed during my research. A descriptive account is provided on the different instruments employed when data was collected and how analysis of the data took place.

3.2 RESEARCH APPROACH

The purpose of research is to review, synthesize, and investigate existing knowledge and situations to provide insight and possible solutions (Neville, 2005). It can also be used to explore or explain phenomena or even generate new knowledge (Collis and Hussey, 2003).

Mouton (2004) describes a research design as a plan or blue print that indicates how one intends to conduct a research. Research design focuses on the end result, in other words, what kind of study is being planned. In my research I made use of a qualitative approach.

A qualitative research approach is typified by:

- The participants' and researchers' perspectives of the research questions
- Taking into consideration the social context and environment in which the research takes place (Struwig and Stead, 2001)
- The researcher's interest of how people 'attach meaning and makes sense' of their lives, experiences and the structures of the world (Creswell, 1994)
- Being exploratory in nature (Denzin and Lincoln, 2005)

Qualitative research was best suited for gathering data on my specific topic. My research was focused on the lived experiences of educators whilst implementing Mathematical Literacy within their different college environments. In qualitative research the researcher most often makes use of open-ended questions during the interview process, which provides an opportunity for the researcher and participants to have spontaneous interaction (Denzin and Lincoln, 2005). The flexibility in questioning allowed me to delve deeper and really get a feel for the “lived experiences” of the participants.

Qualitative research is normally subjective in nature and tends to focus on intangible aspects of research such as perceptions and attitudes (Neville, 2005).

A phenomenological approach was followed, which allows a researcher to explore phenomena as it presents itself in the lived world of a person, as opposed to an abstract subject (Giorgi, 1997). A person is a holistic being, influenced by social and cultural surrounds. Phenomenology aims to analyze the lived experiences of individuals within their own lifeworld (Van Manen, 2002).

A phenomenological approach understands that human responses and behaviour are influenced by the frame of reference of the respondents in a research (Neville, 2005). In this research I investigated the experiences of educators within their respective environments, focusing on how they interpret, attach meaning and make sense of their lived experiences.

Phenomenology helps individuals to understand that there are different ways of understanding the same world. A deeper understanding is facilitated by the flexibility and openness used in a phenomenological approach (Kidd and Kidd, 1990) and is also exploratory in nature (Groenewald, 2004).

According to Lester (1999:1), “phenomenological methods are particularly effective at bringing to the fore the experiences and perceptions of individuals from their own perspectives, and therefore at challenging structural or normative assumptions. Adding an interpretive dimension to phenomenological research, enabling it to be used as the basis for practical theory, allows it to inform, support or challenge policy and action.”

3.3 RESEARCH DESIGN

Struwig and Stead (2001) describes a research design as the method one will use to gather and analyse information in order to find a solution for a specific problem. The research design describes the research process. It focuses on the tools and procedures that are employed to conduct an effective research (Mouton, 2004).

3.3.1 SAMPLING

3.3.1.1 Purposive sampling

Purposive sampling is used when information-rich participants are sought. This means that the participants will embody specific characteristics that are integral within the research (Struwig and Stead, 2001; Nkwi, Nyamongo and Ryan, 2001). Purposive sampling enables a researcher to identify and choose participants that will best satisfy the need and objectives of the research (Neville, 2005).

The research that I conducted included three FET Colleges within the Eastern Cape Province, one specifically situated in a rural area and the other two in urban areas. The geographic differences of the different colleges provided an opportunity for me to gain richer insight into the lived experiences of the respondents within their own frame of reference.

The respondents were selected purposively in order to satisfy the demographic and geographical requirements set by myself. I specifically required respondents who are currently educators in FET Colleges and are teaching Mathematical Literacy, because those respondents were able to supply me with the specific information that I required. The geographic differences were incorporated so that I could get richer data and also to investigate whether it would have a bearing on the experiences of the educators. Geographic differences, however, were not an essential ingredient for effective research in this case. The most important requirement was that the

respondents had to be actively involved in Mathematical Literacy teaching in FET Colleges.

3.3.1.2 Snowball sampling

Snowball sampling is a type of purposive sampling (Nkwi, Nyamongo and Ryan, 2001; Neville, 2005; Babbie, 1995; Crabtree and Miller, 1992) where a respondent refers the researcher to another possible respondent for participation in the research.

Originally I did not plan to employ snowball sampling in the research, but as the research progressed, two of my respondents referred me to other possible suitable candidates to participate in the research. One respondent referred me to a rural respondent that they had dealt with in the past and that the person thought would provide me with some interesting insights.

Another respondent told her colleague at a different college that she was participating in a research. The colleague showed interest to participate in the research and as the respondent met the requirements of the research, I approached the respondent to form part of the research.

3.3.1.3 Sample size

A big advantage of using a phenomenological research approach is that a very small sample size is sufficient for effective research (Neville, 2005). Boyd (2001) regards two to 10 participants or research subjects as sufficient to reach saturation and Creswell (1998, pp. 65 and 113) recommends “long interviews with up to 10 people” for a phenomenological study. I therefore decided to select a sample size that would not exceed four educators.

The reason for choosing a mid-range sample was to deal with the time consuming nature of collecting data from too many samples. The transcription of data from large samples takes a very long time. It can also become a financial burden when a

large sample of respondents has to be interviewed, especially if it is face-to-face interviews with respondents from different locations.

3.3.2 DATA COLLECTION

A multitude of data collection methods can be employed within a research (Boyd, 2001; Cresswell, 1998; Denzin and Lincoln, 2000). According to Opdenakker (2006), one of the best ways to collect data for a phenomenological research is to use interviews. In a phenomenological research a researcher seeks to find a deep understanding of the lived world of respondents. As an interview lends itself to a researcher being able to probe deeper, or make follow up questions after a question has been asked, it assists the researcher to gain a greater insight into different experiences and perceptions as lived by the respondent (Denzin and Lincoln, 2000).

After extensively researching different data gathering techniques, I finally settled on using interviews alone as a data collection method. This method allowed me the greatest opportunity to collect rich data from my respondents.

3.3.2.1 Interviews

Kvale (1983, p.174) defines the qualitative research interview as "an interview, whose purpose is to gather descriptions of the life-world of the respondent with respect to interpretation of the meaning of the described phenomena".

Opdenakker (2006) identifies four different interview techniques namely:

- Face-to-face
- Telephone
- E-mail
- Computer assisted methods such as MSN Messenger

The four interview techniques can be “divided by synchronous/asynchronous communication in space and time” (Opdenakker, 2006:3). Table 3.1 depicts the four different interview techniques related to these dimensions.

a. Face-to-face interview

A face-to-face interview is synchronous in time and place, which means that the interviewer and participant are in the same place at the same time. The advantages of this technique is that the direct contact allows the researcher to observe social cues, tone of voice and body language, which can be a valuable resource of information (Emans, 1986). Answers are normally more spontaneous, with a relatively small delay between questions and answers, making it more interactive (Wengraf, 2001). Disadvantages include the high cost and time factor when traveling is involved, as well as the fact that tape recorded interviews can be very time consuming to transcribe. The alternative could be to take notes in order to save time, but then maybe compromising accuracy in analysis in the process (Wengraf, 2001).

b. Telephone interview

Telephone interviews are synchronous in time, but asynchronous in place. This means that the interview takes place in two different locations, but at the same time via a telephone (Opdenakker, 2006). Mann and Stewart (2000) claim that telephonic interviews offer researchers the opportunity to gain access to a wider geographical area at a reduced cost compared to face-to-face interviews. The disadvantage, however, is that body language and social cues could be missed. Interaction, however, can still be spontaneous as telephonic interviews are synchronous in time.

c. MSN Messenger

MSN Messenger is synchronous in time, but asynchronous in place. This means that like the telephone, communication takes place during the same time, but the location will be different. The advantages and disadvantages with MSN Messenger are the same as for telephone interviews, except that voice intonation cannot be experienced. The use of emoticons, like ☺ and ☹ can be used to alleviate the problem (Neville, 2005).

d. E-Mail interview

E-mail interviews are asynchronous in time and place, meaning that the interviewer and respondent are not at the same location and that the communication would be delayed (Bampton and Cowton, 2002). An advantage of this type of interview is that the respondent can reply at their convenience. It also allows easy access to people in from remote geographical areas and is therefore more cost effective. It provides a respondent more time to reflect on the questions (Bampton and Cowton, 2002; Kivits, 2005). As the respondent is typing and sending the answers, there is no need to transcribe tapes. Although time is saved with regards to transcription, it could still turn out to be a lengthy process, as some respondents take a long time to respond to certain questions.

In this research I have made use of three of the different interviewing techniques, namely face-to-face, telephonic and e-mail interview. In all cases I used suggestions made by Saunders, Lewis and Thornhill (2003) in conducting the interviews. The respondents were thanked for their willingness to participate and at the same time were ensured of the confidential treatment of any data obtained. They were also informed that they could drop out of the research at any time for whatever reason they might deem suitable. The purpose of the interview was explained and the necessary timeframes were discussed in order to facilitate effective interviewing.

My first interview was a face-to-face interview because I live in the same town as the respondent. I had set up an appointment with the respondent at a time and place that was suitable for both of us. It was difficult to take extensive notes during the interview, but I learnt quickly that taking short notes are effective as long as you transcribe the interview as soon as possible after the event took place.

For my second interview I used a telephonic interview as this person lived 360 km away. The telephonic interview saved me on incurring an extra financial burden. Both respondents one and two were chosen by using purposive sampling. I contacted my second respondent in order to establish a time when it would be suitable to phone her and she would have enough time to answer the questions. This method proved to be the most exhausting, as it is hard to take notes while handling a telephone. This problem was overcome, however, by using the speakerphone on my cellular phone.

Respondent three was referred to me by respondent one and the interview was also done telephonically as respondent three stayed in the same town as respondent two. The same method was used as for respondent two.

Respondent four was referred to me by respondent one and as this participant had a heavy foreign accent, the interviewer chose an e-mail interview as the best means of doing the interview. Respondent three and four are examples of snowball sampling.

In the case of respondent one, two and three the interviewer did not have consent to record the interview and thus had to take notes. In respondent four's case the answers were already transcribed in the form of an e-mail.

Respondent 3 subsequently withdrew from the research due to personal reasons. It was stated at the onset of the research that a respondent could withdraw at any time. Consequently, the wishes of that particular respondent had to be observed and the responses from respondent 3 have not been included in the data analysis.

3.3.2.2 Type of interview questions

Interviews can be grouped into three categories according to the types of questions being asked, namely:

- Structured – All respondents answer the same set of questions
- Semi-Structured – The interviewer will have a list of topics to cover and may omit or add in questions depending on the flow of conversation.
- Unstructured – Normally takes the form of an informal discussion in order to gain in-depth knowledge in a spontaneous way. A list of topics to be covered may be present as well (Neville, 2005).

For the sake of conducting an exploratory research, it is best to make use of semi-structured or unstructured interviews (Saunders, Lewis and Thornhill, 2003). It is suitable for when one needs to probe participants to gain a deeper understanding.

In this research, I made use of a semi-structured interview, where a set of predetermined questions were put to the participants. The possibility of other questions being asked depending on the flow of conversation, were not excluded.

Open-ended questions were utilized as it gave me an opportunity to gain richer data. As open-ended questions do not require specific answers, this technique enabled me to obtain multiple responses and at the same time provide an opportunity to allow more detailed responses (Struwig and Stead, 2001).

Using the prompts in my semi-structured interview questions helped me to clarify any misunderstandings or ambiguities during the interview process. When there was an interesting answer that I wanted to probe further, I was able to do so. I had to make notes during the interviews and made sure that I did a “write-up” of the interview as soon as possible afterwards in order to capture as much information as possible. My transcriptions were given to the respondents to scrutinize in order to see if they thought it was an accurate reflection of what was said during the interview. The e-mail interview for respondent four was transcribed by the respondent himself, making it accurate already.

3.4 DATA ANALYSIS

The data collected was organized and analyzed in order to establish any emerging trends (Mouton, 2004). I drew my conclusions from the information gathered during the interviews.

The analysis of data involves the data to be “broken up” into themes, patterns and relationships that are manageable. With qualitative research it is very difficult to capture meaning in a short and structured manner (Mouton, 2004).

Hycner (1999) chooses to use the word “explication” instead of analysis. The reason for this is that he feels that context sometimes gets lost when data gets “broken up” into smaller portions. Hycner identifies five phases to explicate data:

- Bracketing and phenomenological bracketing – No position is taken either for or against the interpretations or responses of the participant. The researcher’s preconceptions are also bracketed out (Cresswell, 1998). I had to ensure that my own experiences and perceptions did not influence the responses of my respondents. Objectivity is of importance here and I had to allow for the different interpretations of questions and the variety of answers that were provided.
- Delineating units of meaning – Illuminating statements in the research are being identified and isolated. After critical scrutiny redundant units of data are discarded. I had to identify the statements that would contribute to my research and those that were redundant. Sometimes it was tempting to include other bits of information, but I had to remember my research questions in order to stay focused.
- Clustering of units of meaning to form themes – Significant topics are identified, also called “units of significance (Sadala and Adorno, 2001).
- Summarise, validate and modify interview – A summary containing all the themes will provide a holistic view of the interview. At this stage I consulted with the respondents to determine if they felt that the interview was captured

correctly. Fortunately I did not encounter any problems as the respondents were all satisfied with the transcriptions.

- General and unique themes for all the interviews and composite summary – All the interviews are considered to identify common themes. According to Sadala and Adorno (2001, p. 289) “the researcher, at this point “transforms participants’ everyday expressions into expressions appropriate to the scientific discourse”. Here I was looking for responses that were the same, but also different, in order to report on the expressions that would be appropriate for the research.

It was my intention to discover what can be learnt from the lived experiences of the educators during the Mathematical Literacy implementation process.

3.5 ETHICAL CONSIDERATIONS

According to the Belmont Report (1979), compiled by the National Commission for the Protection of Human Subjects of Biomedical and Behavioural Research, there are three core principles to remember when conducting a research:

- Respect for people and communities – The dignity of people involved in the research must be respected and they must be protected from exploitation and vulnerability.
- Beneficence – Minimizing social and psychological risks and maximizing the benefits of the research for the participants.
- Justice – Participants in the research should benefit from the findings of the research.

Saunders, Lewis and Thornhill (2003, p. 131) summarise the main issues to consider, although the ethical issues surrounding these items are not always clear-cut:

- The rights of privacy of individuals
- Voluntary nature of participation – and the rights of individuals to withdraw partially or completely from the process
- Consent and possible deception of participants
- Maintenance of the confidentiality of data provided by individuals or identifiable participants and their anonymity
- Reactions of participants to the ways in which researchers seek to collect data
- Effects on participants of the way in which data is analysed and reported
- Behaviour and objectivity of the researcher

The following questions can be asked to ensure that an ethical research is being conducted:

- Will any participants be harmed during the research?
- Will the findings of the research harm anybody that was not involved in the research?
- Is existing research practice being violated?
- Are you violating community or professional standards of conduct (Kervin, 1992, p. 38)

In my research, I made sure that the respondents knew exactly what the purpose of the research was. They also understood that participation was voluntary and that they could withdraw from the research at any time for whatever reason they thought was applicable. Everything possible was done to ensure confidentiality during the research, i.e. to protect their identity and the identity of their respective colleges where they are employed. The respondents were also supplied with a transcription of the interviews in order for them to verify that the transcription was representative of the interview that took place.

3.6

VALIDITY AND TRUSTWORTHINESS

For a research to be deemed valid, it must measure what it is supposed to measure by using a particular instrument (Cohen, Manion and Morrison, 2002). The question “are you measuring what you are supposed to be measuring?” becomes very important when validity is considered (Kvale, 1996:238).

Interviews were used to probe the experiences of educators implementing Mathematical Literacy in Colleges. It was therefore important for me to find respondents that were still actively involved in teaching Mathematical Literacy at a FET College in order to be able to obtain the relevant information for my research.

During the interview process I knew that I could prompt the respondents when asking questions, but I had to be really careful not to let my own biases or interpretations influence the responses from the respondent. If this were to happen then the validity of what the respondent said would have compromised the validity of the research.

Trustworthiness is underpinned by credibility, meaning that the data gathered within a research is representative of the responses from the participant (Guba and Lincoln, 1994). Member checking can be done where the researcher asks the participants to check and verify whether the information gathered from them during the interviewing process was a true reflection of what transpired during the interview (Guba and Lincoln, 1994).

Trustworthiness was obtained by taking notes of the interviews and supplying the resultant writings to the participants and they had the opportunity to refute, change or accept the information as representative. All the respondents received a copy of the transcript of the interview and they indicated that they were happy that the transcripts were representative of what was said during the interviews.

Interviewer bias on the research topic, if there was any, were revealed to the respondent before the interview took place. I also have to ensure that bracketing

should be kept in mind (Groenewald, 2004), meaning that I must not let my preconceptions cloud the meaning intended by the participant.

3.7 TRIANGULATION

Triangulation is a key concept in any qualitative research. There are different forms of triangulation, but in the end, they have the same goal. The goal is to enhance the credibility, validity and trustworthiness within a research (Brown 2001, pp. 227-231).

Altrichter, Feldman, Posch and Somekh (2008) state that triangulation helps to give a more balanced perception of a research. Triangulation is also used as a method to cross check methods of data gathering and multiple source usage (O'Donoghue and Punch, 2003).

Denzin and Lincoln (2005) identify four traditional methods of triangulation, namely:

- Data triangulation which involves time, space and persons
- Investigator triangulation which involves multiple researchers in an investigation
- Theory triangulation which involves using more than one theoretical approach to interpret a phenomenon
- Methodological triangulation involves more than one method to collect data

Brown (2001) also identifies location triangulation, which involves comparing data gathered at different sites. Location triangulation is used to eliminate or identify biases that might occur whilst collecting data from different sites.

In my research I used data triangulation by comparing answers from my four respondents. I also employed location triangulation, making use of three locations from where I collected data. By using this method of triangulation I could minimize biases and try to understand the differences introduced by respondents who are employed by different institutions

3.8 CONCLUSION

Chapter 3 described the research approach and methodology employed in this research. The chapter detailed how the data was collected in a valid and trustworthy way. Ethical considerations were taken into account during the research.

Chapter 4 deals with the findings of the research data. The respondents' answers to each of the questions are presented. The researcher identified emerging trends that were further used in Chapter 5 to analyse the data and to make recommendations.

CHAPTER 4

RESEARCH FINDINGS AND DATA ANALYSIS

4.1 INTRODUCTION

At the onset of a qualitative study a researcher should be clear on the research question that has to be answered (Merriam, 1988:124). The researcher cannot be certain what the outcome of the research will be, even though there is a possibility that certain predictions could be made. The conclusions and recommendations will be shaped by the data that has been collected and the trends that emerge from the respondents' answers.

In Chapter 3 I discussed the research approach and design, focussing on sampling, data collection and analysis. Ethical considerations were also discussed in order to ensure validity and reliability. The questions that were asked in the interview are attached at the end of the thesis.

Mouton (2004) identifies two steps when analysing and interpreting data. The first step is to break up the data into manageable portions and then, secondly, to identify any emerging themes to establish any commonalities. In this chapter I have presented the transcribed answers to the interview questions. Emerging trends were identified, which assisted me in drawing conclusions and making recommendations for Chapter 5.

The research problem, as stated in Chapter 1.3 on p. 11, was kept in mind during analysis and interpretation of the collected data.

4.2 RESEARCH FINDINGS

As already mentioned in the introduction of this chapter, the answers from the respondents are presented. Each question was handled separately, identifying the emerging trends. The interviews were divided into two sections. Section A included question 1 to 8 which dealt with personal information and is presented in Table 4.1. A short summary is included after the presentation of the answers.

Table 4.1 Section A - Personal Information

		RESPONDENT 1	RESPONDENT 2	RESPONDENT 4
1	Age	40	44	32
2	Gender	Female	Female	Male
3	Highest professional Qualification	National Higher Diploma Post School Education	National Higher Diploma Post School Education	ACE (Advanced Certificate) Mathematics Ed
4	What teaching experience do you have?	18 years teaching experience at a College. 17 years teaching Computer Practice, Accounting and Computerised Financial Systems	Private Industry = 8 years. Teaching experience = 15 years Subjects taught: Computer Practice N4 – N6, Information Processing N4 – N6, Office Practice N3 & N4, NIC & NSC Computer Practice.	Taught maths for 7 years and math lit for 3 years.
5	What Mathematical Literacy training have you been exposed to during schooling and professional training?	School – Commercial Mathematics Diploma – Statistics No formal math lit training as such. Reliant on colleagues who are already teaching ML to assist me.	Matric mathematics (1983), L2, L3 & L4 Maths Literacy workshops offered by the Education Department (4 – 5 days each)	3years of tertiary university training at university of Fort Hare- NPDE
6	What level are you teaching?	Level 2	Level 2, 3 & 4	Level 3 and 4
7	Which programmes are you teaching in and are you teaching any other subjects?	Currently only teaching Math Lit to the education learners.	Only Math Lit for finance students	Yes, maths as well.
8	I teach Mathematical Literacy because...	I enjoy the challenge of solving problems and the practical application thereof. Mathematical	I realized there were going to be major changes in the subjects offered by colleges with the start of NCV 4 years ago. The subjects I	It is my area of specialisation as well as I have an interest in the subject.

		Literacy is based on every day real life encounters.	was familiar with were being phased out and I needed to “find” something new. At that time no-one else on the staff was interested in ML. I saw it as an opportunity because I prefer/like practical subjects. I don’t like teaching theory. It was also a challenge teaching something new after doing the same thing for 11 years.	
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Of the three respondents two were female and one was a male, ranging in age from 32 to 44.

Only one of the respondents received formal Mathematics training during their tertiary education, whereas the other respondents completed a generic Higher Diploma. Respondent 3 was exposed to formal Mathematical Literacy during post-graduate studies, respondent 1 received no training and respondent 2 was exposed to the yearly national workshops that was presented by the Department of Education. Respondent 1 specifically mentioned that she has to rely on colleagues for support as she had received no training.

Two of the respondents teach Mathematical Literacy exclusively, but respondent 3 also teach Mathematics. The respondents teach Mathematical Literacy on various levels, where respondent 2 is involved on all 3 levels.

Respondent 3 said he chose to teach Mathematical Literacy because he felt it was his area of expertise. Respondent 1 and 2 felt that they were ready for a new challenge and that they found it interesting to teach a subject that is practical, focused on real life experiences and requires problem solving skills.

4.2.2 Section B: Pedagogical Experiences

Section B included question 9 to 18 and dealt with the pedagogical experiences of the educators. Each respondent's answer is presented with the relevant question and emerging trends were identified separately for each question.

QUESTION 9

What is your experience like teaching Mathematical Literacy? (Probe: describe what this experience has been like for you, generally; why has the experience been like that? Do you feel you have contributed to the development of the student learning? Give some examples of how you feel you have contributed)

RESPONDENT 1

I have enjoyed teaching the subject very much, it has been a new learning experience for me, teaching a subject that I have not taught before.

However, I soon realized how very weak the students that are coming from the schools to the college are. This has made me aware that I cannot assume that students know something, for example, fractions. I have really had to dig deep to find methods to teach students basic calculations very quickly, and try to continue with the syllabus at the same time.

Due to the nature of the subject, lots of reading and interpretation, the language is a problem for most students.

Students have come to me and told me that they are finding what we are doing very interesting, but that they struggle to do the maths. The struggling, it seems, stems from the fact that the maths taught or learned at the schools has been very minimal. Looking back over the year I have seen students marks improve and it gives me joy to see how they are putting into practice what I have taught them.

RESPONDENT 2

It was a learning curve for myself. I had to seriously study maths principles to prepare myself. During the first three years, I had to put in a lot of time and effort to get up to date. The last time I did maths was in 1983.

I was excited about the subject because I realized the importance of it. We teach basic skills and it is evident that most of the students don't have those skills. I find this sad because as informed people, their future seems so much brighter.

It was also frustrating. I have to spend so much time on teaching them the basics, which they should know by now. There is no time for real practical work or even investigating. You just cover the basics to cover the syllabus.

Very few students are interested in the subject. It is just a subject they have to pass. I find it difficult to keep their attention and let them see the "light".

I have always tried to make a difference but I feel disappointed in their attitude.

RESPONDENT 4

As a maths and maths lit educator, I always feel important among my colleagues, probably because maths and maths lit are regarded as difficult subjects to handle. I also regard this practice as a calling to initiate the ones. In short, I am glad to be part of the community of practitioners to exercise such duties.

EMERGING TRENDS

All the respondents felt that they enjoyed the challenge of taking on a new subject as they realized the importance and value that it would have for the learners.

Two of the respondents felt that the learners that they were teaching were very weak and that a language barrier exists, contributing to the attitude and achievement of some of the learners.

QUESTION 10

How do you teach Mathematical Literacy to students? Describe a typical Math Lit session.

RESPONDENT 1

Part of my lesson planning I take new language and terminology used relating to the topic and ensure that I deal/discuss/and teach this to the students before I teach new work. Their English in most cases is not good, and as previously said, places the lecturer under more pressure.

At the beginning of the year we do a baseline assessment to ascertain what the students know. This baseline assessment is kept in mind when doing planning. Generally the lecturer will have to explain most concepts right from the beginning, as in one class, various students are on different knowledge levels. Sometimes I group students weak and strong together and get the students that are more knowledgeable to help the weaker ones.

Generally the lecturer would do a few examples of new work together with the students on the board and then give them a few to do for homework. The next day the lecturer will call on a few students to do the sums on the board, helping and correcting, where necessary. If problems still exist more exercises are given.

RESPONDENT 2

E.g. the beginning of a new section I will briefly inform them of the topic. Will then ask them about examples in their everyday life where these type of calculations might occur. I will write a simple problem on this topic on the board. Discussion will

follow. Allow the students to come up with a solution, whether it is wrong or right, doesn't matter. Then I will give them my explanation/theory. This will be followed by similar exercises from a text book or other resource material which they have to do on their own. After some time we will go through the answers and solve any problems.

RESPONDENT 4

I often combine pedagogies. Usually I use telling and co-operative group activities. Thus, I first explain or give the student the basis, the necessary terminologies, test their prior knowledge of the topic, explain the main concepts of the lesson and then give activities which of course demand cognitive thinking. Those are problem solving activities. This has always been the trend and it is working nicely.

EMERGING TRENDS

Two of the respondents test the prior knowledge of the learners. The topic and new terminology are introduced. The topic is related to real life examples. Problem solving activities are done in class. Sometimes the weaker learners are grouped with stronger learners. Respondent 1 states that this practice also helps to overcome the language barrier. All respondents use class work. Respondent 1 and 2 both felt that homework is futile as the learners usually do not complete it.

QUESTION 11

What teaching strategies do you use when teaching ML? Describe your experience using this/these strategies. (Probe: Teaching strategies, making use of resources, homework, class work, level of learners).

RESPONDENT 1

I use group work, many students like it because it makes them feel more secure, but each student must produce their own answer. Most work is theoretical with practical

aspects, but at the lower levels of maths lit because students knowledge is so lacking more time is spent on trying to “catch up” what they do not know, leaving little time to practically do measuring/weighing etc.

The white board is used extensively, where students are encouraged to come and display their answers. Overhead projector is still used in isolated cases, when teaching student how to draw a graph. Data projectors are also used - allows displaying of maps and distance charts etc.

Text books are used along with class work. Homework is given, but it must be said that very few students actually try to do homework.

RESPONDENT 2

In principle I avoid mathematical terminology, especially in the beginning of a new section. I don't want them to think they are doing maths, because it creates an immediate barrier for some. Very seldom give homework. They don't do it, or they copy from one another. I give them time in class to do the work. Ask questions all the time. With difficult work I ask the stronger students to explain in a language the others can understand. I try to be as practical as possible and use examples the students can relate to. I believe in “seeing” ML problems. Make drawings on the board all the time so that they can see the problem visually.

RESPONDENT 4

Depending on the topic, but I try to vary my approaches as much as I can to accommodate the different learning styles of my diverse learners. But as I indicated above, I often use telling and co-operative teaching approaches.

EMERGING TRENDS

Group work is used extensively as it helps to group weaker with stronger learners. This practice helps to overcome the language barrier in some cases. Examples used for class work must be practical.

The whiteboard are used for learners to display their answers, but also as a tool to make the exercises more visual. Textbooks are available and used in class. Homework is rarely given as the respondents felt that the learners copy from one another or just does not complete it.

QUESTION 12

How do you know when you have delivered a successful lesson? (Describe the feeling/reactions that you have when you get the sense that you delivered the lesson well. Describe those initial reactions/feelings/behaviours? Give some examples of what you felt).

RESPONDENT 1

When you can see on student's faces, yes I get this! It makes me happy, you feel like smiling and you feel renewed to try and achieve it again. I feel good when I have sourced a new technique that I haven't tried and all of a sudden the students understand.

These feelings are also present even when I achieved it with one student.

RESPONDENT 2

This is sometimes very difficult to establish. After repeating work several times most of them will indicate they understand, but when an assessment comes up, the results are sometimes disappointing. Last year 2 Level 4 students (who never used to take part in any discussions) stayed behind to thank me for that particular lesson and also

told me how they enjoyed that particular class. I can't even remember what the topic was. All I remember was that it was after I attended a remedial workshop in JHB by Brombacher. I felt on top of the world and inspired, but it didn't last long. "Somewhere" I made a difference!

RESPONDENT 4

A successful lesson depends mainly on the outcome or the result of an assessment task, as well as general responses of the learners. When the learners participate actively and perform well with the activities, then I know that I have achieved my objective.

EMERGING TRENDS

Success can normally be measured by the outcome of the assessment tasks and when the learners are participating actively, but sometimes it can be difficult to establish. Educators feel happy, good, renewed, inspired and on top of the world when they feel that they have delivered a successful lesson.

QUESTION 13

**How do you know when you have delivered an unsuccessful lesson?
(Describe the feeling/reactions that you have when you get the sense that you have not delivered the lesson well. Describe those initial reactions/feelings/behaviours? Give some examples of what you felt).**

RESPONDENT 1

A blank expression on students' faces and shaking of heads, makes me feel disappointed and let down. It forces me to re-evaluate the lesson and what will I do differently next time (tomorrow) to get students to understand a certain section of

work.

Feelings of doubt start setting in and you ask yourself if I'm good enough.

RESPONDENT 2

If you ask questions by the end of the lesson and they all stare at you. Only 1 or 2 can give you an answer to the problem. Very disappointing and tiring. You immediately realize you have to change your strategy and find another creative way to explain. You also worry about time lost.

RESPONDENT 4

The opposite to the previous question. When the learners do not participate actively during the lesson and underperform with the activities, then I know I have had an unsuccessful lesson.

EMERGING TRENDS

Blank expressions and little participation by learners indicate a lack of understanding. After an unsuccessful lesson educators re-evaluate their strategy and approach.

Educators feel disappointed, let down, tired and worried (about the time lost).

QUESTION 14

Describe the experiences you have had teaching ML with the resources you have available.

RESPONDENT 1

I have many resources available to me. I will be using my data projector a lot in the future as it is a new resource just issued to staff. Students enjoy work projected to them as it is so “big” and they can see clearly, better than over head projectors

Some resources such as measuring cups, scales etc, I don’t often get the chance for students to use them in a practical way, as previously said the students I teach are very weak and a lot of time is spent teaching them basic maths skills which they have not acquired at school, which leaves very little time for using these resources.

RESPONDENT 2

Fortunately we don’t have any problems with resources. My college provided the necessary. Big problem is the students who don’t bring their calculators, rulers and books to college.

RESPONDENT 4

It’s quite great, almost all the learners do have access to an updated textbook.

EMERGING TRENDS

All the respondents were positive with regards to the resources that they have available in their respective colleges.

QUESTION 15

How does your confidence and preparation to teach ML over the years *shape* your teaching experiences? Give examples.

RESPONDENT 1

The more prepared you are for your lessons the better your lessons will flow, and through that your confidence grows. As years go by you do become more experienced and you are evaluating yourself continuously as to how you can improve certain aspects of your teaching. For me, compiling workbooks for my students and organizing their learning material before the academic year starts has been a very good experience. This way I know my students know exactly what they will be doing and what expectations I have of them.

RESPONDENT 2

I am not sure what this question means or how to answer. I am quite proud of what I have achieved personally. I started from scratch. Initially I had no, or very little help or guidance from anyone. No text books or resources. I have learned to hunt for resources, use the internet extensively and the importance of sharing ideas with colleagues. Getting feedback from students is also important and teaching at their level – taking their frame of reference into account. I have the confidence to accept any new challenge that comes my way.

RESPONDENT 4

Teaching, per se, is not that difficult as perceived. It's a matter of knowing what is required of you and what you are doing and to do the right thing to achieve the result.

EMERGING TRENDS

Respondents all agreed that they have become more prepared and confident as they gain more experience and know what is required of them. Planning plays an important role in readiness to teach. Continuous evaluation is necessary to improve on classroom practices.

QUESTION 16

Describe what it has been like for you assessing your student's learning. Give examples (Probe: What assessment strategies have you used most. Describe the experience using these strategies).

RESPONDENT 1

In one year the assessments my students do is 3 practical assessments and 3 theory assessments, and a September trial exam, as prescribed by the assessment guidelines issued by the department of education. Theory assessments are done as theory tests and practicals are also treated as tests.

I have previously allowed students to take practical's home to do them, but have found that students copy from one another thus giving a false impression of what the students actually know.

RESPONDENT 2

Most of the time I use tests. I would like to do more practicals, but it is very time-consuming and we don't have enough time. (strikes, holidays, absenteeism). Assignments don't work, because they copy from each other. If I assess as a group, which is not often, I also incorporate into the assessment an individual section which has to be completed under "test conditions"

RESPONDENT 4

I do use various assessment methods that is depending on the concept concerned. As a NCS maths lit marker, I have to be able to assess the learners' activities objectively.

EMERGING TRENDS

Various assessment methods are used as prescribed by the Assessment Guidelines of the Department of Education. It was felt that assignments and practicals are very time consuming and that the learners do not really benefit as they copy from one another.

QUESTION 17

Mention one incident/experience (or session, or assignment) that you really enjoyed in your ML teaching, and describe some details that happened there to make it enjoyable.

RESPONDENT 1

Maths Literacy is a real life subject. I once gave students a worksheet where they had to compare the prices of items such as tea, coffee, sugar etc. but also had to consider the size of the item which was of better value.

They had to decide for instance was it cheaper to buy a 5 kg of sugar or better value to buy 1 kg sugar packets. This caused them to do calculations and to convince one another which one was the better buy?

The response from the ladies in this class was that they enjoyed the exercise very much and learnt a lot. Next time they went grocery shopping they would be more aware of the size of items and their prices.

RESPONDENT 2

In Level 4 the students build a model of a house. They were interested and couldn't believe their own creations. They were actually competing with each other to build the best house. I was surprised and the students enjoyed it. This year we don't have the time for such a project.

RESPONDENT 4

Using real world activities which make sense to the learners. I also believe that as myself with enthusiasm I make the teaching of math lit exciting for my learners

EMERGING TRENDS

Respondents named various activities, but what they all had in common was the fact that a real life situation was used. The learners felt that the activity could benefit them in their daily walk of life.

QUESTION 18

Considering diverse experiences in ML teaching, describe what it means to you to be a ML teacher.

RESPONDENT 1

Diverse for me is to use examples in my classes from all walks of life and cultures and to use examples and scenario's that my students can relate to.

To sometimes give slightly more difficult or challenging worksheets to stimulate the students who are academically a bit stronger.

RESPONDENT 2

I really would like to make a difference, to change the mindset of the students (and also some colleagues). To teach ML not as an academic subject for a NCV certificate, but as a life skill which each and everyone should apply. It also implies hard work, breaking down barriers and putting oneself in the shoes of the students. Repeating, repeating and being practical and creative to solve problems.

RESPONDENT 4

Someone who tries to educate learners to understand issues around them, for instance, issue of interest rate. Learners should be able to compare and make good decisions.

EMERGING TRENDS

Mathematical Literacy teaching enables educators to make learners relate to real life. It is like teaching a life skill that will help learners make informed decisions in their lives.

4.3 SUMMARY OF EMERGING THEMES

- Respondents were excited to be part of teaching Mathematical Literacy.
- Good preparation and planning is the key to successful teaching and learning.
- Some educators who teach Mathematical Literacy have had little or no formal training to teach the subject.
- The Colleges where the respondents are educators are providing sufficient resources for learners and educators.
- Baseline assessments are used to determine the prior knowledge of learners.
- The prior knowledge of learners is very weak causing educators to worry about finishing the curriculum in time. This causes educators to have less time to spend on practical activities for their learners.
- A language barrier exists that makes it difficult for learners to understand Mathematical Literacy
- Activities must be related to real life situations for learners to feel that they benefit from the subject. Learners should be able to relate to the context of the problem.

- Various strategies are used for teaching and learning, although educators felt that giving homework was a futile exercise as learners either copied from one another or they just did not do it.
- Grouping stronger and weaker learners together is beneficial for the transfer of knowledge.
- Educators measure their success in the classroom by assessing the learners' performance on assessment tasks.
- Educators felt good about helping learners make sense of real life issues. They felt that they were making a difference in the lives of their learners.

4.4 DATA ANALYSIS AND INTERPRETATION

A phenomenological approach, as described in chapter 3, has been followed for the purpose of this study. This approach aided me in order to establish what the pedagogical experiences are of educators who teach Mathematical Literacy in three FET Colleges in the Eastern Cape Province. Interviews with open-ended questions were conducted with four educators working in different FET colleges. Ethical considerations were observed when one of the respondents chose to withdraw from the research. As such, only the responses from the remaining three respondents were included within this chapter.

Interpretation is the stage where the researcher connects the dots between the collected data and the research question (Mouton, 2004). Analysis, interpretation and conclusions should always be done within the framework of the research question.

For the sake of order, the analysis is broken up into three themes, namely teaching, assessments and resource management. In order to interpret the data and make further recommendations, I will incorporate some of my own experiences.

4.4.1 Teaching

4.4.1.1 Nature of Mathematical Literacy Teaching

The DoE (South Africa, 2006a; South Africa, 2007b) defines Mathematical Literacy as a subject that will help learners think critically and will enable them to deal with mathematical information in real-life contexts.

During the research the educators proved to be acutely aware of the fact that they had to include real-life contexts into the way that they were teaching.

The following were instances where educators indicated their use of real-life examples:

Will then ask them about examples in their everyday life where these type of calculations might occur.

The topic is related to real life examples. Problem solving activities are done in class.

Maths Literacy is a real life subject. I once gave students a worksheet where they had to compare the prices of items such as tea, coffee, sugar etc. but also had to consider the size of the item which was better value. The response from the ladies in this class was that they enjoyed the exercise very much and learnt a lot. Next time they went grocery shopping they would be more aware of the size of items and their prices.

Someone who tries to educate learners to understand issues around them, for instance, issue of interest rate. Learners should be able to compare and make good decisions.

I really would like to make a difference, to change the mindset of the students (and also some colleagues). To teach ML not as an academic subject for a NCV certificate, but as a life skill which each and everyone should apply.

We teach basic skills and it is evident that most of the students don't have those skills. I find this sad because as informed people, their future seems so much brighter.

The educators realize that the value of the subject lies within learners believing that they could use their numeracy skills to improve their lives. Learners have to feel that they could add value to their existence by doing Mathematical Literacy.

The educators also realize that an effective way of teaching Mathematical Literacy involves using real life concepts and examples, things that the learners are familiar with and that they feel could be of future use to them.

The responses link well with the definition of Mathematical Literacy as stated by PISA in chapter 2.3.1 on page 28, where it is described as “the capacity to identify, understand and engage in mathematics, and to make well-founded judgements about the role that mathematics plays in an individual’s current and future private life, occupational life, social life with peers and relatives, and life as a constructive, concerned and reflective citizen” (OECD, 2003:24).

It is my experience that a Mathematical Literacy educator needs to be conversant and knowledgeable about a vast array of topics. I have to be able to understand everyday situations, for example accounts, building calculations, pyramid schemes and so forth, to make my learners aware of how these issues are dealt with in real life. In a way you are teaching a life skill, making your learners street smart. An educator also has to have the ability to relate the curriculum to the learner’s context which relates to their background and frame of reference. Learners have to realize the importance of being mathematically literate and how it could benefit them in real life.

4.4.1.2 A Multicultural Mathematical Literacy Classroom

Multicultural education is an emerging discipline aiming to create equal educational opportunities for learners from divergent groups, whether they are racial, ethnic, class, culture or demographically related (Banks, 2001).

Alrø, Skovsmose and Valero (2005) state that conflict can frequently occur in a multicultural classroom, but that the conflict includes potential for learning and development to take place. The conflicts can be related to family traditions, social structures, context of schooling, competencies in Mathematics, teacher background, learner background and planning and organisation of teaching. Successful mathematical literacy is shaped when we take on board the understanding, reasoning and mathematical thinking patterns in the society from which the learners come.

Diverse for me is to use examples in my classes from all walks of life and cultures and to use examples and scenarios that my students can relate to.

Getting feedback from students is also important and teaching at their level – taking their frame of reference into account.

Depending on the topic, but I try to vary my approaches as much as I can to accommodate the different learning styles of my diverse learners.

A multicultural classroom can also indicate demographic diversity, such as age differences amongst the learners. This phenomenon is definitely prevalent in my own classes and could possibly also be present in other colleges. As indicated on page 36, table 2.2, the age of the learners vary from 15 to 45 years. The frame of reference of the learners is thus vastly different and forces me to keep the context in mind when teaching certain topics.

During the interviews the educators mentioned that there was a language barrier that exists, making the transfer of knowledge more difficult.

Group work is used extensively as it helps to group weaker with stronger learners. This practice helps to overcome the language barrier in some cases.

With difficult work I ask the stronger students to explain in a language the others can understand.

Their English in most cases are not good, and as previously said, places the lecturer under more pressure.

Due to the nature of the subject, lots of reading and interpretation, the language is a problem for most students.

In my experience, language is a great obstacle for the learners who speak English as a second language. The nature of Mathematical Literacy is such that it involves a large amount of information that has to be read to form an understanding of the questions or problems asked in question papers. If learners are struggling with the language, it is inevitable that they will not form an understanding of the problem and therefore be unable to come up with solutions.

There was also a problem regarding the mathematical competence of learners, some educators saying that basic knowledge was lacking.

Most work is theoretical with practical aspects, but at the lower levels of maths lit because students knowledge is so lacking more time is spent on trying to “catch up” what they do not know, leaving little time to practically do measuring/weighing etc.

Sometimes I group students weak and strong together and get the students that are more knowledgeable to help the weaker ones.

Generally the lecturer will have to explain most concepts right from the beginning, as in one class, various students are on different knowledge levels.

I have to spend so much time on teaching them the basics, which they should know by now.

Students have come to me and told me that they are finding what we are doing very interesting, but that they struggle to do the maths. The struggling, it seems, stems from the fact that the maths taught or learned at the schools has been very minimal.

However, I soon realized how very weak the students are that are coming from the schools to the college. This has made me aware that I cannot assume that students know something, for example, fractions. I have really had to dig deep to find methods to teach students basic calculations very quickly.

It seems that the lack of basic mathematical competence of learners encroach on the time spent on the different topics. The statistics from the DoE (South Africa, 2008:1-5) seems to mirror the problem with regard to weak results.

Rutherford and Ahlgren (1989) claims that it is of critical importance that learners should be taught in their mother tongue in order to construct knowledge in an effective way. In practice this is not always possible, as multicultural classes consist out of learners from different language groups. The fact also remains that examinations are only conducted in Afrikaans or English, leaving no scope for learners from other language groups to participate in their mother tongue.

At this stage, I can only speculate as to why the mathematical competence of the learners is so weak when they arrive at the colleges. As an educator I have noticed that the learners really struggle to cope with very basic Mathematical concepts. The bulk of class time is spent on “re-teaching” the basics. For the weak learner it means trying to overcome their fear of numbers and failure, but for the stronger learner it can be a very boring exercise.

4.4.1.3 Teaching Strategies

As discussed in Chapter 2.3.2 on page 29, teaching can be either teacher or learner centred. A combination of these two approaches was used by the educators that were interviewed.

A teacher centred classroom is driven by the educator (Musslewhite, 2006).

Generally the lecturer would do a few examples of new work together with the students on the board and then give them a few to do for homework. The next day the lecturer will call on a few students to do the sums on the board, helping and correcting, where necessary. If problems still exist more exercises are given.

For me, compiling workbooks for my students and organizing their learning material before the academic year starts has been a very good experience. This way I know my students know exactly what they will be doing and what expectations I have of them.

My own classes are mostly teacher-centred, otherwise I would not be able to complete the curriculum in time and prepare my learners for the examinations. Too much time is used on catching up on the basics and therefore leave little time for the learners to direct what should be taught in class. I do find that when learners reach Level 4 they can direct learning to some extent and making the classroom learner-centred.

Tomlinson (2000) claims that learner interests, learning styles and life circumstances can dictate what kind of learning takes place in the classroom. Learners are encouraged to communicate with one another. Cooperative learning, including problem-based learning, is part of the learner-centered approach (Musslewhite, 2006).

I will write a simple problem on this topic on the board. Discussion will follow. Allow the students to come up with a solution, whether it is

wrong or right, doesn't matter. Then I will give them my explanation/theory.

I often combine pedagogies. Usually I use telling and co-operative group activities.

Depending on the topic, but I try to vary my approaches as much as I can to accommodate the different learning styles of my diverse learners.

Educators use a combination of teaching strategies, as pointed out in chapter 2.5.2. on page 47. It seems that all of the respondents in the research introduce the topic and terminology first before they move on to class activities.

Part of my lesson planning I take new language and terminology used relating to the topic and ensure that I deal/discuss/and teach this to the students before I teach new work.

The beginning of a new section I will briefly inform them of the topic.

Thus, I first explain or give the student the basis, the necessary terminologies, test their prior knowledge of the topic, explain the main concepts of the lesson and then give activities which of course demands cognitive thinking.

Normally I would also introduce the topic and ask them to tell me what they think it means or if they have heard about it before. By employing this strategy I can see what their basic knowledge is regarding the new topic.

Baseline assessments are done to establish prior knowledge of the learners. From there the educator can then establish how to proceed and also at what level he has to pitch the lesson.

At the beginning of the year we do a baseline assessment to ascertain what the students know. This baseline assessment is kept in mind when doing planning.

I normally also administer a baseline assessment in the beginning of the year for Level 2 learners. To my shock and amazement, during my first year of teaching Mathematical Literacy, some learners did not even know how many seconds there are in a minute. With such a weak basic knowledge it is hard to work with topics such as train timetables.

Examples are given in class and worked through with the learners. Learners supply answers or do the answers on the board. Individual, as well as group work, are done in class. Homework is given, but the educators felt that the learners copy from one another or just refuse to do it.

In my case I would hardly ever give my learners homework. I prefer my learners to work in class so that I can see what their train of thought is. In this way I can identify and deal with problems as they arise. Homework is certainly copied from one another, if done at all.

I use group work extensively within my classes. I feel that it provides the learners an opportunity to discuss the problems. It also provides an opportunity for stronger learners to explain to weaker ones in a language that they understand. The problem this creates though is that the learners are not used to work independently and it can cause them to struggle in examinations. However, it still allows them the best chance to master a topic.

The next day the lecturer will call on a few students to do the sums on the board, helping and correcting, where necessary. If problems still exist more exercises are given.

This will be followed by similar exercises from a text book or other resource material which they have to do on their own. After some time we will go through the answers and solve any problems.

I use group work, many students like it because it makes them feel more secure, but each student must produce their own answer.

The white board is used extensively, where students are encouraged to come and display their answers.

Homework is given, but it must be said that very few students actually try to do homework.

Very seldom give homework. They don't do it, or they copy from one another. I give them time in class to do the work.

I give them time in class to do the work. Ask questions all the time. With difficult work I ask the stronger students to explain in a language the others can understand. I try to be as practical as possible and use examples the students can relate to. I believe in "seeing" ML problems. Make drawings on the board all the time so that they can see the problem visually.

In chapter 2.5.2 on page 48 Mavuagara-Shava (2005) supplied some effective strategies for teaching Mathematical Literacy. The strategies that are mirrored by the respondents were:

- Use of real life problems
- Overt mathematical communication that includes oral and written work
- Use of a multiple approach to problem solving
- Connecting mathematical concepts and skills to other subjects.

Mavuagara-Shava (2005) recommends using extended projects and investigations to enhance Mathematical Literacy teaching. The respondents, however, indicated that it was difficult to tackle projects and assignments as they are too busy trying to teach basic concepts to the learners. This leaves very little time for other activities as they are rushing to finish the syllabus.

Planning and reflection are two important factors in effective learning and teaching. Planning in NC(V) is extensively discussed in chapter 2.5.1 on page 43.

The more prepared you are for your lessons the better your lessons will flow, and through that your confidence grows. As years go by you do become more experienced and you are evaluating yourself continuously as to how you can improve certain aspects of your teaching.

All the participants in my research have a formal teaching qualification and as such are familiar with planning. It is however my experience that not all college educators have a formal teaching qualification and therefore they struggle with the administration of planning. Colleges are encouraging their educators to further their studies and obtain professional teaching qualifications.

5.2.1.4 Professional Development

Professional development of Mathematical Literacy teachers is discussed extensively in Chapter 2.5.5 on page 58. During the interviews it became clear that not all educators received training to teach Mathematical Literacy.

I am quite proud of what I have achieved personally. I started from scratch. Initially I had no or very little help or guidance from anyone. No text books or resources. I have learned to hunt for resources, use the internet extensively and the importance of sharing ideas with colleagues.

No formal math lit training as such. I am reliant on colleagues who are already teaching ML to assist me.

Maths Literacy workshops offered by the Education Department (4 – 5 days each)

3 years of tertiary university training at university of Fort Hare- NPDE

In my own experience, as discussed in chapter 1.2.6 on page 9 and 2.5.5 on page 58, educators were not adequately prepared for the implementation of Mathematical Literacy. The first workshop, in fact,

had to be repeated as it did not achieve the objectives. On average only one educator per college attended. These educators, in turn, had to workshop their colleagues when they returned to their respective colleges, a difficult task if those educators are still in the dark themselves.

The Department of Education should provide suitable avenues for educators to enhance their knowledge of teaching Mathematical Literacy, but in turn the educators should be willing to sacrifice private time in order to improve their skills.

4.4.2 Assessments

The educators follow the Assessment Guidelines for Mathematical Literacy supplied by the Department of Education. The practicals are treated as tests because the educators feel that the learners copy practicals from one another and then it does not give a true reflection of the learners' work.

In one year the assessments my students do is 3 practical assessments and 3 theory assessments, and a September trial exam, as prescribed by the assessment guidelines issued by the department of education. Theory assessments are done as theory tests and practicals are also treated as tests.

I have previously allowed students to take practical's home to do them, but have found that students copy from one another thus giving a false impression of what the students actually know.

Most of the time I use tests. I would like to do more practicals, but it is very time-consuming and we don't have enough time. (strikes, holidays, absenteeism). Assignments don't work, because they copy from each other.

I do use various assessment methods that is depending on the concept concerned.

In my college files are kept with the assessment guidelines provided by the Department of Education. Assessment schedules have to be handed in to the Head of Department on a quarterly basis. Tests and practicals are moderated by the Head of Department for quality assurance purposes and especially to ensure that Bloom's Taxonomy has been adhered to.

Though the Assessment Guidelines (South Africa, 2007b) requires educators to use an array of assessments, it seems that the respondents felt that tests are more effective. The reason for this seems to be that learners do not complete practicals or that they would copy from one another. The feelings of the educators were that it was easier to administer tests, rather than provide opportunities for assignments, practicals and projects. It is also possible that it is more time consuming to do practicals, placing even more strain on educators to finish the curriculum in time for examinations.

4.4.3 Resource Availability

All participants indicated that they were happy with the resources available to them. Older technology, such as the white board and overhead projectors are used. In some cases educators have access to data projectors, making the learning process visually stimulating.

I have many resources available to me. I will be using my data projector a lot in the future as it is a new resource just issued to staff. Students enjoy work projected to them as it is so "big" and they can see clearly, better than over head projectors

Some resources such as measuring cups, scales etc, I don't often get the chance for students to use them in a practical way, as previously said the students I teach are very weak and a lot of time is spent

teaching them basic maths skills which they have not acquired at school, which leaves very little time for using these resources.

Fortunately we don't have any problems with resources. My college provided the necessary.

It's quite great, almost all the learners do have access to an updated textbook.

It can certainly be said that where the Department of Education may have fell short in preparation of educators, the government and labour market came to the party by upgrading college infrastructure and resources by means of the Recapitilization Fund (Chapter 2.5.4 on page 57). The money is there to provide educators with the best opportunity to provide effective teaching and learning. College management has to distribute the funds as they see fit and that can sometimes cause problems. In my college educators have received netbooks to use in conjunction with the data projectors which have been installed in the classrooms.

Having said that, simple items such as paper and whiteboard markers, are not available when needed due to cash flow problems. In general the availability of resources is not a major problem. Other colleges could have the same experiences, but it was not established outside the boundaries of the interviews.

4.5 CONCLUSION

In this chapter I have presented the responses from the educators who participated in the interview process. After each question I have identified emerging themes. A summary of the emerging themes have been presented. The emerging themes was used in Chapter 5 to draw conclusions and make recommendations with regard to pedagogical practices in teaching Mathematical Literacy.

Data analysis was done by linking the literature review to the responses of the participants.

Taking into account the emerging themes and data analysis, chapter 5 deals with the conclusions and recommendations of the researcher.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 CONTEXTUALISATION OF MATHEMATICAL LITERACY

Chapter 1 of this study provided an introduction and background to the research problem. An historical overview of FET College education in South Africa was discussed.

The FET College curriculum was discussed and tied in with the Mathematical Literacy curriculum. The chapter further focused on the demands that are placed on Mathematical Literacy teachers and how they were prepared to teach the subject.

The research indicated that although short courses were presented to prepare Mathematical Literacy teachers, many of them have received no training prior to implementation of the subject into the FET curriculum. In fact, many of the educators came from teaching sectors that were unrelated to Mathematics or Mathematical Literacy (Mbekwa, 2006).

The research problem was formulated along with the research questions. The definition of key concepts was provided in order to enlighten the reader on the purpose, significance and rationale of the study.

5.2 LITERATURE REVIEW RELATED TO MATHEMATICAL LITERACY PRACTICES

It was a challenge to obtain enough suitable material to use for the research. The researcher found that there was normally an abundance of information available with regards to Mathematical Literacy implementation in FET Schools, but very limited information available pertaining to implementation of the subject in FET Colleges.

In Chapter 2.2.1 the researcher referred to the Norms and Standards of Educators (South Africa, 2000) to indicate that educators are the implementers of the curriculum, as well as the class managers. As class managers they will have

pedagogical experiences within the classroom. It also states that educators are lifelong learners, putting emphasis on educators to take part in professional development to be able to keep up with the demands of teaching Mathematical Literacy.

In Chapter 2.2.2 a social constructivist perspective was reviewed. Part of the theory revolves around assumption that a more knowledgeable other can provide an individual to construct meaningful learning. Educators can make use of more experienced colleagues to help them cope with the demands of teaching Mathematical Literacy. During the research it also became apparent that educators make use of this process when teaching in class. Educators sometimes group stronger learners with weaker ones in order to enhance knowledge transfer.

Communities of practice are formed when people share common interests, crafts and/or profession (Lave and Wenger, 1991). When Mathematical Literacy was introduced the Mathematical Literacy educators became a new community of practice. In the research a respondent pointed out that she relies on the support of colleagues who also teach Mathematical Literacy.

5.3 RESEARCH DESIGN AND METHODOLOGY

Chapter 3 outlined the research approach and design. A phenomenological approach was followed as it provided the researcher with the best option to capture the lived experiences of the educators involved in the research.

Data was collected after a suitable sample was identified. Data was collected making use of interviews which included two sections, namely personal information and a section with a set of semi-structured questions. The respondents answered the same set of questions.

Data analysis and interpretation was done by transcribing the interviews and subsequently identifying emerging trends. Ethical considerations had to be observed to ensure the validity and trustworthiness of the research. The ethical considerations

came into play when one of my respondents chose to withdraw from the research at a very late stage.

5.4 CONCLUSIONS AND RECOMMENDATIONS

Teachers are the deliverers of the curriculum and are therefore steering the teaching and learning that takes place in their classrooms. As discussed in Chapter 2 there are many circumstances that can influence the pedagogical experiences of educators within their classrooms.

The following conclusions are observed and recommendations are made to assist educators to have positive pedagogical experiences within their classrooms:

- Educators have to familiarise themselves with the curriculum before they can teach Mathematical Literacy. This implies that they should know the content, but more importantly, they should be able to relate the content to context. Context means that the educator must make use of real-life examples that are familiar to the diverse group of learners in the class (Rutherford and Ahlgren, 1989). Connecting life experiences to learning is an important part of creating effective educational experiences. Learners will be more engaging when learning is connected to real life situations (Musslewhite, 2006).
- In the South African context, it is found to be hard for learners to construct knowledge if they are not being taught in their mother tongue. It is therefore of great importance that there should be less reliance on textbooks and more emphasis placed on practical experience (Rutherford and Ahlgren, 1989).
- Planning ahead for the next year is very important. Upon reflection of a lesson an educator can plan ahead for the next year, making adjustments where necessary. Teaching activities should be planned well in advance to ensure inclusivity. Planning should be monitored for quality assurance purposes.
- The researcher got the feeling that most of the educators did not feel adequately prepared to teach the Mathematical Literacy curriculum. It is

therefore suggested that when the Department of Education embarks on implementation of new learning areas, they should possibly spend time on an advocacy campaign to inform and prepare educators for reform. Once educators understand the principles and purpose of a new learning area they will be more open to change and implementation should be much easier.

- Educators should persist in professional development in order to stay up to date with new teaching methods and changes in the curriculum. Networking with colleagues and Mathematical Literacy forums can act as an important support system for an educator. In my opinion, college management should empower educators to take part in professional development activities, such as encouraging staff to study further and attend workshops (Chapter 2.5.5.1 on page 58).
- It is the responsibility of educators to actively take part in their own professional development. It is the duty of the FET Colleges to empower their educators to take part in such activities. At the same time it is the responsibility of the Department of Education to provide avenues for educators to improve themselves on a professional and personal level.
- It seems that resources are readily available in the FET Colleges, possibly because of the recapitalisation of the colleges (Chapter 2.5.4 on page 56). Educators are encouraged to make use of these resources to make teaching and learning more appealing for learners. Educators need to be trained to use the resources effectively, for example, data projectors where they are available. As indicated in the research, educators are willing to do the work if they have the necessary resources available.
- A variety of teaching strategies must be used to ensure effective teaching and learning (Mavuagara-Shava, 2005). The research has shown that educators believe that learners have different abilities and learning styles. Classes are multicultural and therefore the educators have to be aware of inclusivity in their classes. Lesson planning should reflect inclusivity.

- Assessments should be moderated internally to ensure that they are pitched at the correct level. This will ensure that learners are adequately prepared for examinations. Assessments pitched at a low level will do the learners no favours in the examinations. Assessment schedules should be available so that there is transparency, as well as timeframes to ensure that activities take place in time.

5.5 LIMITATIONS OF THE STUDY

The scope of this research was limited to Mathematical Literacy teachers within three FET Colleges within the Eastern Cape Province. The Colleges were selected to represent an urban as well as a rural setting. As the research was only conducted in three colleges the findings of the research cannot be generalized.

In retrospect the e-mail interview did not work as well as I thought. It did not allow me the opportunity to really delve as deep as I wanted to. The reason for this was that I ran out of time to follow up on the various questions. The e-mail respondent had very short answers, possibly because he did not have enough time or perhaps it is the fact that logical mathematical thinkers normally do not enjoy answering long questionnaires.

5.6 RECOMMENDATIONS FOR FURTHER STUDY

The findings of this research could inform recommendations for further studies.

Suggestions for further studies include:

- A learner's perspective of teaching and learning practices within a Mathematical Literacy classroom in a FET College.
- Investigating the perception that the basic Mathematical knowledge of new learners in FET Colleges is lacking.
- Steps to overcoming the language barrier that is present in Mathematical Literacy classrooms.

5.7 CONCLUSION

In this chapter I presented an overall conclusion and recommendations from my research. I interpreted the responses from my respondents and using my own experiences made recommendations.

Educators have different pedagogical experiences within their classrooms, but there were also many similarities. The research indicated that educators understood the rationale and aim of Mathematical Literacy as a subject. This fact influenced the way that they teach in their classrooms e.g. making use of real life context.

The research has also revealed that educators are frustrated in their teaching because they feel that the language barrier and the lack of basic mathematical knowledge are hampering their efforts to provide effective teaching and learning.

The educators who were interviewed were in consensus that they were excited to teach such a practical, and possibly life changing, subject. They felt that they could make a difference in the lives of their learners.

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ADDENDUM A

A STUDY OF FET COLLEGE EDUCATORS' PEDAGOGICAL EXPERIENCES IN IMPLEMENTING MATHEMATICAL LITERACY, 2010

COVER LETTER

Dear participant,

Thank you for volunteering to participate in this study.

The purpose of this study is to investigate FET College educators' pedagogical experiences in implementing Mathematical Literacy. Your response is solicited because you are an educator who teaches Mathematical Literacy in a FET College.

All information that you share will be kept confidential. Thus, whatever you say will not be shared with others. Your identity will remain anonymous. Personal details will be kept confidential. If so desired, the results of this study can be shared with you. You are also free to withdraw from the study at any time during the research.

Please respond to the interview questions as honestly as you can. With your permission the interview will be audio recorded. The audio tapes will be securely stored and disposed of after all data has been captured.

My contact details are as follows in case there is a need to contact me regarding the research:

e-mail mgerber@bccollege.co.za

cell number 083 469 2820

Thanking you in advance.

Mirinda Gerber

ADDENDUM B
INTERVIEW SCHEDULE

Section A: Personal Information

Kindly tell me about yourself, starting with the following questions. Talk about each issue as much as you can.

1. Your age: _____

2. Your gender: _____

3. Your highest professional qualification: _____

4. What teaching experience do you have? (Probe: Number of years
teaching at college/schools, which subjects being taught) _____

5. What Mathematical Literacy training have you been exposed to during schooling or professional training? _____

6. What level are you teaching? _____
7. Which programmes are you teaching in?(prompt: are you teaching other subjects other than ML) _____

8. I teach Mathematical Literacy because _____

Section B: Describe your pedagogical experiences

9. What is your experience like teaching Mathematical Literacy? (Probe: describe what this experience has been like for you, generally; why has the experience been like that? Do you feel you have contributed to the development of the student learning? Give some examples of how you feel you have contributed) _____

10. How do you teach Mathematical Literacy to students? Describe a typical Math Lit session. _____

11. What teaching strategies do you use when teaching ML? Describe your experiences using this/these strategies. (Probe: Teaching strategies, making use of resources, homework, classwork, level of learners) _____

12. How do you know when you have delivered a **successful lesson**?
(Describe the feeling/reactions that you have when you get the sense that you delivered the lesson well. Describe those initial reactions/feelings/behaviours? Give some examples of what you felt)_

13. How do you know when you have delivered an **unsuccessful lesson**?
(Describe the feeling/reactions that you have when you get the sense that you have not delivered the lesson well. Describe those initial reactions/feelings/behaviours? Give some examples of what you felt) _

14. Describe the experiences you have had teaching ML with the resources you have available. _____

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18. Considering diverse experiences in ML teaching, describe what it means to you to be a ML teacher. _____

Thank you for your participation.