# AN EXPLORATION OF THE TEACHING STRATEGIES USED BY MATHEMATICAL LITERACY TEACHERS: A CASE STUDY OF GRADE 11 TEACHERS IN UMLAZI DISTRICT

**BY**

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**DECLARATION**

I, Gwendoline Phumzile Dlamini, declare that this Thesis is my own original work. Where other people's work was used, this has been properly acknowledged and referenced according to the University requirements. I have not used work previously produced by another student or any other person to hand as my own. I have not allowed and will not allow anyone to copy my work with the intention of passing it as his/ her own.

Signature of student: …….

Signature of supervisor: ……

**DEDICATION**

This Thesis is dedicated to my late parents Abel and Mary, as well as my late brother Khalulu Magwaza

**ABSTRACT**

Keywords: mathematics literacy, teaching strategies, lesson presentation

This research project was aimed at exploring how teachers teach a specific concept in Grade 11 such that the learners could understand and perform better. The study employed a case study method with two teachers from two different environments, with an intention to check whether the environments also contribute to the choice of strategies employed by each participant. The study also identified the importance of developmental programmes that the Department of Education should provide on a continuous basis to help teachers improve on their lesson presentation using modern teaching strategies such as Information and Communications Technology (ICTs). The assumption that Mathematical literacy could be taught the same way as mathematics by not linking the content to relevant contexts in order to enhance learner understanding was also identified by the study. I also noted that some teachers would adopt a particular teaching strategy based on the fact that learning environment compels them to use that strategy. The findings from this study would be beneficial to Mathematical literacy teachers in realising the importance of selecting a proper teaching strategy for use in the teaching of a specific concept. The findings also shed the light of the challenges faced by some teachers besides the absence of Learner-Teacher Support Materials but due to the learning environment. The study could also inform school management team who take Mathematical literacy for granted on the importance of continued support that should be provided to teachers in order for learners to perform better in this new subject.

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# CHAPTER 1

## GENERAL OVERVIEW

### 1.1 INTRODUCTION

Since South Africa became democratic in 1994, the Department of Education has made changes in curricular. In 2006, Mathematical literacy was introduced into the school curriculum at the grade 10 level. The reason for introducing this subject was because of increased number of learners that exited grade 12 without mathematics, an important subject which is also done at Further Education and Training (FET) level, although since the subject was optional. In other words, the high failure rate throughout the country was the reason for introducing the subject. Mathematical literacy was introduced to ensure that, every learner that exits grade 12 possesses mathematical knowledge and skills. When Mathematical literacy was to be introduced in 2006, being a Mathematics teacher at General Education and Training level and having taught the subject for the past 28 years, I developed interest since I also wanted to discover how the subject differs from the mathematics that I already knew. I also wanted to see what difference would be brought by Mathematical literacy into the lives of the learners as future citizens.

According to Christiansen (2007), Mathematical literacy was meant for the 200 000 learners who left grade 12 every year without mathematics, as well as the additional 200 000 learners who failed mathematics every year. Christiansen also argued that the subject would equip the learners with competencies and knowledge, which would result in improved lives, social justice, as well as democracy. Bowie and Frith (2006) also assert that the reason for introducing Mathematical literacy was to ensure that learners become aware of, and appreciate the role of mathematics in the modern world. The experience would also present them with the opportunity to connect with the real life problems that are encountered in different situations.

I have been a mathematics teacher for 28 years now and I have been teaching Mathematical literacy from 2006 to date. That is what motivated this study, which investigated the teaching strategies that are used by Mathematical literacy teachers in KwaZulu-Natal, with specific reference to the concept of shape, space, and measurement. As a relatively new subject in public schools, the aim of introducing Mathematical literacy was to give more learners the opportunity to have a mathematical background up to grade 12 in preparation for the work environment.

## 1.2 BACKGROUND TO THE PROBLEM

Mathematics was my major subject at college and I have been teaching the subject for 28 years. When Mathematical literacy was introduced in 2006, I developed interest since I also wanted to discover how the subject would differ from the mathematics that I already knew. Mathematical literacy (ML) was introduced because of the continued high failure rate of mathematics throughout the country.

To equip myself enough to be able to teach the subject, I enrolled for the ACE Mathematical literacy programme. Given this background information, this study aims to assess the teaching strategies used by Mathematical literacy teachers in KwaZulu-Natal, given that the subject is comparatively new, especially in public schools and that the aim of introducing Mathematical literacy was to give more learners the opportunity to do and pass mathematics in preparation for the world of work.

Another reason for doing this study is to test Mhakure and Mokoena (2011) assertion that teachers need to create a classroom environment that integrates the development of mathematical experiences in different cultures. Weller (1991) calls for a multi-pronged approach to the teaching of mathematics.

A number of teaching strategies can be used in teaching the subject in question. These strategies can either be “traditional strategies” such as teacher talk method (or lecture method), group work/discussions or “non-traditional strategies” such as the use of Information and Communications Technologies (ICTs). Minty and Pather (2014) claim that ICTs could be used by teachers as additional teaching strategies. However, the problems encountered are that some teachers are still not computer literate or if computer literate, there

are no computers in their schools. Being a grade 12 Mathematical literacy teacher and who, time and again, gets an opportunity to mark Mathematical literacy final examination scripts, I have noticed several times that learners (including my own learners) encounter problems in answering questions based on the researched topic.

This study focused on the "traditional strategies" used in Mathematical literacy teaching, mainly because the research was conducted in a rural area where resources, especially technological, are limited. Field, Lovell and Weller (1991) call for a multi-pronged approach to the teaching of mathematics:

> *"To focus on adopting the best mathematics instructional, and assessment for all learners, with emphasis on strategies to benefit the weaker learners and provide a stronger leadership at all levels of education system to promote Mathematical literacy for all."*

Through interacting with the teacher participants, I had an opportunity to explore whether strategies used resulted in learners showing an understanding of the concept on shape, space and measurement.

As an experienced Mathematical literacy teacher in a rural and no-fee paying school, I have also experienced challenges pertaining to successfully teaching the concept of shape, space, and measurement. For example, learners would experience difficulties in seeing connection among various units of measurement and it even becomes more difficult when they need to do conversions between the units. Practical work using either a ruler to measure or a calculator also seems problematic. The purpose of this study is on the exploration of teaching strategies used by Mathematical literacy teachers in Umlazi district, a district which comprises of rural, semi-rural, and urban schools.

### 1.3 PROBLEM STATEMENT

It is believed that through exploration of the teaching strategies used in teaching space, shape and measurement, to I would come to an understanding of why learners experience difficulties in their final examinations of the Mathematical literacy as they exit FET level. Upon identifying the challenges encountered by teachers in teaching this subject, it would

also help me to suggest ways in which school management and the DoE could intervene in assisting the teachers.

## 1.4 AIM OF THE STUDY

The aim of this study is to explore teaching strategies used by Mathematical literacy teachers in the teaching of space, shape, and measurement.

## 1.5 OBJECTIVES OF THE STUDY

**1.5.1** To identify teaching strategies used by Mathematical literacy teachers in teaching space, shape, and measurement at grade 11 level.

**1.5.2** To understand the reasons why mathematical literacy teachers use these strategies when teaching space, shape and measurement at grade 11 level.

## 1.6 RESEARCH QUESTIONS

This study is informed by the research questions below:

**1.6.1** What teaching strategies are used by Mathematical literacy teachers in teaching space, shape and measurement at grade 11 level?

**1.6.2** Why do Mathematical literacy teachers use these teaching strategies when teaching space, shape and measurement at grade 11 level?

## 1.7 SIGNIFICANCE OF THE STUDY

It is believed that the findings of this research would be helpful to Mathematical literacy teachers by creating an awareness of the impact of their teaching strategies on this subject. It is also believed that the study would make the DoE realise the importance of supporting teachers who are teaching this practical subject.

Given the few studies done on the subject of Mathematical literacy in South Africa, it is believed that the study would benefit Curriculum Developers, Department of Basic Education, and also other Mathematical literacy Teachers. It is also hoped that anyone who still lacks an understanding of what Mathematical literacy is about would also realise its value to learners and the community at large. I believe that through exploration of strategies

used by other teachers in teaching shape, space, and measurement, one would understand the reasons why this section of work, even at a grade 12 level, poses problems to learners, leading to poor performance even in the final examination. It is hoped that this study would help I to acquire knowledge that she can also employ as a Mathematical literacy practitioner. The study might also help Mathematical literacy teachers who might want to enhance their knowledge on the subject.

## 1.8 METHODOLOGY

This research project is qualitative in nature and is influenced by the ideas of Schwandt (2001) and Johnson and Onwuegbuzie (2004) within an interpretive paradigm. The study employed a mixture of case study influenced by Bromley (1991) and Merriam (1998). Participants were observed while teaching the concept under research and later interviewed after completion of the concept. The data collection instruments used in the project are also supported by Reksoatmodjo and Hargo Utomo (2012), who maintain the fact that there should be interaction with the participants. This idea is also supported by Klein and Meyers (1999). Participant observation was done at both a rural and a peri-urban school with adequate resources in order to be able to see how teachers from these two contrasting environments teach the learners

## 1.9 ETHICAL CONSIDERATIONS

In every research, ethical considerations are important, especially when the research involves human beings. In that view, I was careful to observe the ethics required. Ethical clearance was given by the University of KwaZulu Natal (see attached appendix) to do this study. Permission to access the participants was also granted by the Principals of the schools investigated. Participants for the study were informed about the study and they participated voluntarily. They were also informed that the results of this study would be used purely for academic purposes. Participants were informed of their rights to withdraw from the study at any point, without negative consequences.

## 1.10 THESIS OUTLINE

This chapter is the introduction of the research study. It highlights background information, the problem statement, the objectives of the study, the research questions, as well as the significance of the study. Chapter 2 discusses literature review concerning the study. Concepts of the various teaching strategies are explained in the chapter. The chapter serves to provide the theoretical foundations on which the study is based. Chapter 3 contains a detailed methodology, explaining the data collection methods and instruments. Chapter 4 analyses the results of the study, based on the methodology applied. Chapter 5 discusses the conclusions drawn from the study. Recommendations based on the results of the study are also highlighted. The limitations of the study, as well as areas for further research, are also discussed in chapter 5.

# CHAPTER 2

## LITERATURE REVIEW

### 2.1 INTRODUCTION

The previous chapter gave an overview of the study. Important information regarding the study was highlighted, particularly the rationale for carrying out this study. This chapter is building on from the previous chapter. The chapter reviews literature relevant to the study: the role of mathematical literacy in our daily lives. Also discussed in depth is the effectiveness of the strategies used in teaching the subject. In this chapter, I will be presenting literature review on Mathematical literacy education and teaching strategies used to enhance learning. Concepts that include, Meaning of Mathematical literacy, meaning of the common types of teaching strategies used in Mathematical literacy and Mathematics , the impact of teaching strategies used by Mathematical literacy teachers for learner understanding, challenges faced by learners from usage of second additional language in Mathematical literacy, are all discussed in this chapter. Since Mathematical literacy is still a new subject in South Africa and to date, still under debate as to whether or not it is suitable for South African schools, there are limited resources on the subject hence, continuous reference is taken from Mathematics journals since these are related subjects.

The fact that Mathematical literacy is mathematics in action is grounded from the description by the Programme for International Student Assessment of the Organisation for Economic Cooperation and Development (OECD, 2004), which describes Mathematical literacy as the capacity that enables one to recognise, appreciate and engage in mathematics as well as making informed decisions concerning the role played by mathematics in our present and future lives as concerned, productive and reflective citizens.

Studies conducted by other researchers on strategies used in teaching Mathematical literacy and also mathematics locally and internationally reveal that these concepts are perceived differently. A view on Mathematical literacy teaching strategy by Shulman (1986), states that the Mathematical literacy teacher needs to know about the teaching of mathematics entailed

in the 'basic skills topic' (DBE, 2011, p. 13). For Shulman, the Mathematical literacy Pedagogic Content Knowledge (PCK) is of utmost importance for the teacher to successfully mediate teaching. Shulman further emphasises the fact that topics that are regularly taught in one's subject area require the most suitable ways of representation of "ideas, powerful analogies, illustrations, examples, explanations, and demonstrations" in a word. The methods highlighted above will therefore make the subject more understandable to others, especially learners. It is therefore of utmost importance that teachers do their best when selecting strategies that would successfully help learners to understand what they are being taught.

Literature available locally and internationally reveals that there are different interpretations as to what Mathematical literacy is. For example, in the UK it is called 'Numeracy' while in the US it is called 'Mathematical literacy' or 'Mathematical Proficiency'. de Lange (2007) asserts that the terms seem to convey different concepts that could be perceived by people in different parts of the world in various ways and that these could be used correctly or incorrectly. Through defining the concept, this discussion will clarify why Mathematical literacy has been introduced into the curriculum of South African schools.

It has been noted that Mathematical literacy is not similar to basic mathematics. The subject provides learners with decontextualized mathematical skills. Bowie and Frith (2006) claim that numeracy is not inferior to, and neither is it an element of mathematics. Instead, it is something which is more than mathematics. Yasukawa and Johnston (2001), describe Mathematical literacy as being "the ability to situate, interpret, critique, use and perhaps even create mathematics in context" (Yasukawa & Johnston, 2001, p. 279).

This study is conducted with the intention that at the end I will acquire a better understanding as to the various teaching strategies that one could employ to fulfil the goal of teaching a specific concept in Mathematical literacy. This may further assist other mathematics and Mathematical literacy teachers on improving their teaching of a particular concept and, maybe, even considerations as to prescription of these strategies by curriculum developers could be done.

## 2.2 CONCEPTUAL FRAMEWORK

This section will focus on the teaching strategies used in mathematical literacy as advocated by some researchers. It is therefore essential to briefly give an idea of what the subject entails. Within the South African National Curriculum Statement for FET phase, Mathematical literacy has been conceptualised as follows:

> *"Mathematical literacy provides learners with an awareness of understanding of the role that mathematics plays in the modern world. Mathematical literacy is a subject driven by life related applications of mathematics. It enables learners to develop the ability and confidence to think numerically and spatially in order to interpret and critically analyse everyday situations and to solve problems (Education, 2003a, p. 9)."*

This definition still applies in the revised curriculum which is now referred to as CAPS (Curriculum Assessment Policy Statement). Mathematical literacy is numeracy and one can describe numeracy as an effective way of using mathematics in meeting the daily needs at home and school and, at work where one is paid, as well as where one participates in community activities.

The establishment of Mathematical literacy was mainly to answer the question regarding the kind of mathematics required in one's life. Niss (2003) states that a well educated population is needed in order to enhance the society, to have a broadly qualified work force that can activate mathematical knowledge, insights, and skills in several situations. It should also be noted though, that Mathematical literacy has been around for quite some time in other countries, even though it is still a comparatively new subject in South Africa and is still being debated as to its relevance in the South African context.

The subject has been named differently in different countries: Mathematical literacy, Quantitative Literacy, Numeracy and Critical Numeracy (Stoessiger, 2002). The commonality in these different names is that they all refer to mathematics applied in perspective. In England, Functional Mathematics is defined as a certain way in which an

individual displays adequate appreciation of an array of mathematical concepts and understands when and how to use it. Equipped with this, learners become confident and capable of using maths to unravel problems entrenched in the increasingly multifaceted contexts, as well as being able to apply various tools including ICT, appropriately, (Venkatakrishnan & Graven, 2006, pp. 14-28). Numeracy has been defined as "the ability to process, interpret and communicate numerical, quantitative, spatial, statistical, even mathematical information, in ways that are appropriate for a variety of contexts and that will enable a typical member of the culture to participate effectively in activities that they value" (Coben, 2003, p. 279).

The Department of Education defined Mathematical literacy as "a subject driven by life-related applications of mathematics enabling learners to develop the ability and confidence to think numerically and spatially in order to interpret and critically analyse everyday situations and to solve problems" (Education, 2003a, p. 9).

**2.3 WHY MATHEMATICAL LITERACY IN SOUTH AFRICA?**

As South Africa was faced with large numbers of the population showing low levels of competence in mathematics, curriculum developers needed to ensure that every learner that exits grade 12 acquires the basic Mathematical knowledge. Another concern as advocated by Adler (2008) was based on the fact that when one compares the number of learners who registered and passed mathematics with the number of those who entered for other subjects, they were comparatively lower than the related rates of those subjects. A lack of numerical competencies has a negative effect on employment and economic development. It was therefore necessary for the incumbent government to take appropriate action to address this issue. In South Africa, all learners in grades 10, 11 and 12 now have to choose between Mathematics and Mathematical literacy as part of their National Senior Certificate curriculum.

As a teacher, I concurs with (Ojose, 2011) who asserts that "Mathematical literacy involves more than executing procedures. It implies a knowledge base and the competence and confidence to apply this knowledge in the practical world. A mathematically literate person

can estimate, interpret data, solve day-to-day problems, reason in numerical, graphical, and geometric situations, and can communicate using mathematics". It then becomes evident that Mathematical literacy requires teachers to develop new beliefs, perform new roles, and construct new identities in relation to other learning areas. The contextualisation and newness of the subject requires that teachers put the mathematical content into real life context and become participants in the classroom rather than didactical leaders.

DeLong, Bragg, and Simmons (2008) affirmed that Mathematical literacy contributes to economic success. Learners can become citizens who can negotiate and function in the economic world with everyday mathematical calculations and problems. Vithal and Valero (2003) pose an idea that learners are expected to use their skills in enacting their electorate in this progressively changing technological world once they become school leavers. From the Learning Programme Guideline (Education, 2005), it is stated that the infusion of Mathematical literacy as one of the essential subjects in the Further Education and Training curriculum is to ensure that learners become highly literate consumers of mathematics. As also stated in the Department of Education document (Education, 2003a), learners would be provided with opportunities that will ease their engagement with real life troubles in different situations and thus consolidating and extending fundamental mathematical skills. This is I's basis for exploring whether the strategies being used do impact on the learners' thinking abilities.

Furthermore, Mathematical literacy inclusion afforded the learners who were battling with mathematics and would not include the subject in their subject package beyond grade 9, an opportunity to have access in the skills necessary for participation in the modern world in a meaningful way. Most of the rural schools were disadvantaged during the apartheid regime, and some of them are still in that state. Given the lack of resources and the lack of qualified teachers, Mathematical literacy can be considered a good option in ensuring that each and every learner that exits Further Education and Training Phase (FET) acquires basic mathematical skills, since it is not everyone who is particularly good at mathematics. Learners doing pure mathematics should have a very good teacher who is qualified for the subject, while the learners themselves should have the right aptitude.

It should be noted that this does not imply that Mathematical literacy can be taught by an unqualified teacher, but the subject is more of a practical nature and a learner could easily associate what he/she learns in the subject with the world in his /her immediate environment. As proof that Mathematical literacy also requires qualified teachers, the Department of Education ensured that teachers with Mathematics at least up to grade 12, were afforded the opportunity to register for Advanced Certificate in Education (ACE) in Mathematical literacy as from 2006. This was an implication that the learners choosing the subject would from the onset, be taught by teachers that better understand the content dealt with in Mathematical literacy. In describing the quality of learners' school learning experiences, Lindberg (1995) asserts that there is nothing that can replace the power of a high quality teacher.

One can also note from the PISA (OECD, 2004) that Mathematical literacy domain has its concern on the capacities of learners to evaluate, explain and to effectively communicate ideas as they create, devise, solve and analyse mathematical problems in different contexts . Under PISA (OECD, 2004), Mathematical literacy is defined as "An individual's capacity to identify and understand the role that Mathematics plays in the world, to make well founded judgments and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen" (OECD, 2004, p. 109).

**2.4 WHAT ARE TEACHING STRATEGIES?**

Today's leaders in education institutions are faced with challenges of having to improve the expertise of their teachers. Teacher effectiveness is now the order of the day than ever before, as it has also become an important aspect of the national debates on education. What matters the most now is what we as teachers do in the classroom and has become everybody's concern. In their investigation on the world's top 25 school systems, Barber and Mourshed (2007) stated that the education system cannot be more than the quality of its teachers. A wider body of research depicts that one of the greatest factors affecting student success is the strategy used by teachers in imparting knowledge. Mortimore and Sammons (1987)

conducted a study in which classroom instruction was found to impact more on student learning as compared to other factors.

In schools, it is usually normal that learners are expected to learn the same way. The same curriculum content is conveyed to them at the same time, besides the fact that we as classroom practitioners know that learners are different in their needs, abilities, interests, backgrounds or experience. Hechter (2011) maintains that this is possibly driven by the fact that we as teachers tend to structure our teaching strategy directed by our own interpretation, not considering the differences that exist in our learners.

From PISA (2003), teaching strategies can be viewed as a variety of techniques used by teachers to organise and use classrooms and resources, to the techniques that both teachers and learners engage with in their daily activities when facilitating learning. On the other hand, learner strategies include the cognitive and meta-cognitive processes that learners employ in an attempt to learn something new. There are different ways by which PISA measures these strategies. These could be the usage of questionnaire items, be integrated, and measured to produce several complex variables that embody greater constructs. Amongst them are the following: teacher-learner relations, memorisation, the environment, and time utilised for different learning activities.

Teaching Strategies refer to principles, pedagogy, and management strategies for classroom instruction in general. A teacher's choice of teaching strategy is regarded as one that depends on what fits into one's philosophy of education, classroom demography, subject area and the school's vision and mission statement. There are two main groups into which teaching theories can be classified: teacher-centred and learner-centred strategies.

Teaching and learning practices tend to vary depending on the educational systems as well as across schools within systems. Essential aspects of educational policies and practices are formulated using teaching and learning strategies. Teaching and learning strategies are interconnected and this necessitates detailed, situation specific analyses important for one to

have an idea of the role of each strategy to enhance students' performance. Interesting exceptions are that most of these teaching and learning strategies are not directly linked with the way in which students perform across countries. Other factors that tend to moderate the relationship between the strategies and performance include the attitudes of the students as well as their background. Such issues cannot be separated from one another.

It is normal that no two teachers would teach in the same way, even if they obtained their teaching qualification at the same institution. Likewise, no two learners would learn something in the same way, even if they are being taught by the same teacher in one class. It is thus of utmost importance for the teacher to continuously revisit the strategies he or she uses, particularly when dissatisfied with the students' performance rate in a specific concept.

One can also further point out that since Mathematical literacy was introduced following the problem of high failure rate in mathematics, this problem (of failure in mathematics) is a global concern and researchers continue to want to discover the best strategies for teaching mathematics so that teachers of Mathematical literacy can also adopt as the subject is closely related to mathematics. Battista (1999) maintains that, "to perform a reasonable analysis of the quality of mathematics teaching requires an understanding, not only of the essence of mathematics, but also of current research about how students learn mathematical ideas (Battista, 1999, pp. 425 - 433)". He further asserts that the absence a deeper knowledge of judgments made on the kind of mathematics that needs to be taught to school children and how this mathematics should be taught, are naive and almost always wrong.

From a personal perspective, strategies are techniques or approaches that we use as teachers in order to simplify the content that learners need to learn. Engelbrecht (1992) suggests that instructional practices refer to qualitative dimensions of teachers' behaviour in their practices. These dimensions usually involve abilities that the teachers use in modelling cognitive strategies in meaningful and purposive activities, adjust instruction as required, promote classroom dialogues and establish classroom communities in which learners will collaboratively and cooperatively participate in enquiry-related activities. According to Artzt (2008) this is considered "a framework used in observing and describing teachers'

instructional practices, is built on three observable aspects of mathematics lessons namely tasks, discourse and learning environment" (Artzt, 2008, pp. 10-12).

There have also been reports about out-dated teaching practices and lack of knowledge of basic content as being amongst the causes of poor standards of teaching. Some scholars also suggest that "this new curriculum required that teachers change the way they taught and learn new teaching methods, overlooking the glaring inequalities in teacher competencies and conceptions of professionalism" (Msibi & Mchunu, 2013). Mji and Makgato (2006) also argued that "the poor standards have been exacerbated by a large number of under-qualified or unqualified teachers who teach in over-crowded and non-equipped classrooms.

Lengnik (2005) is of the idea that from an educational point of view, not everyone will be a mathematical expert, but everyone should at least reach a particular stage of mathematical literacy that enables one to reflect and assess mathematical processes which are an essential aspect of our everyday life. Julie (2006) suggests that "there is emerging acceptance that learner handling of subject matter should form an integral part of the desirable knowledge that teachers should be exposed to" (Julie, 2006, p. 65). Julie (2006) further argues that teachers have a tendency of amending and adapting teaching products so that they are suitable for the contextual demands at hand.

Blum and Ferri (2009) have noted that the school of mathematics requires that a major objective is to ensure that students are able to find solutions to real life problems. To successfully fulfil this aim, the school of mathematics should employ various strategies. A complex situation requires that learners are able to search for necessary data and this has been proven to be difficult to achieve, especially for younger students. Blum and Ferri (2009)further assert that the effective teaching to model competence depends on some factors like a "balance between teacher's guidance and students' independence". However literature indicates that the use of contexts to teach mathematics can be challenging since there are very few detailed examples that exist. It is therefore fundamental for teachers to not only possess a clear appreciation of the underlying concept to be taught, but also the learners' understanding and possible misconceptions that may arise. When teachers anticipate certain common

mistakes or misconceptions, they can use these as learning experiences. Shulman (1986) coined this conception of pedagogical content knowledge (PCK).

Graven and Venkat (2007) are of the view that one of the problems associated with Mathematical literacy is that the curriculum and many accompanying textbook resources introduce several interesting but quite complex scenarios for learners to engage with at Grade 11 level, which firstly, assume that GET phase content knowledge is secure and, which secondly, exemplify progression in largely content based terms. Clark (2009) argues that "Mathematical literacy is NOT an alternative to standard grade mathematics, but an entirely new and independent subject in South Africa (Clark, 2009, p. 2)". Thomson and De Bortoli (2008) also argue that Mathematical literacy also fulfils the objective of the Programme for International Student Assessment (PISA) that it has to do with measurement of competencies that will equip learners in participating productively and in an adaptive way in their lives and beyond school education.

From Julie (2006) ideas , one can concur that "teaching is decidedly different from what happens when a member of a knowledge-making community informs and conveys her/his frontier knowledge products to the affiliated knowledge-making community (Julie, 2006, p. 64)". Due to this claim held on the difficulty of teaching Mathematical literacy compared to other school-going mathematics, it is then wise to search whether or not this is true, from the practicing individuals, the teachers. Wittman, Velde, Carawan, Pokorny, and Knight (2008) are of the idea that one of the core tasks of Mathematics Education as an area of study is for one to develop resources leading to productive and meaningful learning. Wittman et al. (2008) further maintain that mathematics teachers have a critical function to play regarding this aspect and analysing the subject matter is one of their tasks to enable them to didactically design the resources to use whilst teaching.

Julie (2006) is also of the idea that teaching is a deliberate act whereby a person possessing knowledge relays her/his understanding of established knowledge to someone not in possession of much knowledge on this declared knowledge. When teachers relay this knowledge, they reveal and provide opportunities to engage with the skills and technologies

necessary for constructing artefacts that belong to the domain. When knowledge is being relayed, there is a clear historically-developed-and-changing identity in various contexts. For instance, a teacher teaching Grade 8 learners is completely different from the one teaching a group of Grade 11 learners, since the Grade 11 learners look at the content of the subject differently and they may sometimes challenge their teacher in a particular concept. The Grade 11 teacher thus needs to continuously make a consideration of which strategy to use in presenting a particular concept.

Clark, Berenson, and Cavey (2003) argue that the strategies employed by teachers in solving problems greatly affect the students' perceptions, while the students' preferences might also influence which strategies the teachers would employ, therefore, the classroom mathematical practices would also be influenced. Based on my experience in teaching, I concur with the above assertions since, we as teachers have a tendency of wanting to choose a strategy that would most of the time suit our presentation of a particular concept. We usually consider accommodating learners that grasp slowly after several activities have been given and still these learners seem not to understand.

In ensuring that the more complex and analytical skills they needed for the 21st century are learnt by young people, it is thus essential that educators acquire the ability to teach using strategies that would develop learners with higher-order thinking and performance. All levels of education systems thus need to ensure that they offer more effective professional teacher development in order that these teachers keep with the pace of modern technology available to them to assist learners to achieve. This however would not imply that teachers have to completely do away with traditional teaching strategies, but may use a combination of both. Mathematical literacy teachers should also continue to provide all learners with tasks which are cognitively demanding.

According to the National Study Group for the Affirmative Development of Academic Ability (2004), the application of proven pedagogical practices and adoption of policies that are within our reach will enable all students to obtain high levels of academic ability. I concur with this idea, given the fact that the government continually makes provision to try and

develop teachers such that even if there is a combination of mental capabilities in a class, these strategies would be suitable.

Pogrow (1988) maintains that it is important for all students to be exposed to challenging tasks. He further asserts when teachers try to protect the image of learners that are under-achieving by giving them only "simple, dull material" (p. 84), this prevents them from developing their self-confidence. Pogrow (1988) further maintains that the under achieving students would improve their confidence in their abilities if they see themselves succeeding on these complex tasks. Pogrow (1988) is also of the idea that there will come a period whereby learners struggle while beginning to grapple with problems. He further asserts that "this 'controlled floundering' is essential in enabling students to begin to think at higher levels (Pogrow, 1988, p. 84)."

Sullivan, Cheeseman, Mornane, and Middleton (2011) also support Pogrow in that they characterise challenging tasks as those that require learners to, among other things, have a planned approach particularly when sequencing more than a single step. Learners will thus be able to deal with important mathematical ideas and expand their knowledge and thinking in different ways.

The Department of Education (2005) also emphasises the fact that when teaching Mathematical literacy, teachers need to avoid teaching and assessment of content without context. The Department of Education (2005) further recommends that teachers also need to focus on "identifying in and extracting from the contexts, the underlying mathematics or 'content', that is, avoid teaching and assessing contexts without being deliberate about the mathematical content" (Education, 2005, p. 7).

Whilst there are various strategies used by teachers in the classroom, they can also make use of technology in reducing time taken on scheduled mathematical tasks thus, promoting thinking, and concept development. It is therefore suggested in this technological era that all learners should be able to access learning environments that have ICTs supporting them. To

date, our country still faces a challenge that there are some schools that are still without electricity, adequate computing facilities, or teachers who are computer literate. This proves the fact that learning to use technology appropriately is still another crucial aspect in the area of Mathematical literacy. These are the challenges that the Department of Education still have to address and provide a plan of action on how access to technology will be made available to all schools.

## 2.5 TYPES OF TEACHING STRATEGIES

This discussion will focus mainly on traditional teaching strategies (teacher-centred approach) and modern teaching strategies (learner-centred approach). I will also indicate examples under each main type of teaching strategy. It should be borne in mind that the strategies that will be discussed are mostly those that have been used and are still being used in the teaching of mathematics as a subject that is closely related to Mathematical literacy.

Before 1994 democratic elections, the South African community was traditionally used to traditional theories and practices of teaching and learning. The type of learning in schools was regarded as a set of contents prepared to be learned in a particular sequence and time. Each subject had a syllabus which had to be followed in a particular way and the content to be covered at a specific time. Learners were exposed to rote-learning only and critical thinking and questioning was minimally accommodated. Teachers were trained to fit in this framework hence; we had teachers' training colleges and not colleges of education. Colleges of education only emerged when the country was heading towards democracy. Post 1994 the situation of a democratic South Africa required the development of a new pedagogy in order to have the kind of citizens who were independent, critical and reflective thinkers. This was mainly based on our exposure of accepting the nature of knowledge and learning, as well as a variety of hindrances to learning.

### 2.5.1 TRADITIONAL TEACHING STRATEGIES

A traditional teaching strategy entails a teaching strategy whereby the teacher stands in front of the class and directs learning, controlling all the classroom activities. In most schools, this is still happening with traditional mathematics teaching. This strategy implies that there is a

directed flow of information from teacher to learners. Class work, homework, and tests are then used as a form of assessment as to whether or not learners have grasped a concept. Marks and or percentage obtained after each test usually measure how intelligent each learner has been in successfully grasping that particular concept.

Traditional/teacher-centred strategy is mainly what the theorists refer to as Direct Instruction. In a teacher-centred strategy, the teacher is mainly the figure of authority and learners are perceived as "empty vessels" that are primarily passive and receive information so as to be tested or assessed. The teacher's basic role in this regard is the transmission of knowledge and information to learners. The learners' learning is measured by use of objectively scored tests and assessments.

Direct instruction is therefore a general term referring to the traditional way of teaching that relies on explicit teaching using lectures and teacher-led demonstrations. Joyce, Weil, and Calhoun (2000) regard direct instruction as an effective way when basic and fundamental skills are taught across all content areas. According to Vaughn and Baker (2008) there are three categories into which this strategy is divided i.e. formal authority, expert and personal model.

Formal authority is a kind of instruction whereby the teacher is in possession of power and authority because of the knowledge and status that they possess over their learners. Expert instruction is whereby the teacher possesses all knowledge and expertise in the classroom. The primary role of the teacher is that of guiding and directing learners throughout the process of learning. The learners are solely viewed as receptors of information. In Personal model is whereby the teacher leads by example through demonstrating to learners how they can access and comprehend information. Learners observe and copy the teacher in order to learn.

If the DoE can continually develop teachers through providing various forms of strategies, the tendency of most students to try to memorise school mathematics would gradually come to an end and instead, the subject would make more sense to them. The traditional teaching strategy would also be minimal or even come to an end in the teaching of mathematics. Traditional teaching strategies also do not accommodate the fact that when learners come to school, they are not empty vessels, but they do have some knowledge from home and teachers can perhaps build on this acquired knowledge and it becomes relevant to the classroom situation.

There have been numerous scientific studies revealing the use of traditional teaching strategies in mathematics. It has been noted that some of the strategies are not only ineffective, but they also seriously prevent learners from strengthening their mathematical capacity and problem-solving skills. As a practising teacher, I can concur with the fact that some teachers using traditional teaching strategies do not only ignore the recommendations by professional organisations in mathematics education, but they also overlook modern scientific research that indicates how children can learn mathematics. In a study of instructional policy implementation among elementary and middle school teachers, Spillane (1999) found teachers to be more likely to alter the core of their instructional practices when their 'zones of enactment' allowed opportunities to discuss and practice new ideas about teaching with their peers.

How one uses a traditional strategy in Mathematics can be identified when the teacher shows learners a variety of examples on how to solve a problem. He/she will then expect the learners to make use of this method in class and/or for homework. Kohn (1999) asserts that this method of instruction has been referred to as "mindless mimicry" by the National Research Council. Learners do not develop their own methods of finding a solution to a problem when taught this way. The paradigm shift of education now requires that we as teachers gradually move away from using traditional teaching strategies that are basically teacher-centred and move towards the learner-centred teaching strategies.

### 2.5.2 DEVELOPMENTS THAT CHALLENGE TRADITIONAL TEACHING STRATEGIES

Educational focus on delivery of content and discrete skills may have previously been appropriate. Darling-Hammond and Richardson (2009) state that what is needed in the modern day environment are the kind of education models that mirror the contemporary society, the economy, the rise of new technologies and digital networks as well as new approaches in the learning sciences. They further write: "Most of today's jobs require specialised knowledge and skills, including the capacity to design and manage one's own work, communicate effectively and collaborate with others; research ideas; collect, synthesize and analyse information; develop new products; apply many bodies of knowledge to novel problems that arise (Darling-Hammond & Richardson, 2009, p. 1)". Davis, Sumara, and Luce-Kapler (2008) maintain that learning in decontextualized environments result in limiting the ability of people to remember ideas and knowledge. This results into learning facts or procedures as repetitive drills bearing little meaning that would soon be discarded.

### 2.5.3 MODERN TEACHING STRATEGIES

These strategies are mainly centred on the learner hence; they are also referred to as learner-centred teaching strategies. These strategies can be categorised into Inquiry-based and Co-operative learning, whereby Inquiry-based learning can be categorised into facilitator, personal model, and delegator.

#### 2.5.3.1 INQUIRY-BASED LEARNING

Pedaste and Sarapuu (2006) view inquiry-based learning as ways of solving problems and involve the application of several problem solving skills. Inquiry-based learning focuses on learners' investigative and hands-on learning. The teacher's role in this perspective is to facilitate through provision of guidance and support to the learners. This is a learner-centred approach since learners assume the active and participatory role to play in their own learning process. Inquiry-based teaching is a pedagogical strategy inviting learners to explore academic content through posing, investigating and answering questions.

The co-operative strategy is similar to being facilitator and delegator. This strategy has its emphasis on group work and a strong sense of community. Newhouse, Lane, Brown, and Cluffetelli (2007) assert that co-operative learning fosters the academic and social growth of learners. This includes teaching strategies like "think-pair-share" and reciprocal teaching. The co-operative strategy is regarded as a learner-centred strategy since learners are responsible for their own learning and development. The focus of the method is on the belief that learners learn at their best when they work with and when they learn from their peers.

#### 2.5.3.1.1 THE VARIOUS FORMS OF INQUIRY-BASED STRATEGY

Kohl (2013) explains that as the facilitator strategy emphasises the teacher-learner relationship. In the classroom, both learner and teacher undergo the learning process together, implying a de-emphasis on teacher instruction. Learning mainly focuses on the fostering of independence, exploration, and hands-on learning. There is a loose guidance of learning by the teacher, whose main role is to facilitate the learning process. In personal model, the teacher leads by example and demonstrates to learners how information can be accessed and comprehended. Learners learn through observation and copying the teacher's process. As a delegator, the teacher serves as a resource to learners, answers questions and reviews the learners' progress as required. The teacher has a minimal role to play in the learning process. Learners are active and engaged participants in their own learning. The goal of the delegator strategy is to foster a sense of autonomy in the learning process.

#### 2.5.3.1.2 COOPERATIVE LEARNING STRATEGY

Cooperative learning is a strategy of teaching and classroom management. It has its emphasis on group work and a strong sense of communication. Tsay and Brady (2012) assert that the cooperative learning strategy is another type of collaborative learning through which learners learn together on a structural activity. Each individual in a group has accountability for his/her work, while the work of the whole group is also assessed. Cooperative learning groups get used to the idea of working as a team since they work face to face.

The paradigm shift of education in South Africa now requires that we as teachers gradually depart from the traditional teaching strategies that are mainly teacher-centred and move towards the learner-centred learning environment. Bereiter (2002) noted four aspects that are being emphasised in cooperative learning: socialisation, externalisation, The purpose of this study is on the exploration of teaching strategies used by Mathematical literacy teachers in Umlazi district, a district which comprises of rural, semi-rural, and urban schools. combination, and internalisation. Socialisation involves knowledge sharing whilst in externalisation; expression of tacit knowledge is required. Externalisation requires that this tacit knowledge is translated into understandable formats. Combination entails that explicit knowledge is converted into sets of complex knowledge whilst internalisation involves converting knowledge that is newly created from explicit knowledge to the organisation of tacit knowledge.

Davies and Stone (2001) argue that tacit knowledge is highly personal and informal. It is the knowledge we have but nonetheless cannot put it into words whereas explicit knowledge is learned at school. Davies and Stone (2001) further maintain that explicit knowledge is a kind of knowledge which is formal and systematic. Explicit knowledge can be communicated and shared. This is the kind of knowledge that has been documented. It is articulated knowledge which is expressed numerically. Explicit knowledge can further be expressed in words or codes and represented through mathematical and scientific formulae and musical notations. Explicit knowledge can be communicated with ease, stored, and distributed. We can access this knowledge from books, online and on other visual and oral means.

Tacit knowledge is highly personal knowledge which cannot be easily expressed, formalised and/or communicated to others. One cannot easily identify elements of tacit knowledge that can be captured hence, its capturing is impossible. The goal of tacit knowledge is connection of its possessors with its seekers.

### 2.5.3.2 CONSTRUCTIVIST TEACHING

This is another type of modern teaching strategy based on the constructivism learning theory. According to Christie (2005) constructivist teaching strategy is more of a cooperative method. This method holds a belief that there is active engagement of learners in the process of knowledge and meaning construction as opposed to learners being passive recipients of information. In the constructivist teaching strategy are the makers of meaning and knowledge. This results into motivated learners who are independent and critical thinkers. The teacher attempts to use questions in leading learners. New knowledge is enforced in activities where learners will discover, discuss, appreciate and verbalize this knowledge.

The development of informal education has been influenced by Dewey and Piaget. The idea of informal education by Dewey suggests that education has to engage with and broaden experience and the exploration of thinking and reflection in fulfillment of the role of teachers. When we expand our knowledge through experiences that have been generated in play from infancy to adulthood which necessitates learning that fulfills Piaget's constructivist teaching. Constructivist learning theory states that prior knowledge forms the basis of all knowledge. This suggests that the constructivists' method supports the idea that an individual has tacit knowledge. Learners are not a blank slate as assumed in traditional teaching method. For the teacher to impart knowledge, each learner has to make sense of this knowledge, based on his/her current conceptions. Learners learn at their best if afforded the opportunity to construct personal understanding through gaining experience on things and reflecting on such experiences.

## 2.6 THE TRADITIONAL VERSUS THE MODERN CLASSROOM

Christie (2005) maintains that the traditional classroom emphasizes basic skills through beginning with the parts of a whole. From this perspective, teachers strictly adhere to fixed curriculum, textbooks and workbooks. The teacher gives and the learners receive. The teacher directs the learners. He/she has an authoritative role and uses tests to assess. In a traditional classroom, learners work as individuals. The constructivist classroom begins with the whole and expands to parts. Learners' questions / interests are a priority. Learning builds

on what is already known by learners. The teacher interacts / negotiates with learners and uses learners' work, observations and points of view in assessing them. Learners work in groups.

In the constructivist classroom, the teacher prompts and facilitates discussion, with the main focus placed on guiding learners by using questions leading them to develop their own conclusions on the subject. Shulman (1986) asserts that teachers' effective teaching is not as a result of knowledge possessed by the teacher, but the teacher should make his/her own knowledge understandable to the learners. It is therefore imperative to choose a suitable strategy when presenting each particular concept. Shulman (1986) further states that PCK is that knowledge allowing a teacher to convert his/her own content knowledge to a form that students can understand. Shulman (1986) also maintains that PCK consists of four major components and two of these are subject matter knowledge and pedagogical knowledge. Differentiating between teachers from subject experts emanates from the other two components of teacher knowledge. A teacher also needs to know how his/her learners learn (learning strategies) and what their abilities are. This should accompany knowledge of learners' ages, developmental level, attitudes, and what the learners already know. Another component that teachers are supposed to understand as part of their pedagogical content knowledge is socio-political and physical environment where learners learn.

Mason and Spence (1999) assert that teachers have recently increased emphasis on the importance of "knowing-to", rather than equating mathematics education with teaching learners about mathematics, Pugalee (2001) maintains that mathematics teachers perceive mathematics education as implying teaching learners to acquire knowledge on how and when to use the knowledge gained mathematically. I concur with Ellis and Berry III (2005)who assert that mathematics education combines mathematics knowledge through which one knows where, when and how to apply this knowledge, that is being mathematically literate and being able to apply and use knowledge, skills and practices in mathematics flexibly.

It is assumed in Mathematical literacy that the practical nature of the subject engages learners' preconceptions. We need to ensure that the pattern of classroom instruction is non-routine or non-traditional. Dubinksy (2000) proposes that inclusion of mathematical literacy in South Africa constitutes a departure from the traditional routine. Weller (1991) further argues that the major challenge for teachers in the face of globalisation is the creation of a classroom environment that will integrate the development of mathematical experiences in different cultures and how to deal with the abilities in the multicultural mathematics classroom."

An understanding of one's teaching style at an early stage will prove effective for both the teacher and learner. This would further create a balance between the teacher's teaching preferences and the learners' learning preferences. This further brings us to what Ferri (2010) regards as Mathematical Thinking Styles (MTS). Ferri (2010) characterises these styles as a method that an individual prefers to present, to understand and to think through the use of mathematical facts (which can be internal) and or representations (which can be external). Grigorenko and Sternberg (1997) are of the idea that a style is a way of thinking and not ability, but rather, a way preferred by one in using his/her abilities". However there is still less research on Mathematical Thinking Styles since most studies still place their focus on how individuals think mathematically in various contexts of secondary school learners with different cultures.

Realising the fact that learners are different and taking that into consideration, we will then see the need to appreciate that these learners learn in different styles. These learning styles can be related to different learning areas/subjects in each school setting. One cannot over-emphasise how important it is to interconnect the individual's cognitive development and their differences. Cognitive development and individual differences also contribute to human performance.

However, researching on a program based on student self-regulation in the United States of America, Ames (1992) maintains that learners' approach to learning can be influenced by teachers through careful task design. I concur with this idea, based on the fact that if the

Department of Education in South Africa can ensure that all schools, despite their location, are equally provided with the same resources and teachers are continually given professional development on a regular basis. As it is in our country right now, such strategies would still take decades to apply in our situation since there are still cases where we have multi-grades in a single class, learners without enough or proper furniture to sit on, even worse there are still schools whose buildings are dilapidated.

## 2.7 INFORMATION and COMMUNICATION TECHNOLOGY AS A MODERN TEACHING STRATEGY

Some researchers generally believe that if ICTs can be used in educational practice, this will "empower both teachers and learners, promote change and foster the development of 21st century skills (Trucano, 2005, p. 5)". A report by United Nations (1999) on Information and Communications Technology states that ICTs cover a variety of fields. These fields as maintained by Karchmer (2001) are provision of internet service, telecommunications equipment and services, information technology equipment and services together with other related information and communication activities. Yusuf (2005) states that ICTs have affected the field of education and has extended to affecting teaching, learning, and research. Davis and Tearle, (1999), Lemke and Coughlin (1998) are of the idea that some of the potentials brought about by ICTs include, among other things, innovation, enrichment and deepened skills. These motivate, engage, and help learners in relating school experience to work practices thus, assisting by strengthening teaching and helping schools to change.

Oliver (2000) asserts that conventional teaching has emphasised content. He further explains that for several years, courses have been written around textbooks. Teachers have been teaching using lectures and presentations mixed with tutorials. Learning activities have been constructed such that they consolidate and rehearse the content. Curricula now gradually put emphasis on capabilities and have more concern on how information will be utilised than with what information.

Among other factors that influence the integration of ICT into successful teaching, are the attitudes and beliefs of teachers towards technology(Hew & Brush, 2007); (Keengwe, Onchwari, & Wachira, 2008). Zhao and Cziko (2001) maintain that there are three conditions which are necessary in introducing teachers to ICTs in their classrooms. They noted that it is important for teachers to appreciate the effectiveness of technology, and that the use of technology will not distract their teaching. Finally teachers should be confident that they are able to control technology. Having mentioned the fact that the Department of Education still needs to ensure that teachers are regularly developed professionally, ICT infrastructure is still a dream that has not been realised in most schools, especially rural schools. This is either based on the fact that some teachers still have little or no knowledge of the use of computer technology or the schools are lacking the relevant resources and/or electricity.

Lawless and Pellegrino (2007) reiterated the importance of integrating technology in teacher training and professional development. However, Song, Bae, Park, and Kim (2013)argue that the necessary support for learning specific technology skills, like for example, the use of particular tools or software programs, has not been adequately provided to teachers. Ertmer (2005) suggests that teachers' traditional beliefs on current practices remain a barrier that inhibits technology integration. Ertmer (2005) further maintains that even though there is technology and technical knowledge for technology to be integrated, it requires that teachers believe that they have acquired the new methods of doing things.

Schiller (2003) maintains that the adoption of technology can be influenced by personal characteristics that include aspects such as educational level, age, gender, and experience, together with the computer for educational purpose and attitude towards computers. Jones (2004) argues that it is expected that teachers should adopt and integrate Information and Communications Technology into classroom activities, but this is dependent on how prepared the teachers are in integrating ICTs into their teaching. According to Russell and Bradley (1997) factors like anxiety, being less confident and less competent, combined with fear, often imply that ICTs will often take a back seat to conventional learning mechanisms.

Nivala (2009) noted that a distinct characteristic of modern times is the globalising phenomenon of ICTs. The speed and immediacy of ICT, the increased information flow through various routes of communication present the perception that we have moved to a period of unparallel change, an environment in which ICTs affect every aspect of our lives, be it at individual or societal level. In that view, teachers and learners can be revitalised by the integration of ICTs. This would in turn help to advance and increase the quality of education through the provision of curricular support in subject areas that pose a challenge. In achieving these objectives, there exists the need for teachers' involvement in collaborative projects and the development of intervention change strategies. These should include teaching partnerships using Information Communications Technology as a tool. This idea tallies with the cooperative teaching strategy mentioned earlier in this chapter.

In concluding the ideas about the use of ICTs as one of the modern teaching strategies, Condie and Livingston (2007) identified that teachers become hesitant to use computers if they are less confidence. Bingimlas (2009) also claims that teachers' lack of knowledge in ICTs together with the fear of failure have been identified as some of the major reasons why teachers lack the confidence to adopt and integrate ICTs into their classroom teaching. Sandholtz and Reilly (2004) claim that strong determinants of ICT integration include the teachers' technological skills. However, these are not conditions that will result in effective use of technology in the classroom. Wepner, Tao, and Ziomek (2006) maintain that teachers committed to professional development activities have an advantage of gaining knowledge on how to integrate ICTs and how to organise technology in their classrooms. Tondeur, Van Keer, van Braak, and Valcke (2008) also maintain that using suitable kinds of tools and programs in supporting teaching and learning are as important as accessing hardware and software.

## 2.8 SUMMARY OF THE CHAPTER

This chapter has outlined the reasons why Mathematical literacy has been included in the South African curriculum. The chapter focused on the conceptual framework for the research and literature review thereof, has been provided. The differences between Mathematical literacy and mathematics have also been explained, as well as the reasons why have

mathematics teaching approaches have been used as references when discussing strategies for the teaching of Mathematical literacy. The various types of teaching strategies that can be helpful in achieving the goals of successful teaching Mathematical literacy have been discussed under two main types of teaching strategies: traditional and modern teaching strategies. The next chapter discusses the methodology.

# CHAPTER 3

## RESEARCH DESIGN AND METHODOLOGY

### 3.1 INTRODUCTION

The previous chapter discussed the theoretical foundations of the study. This chapter discusses the methods used to achieve the objectives of the study. It is important to reiterate that this study is an exploration of the teaching strategies used by Mathematical literacy teachers when teaching space, shape, and measurement to Grade 11 learners. I will briefly describe research the design, paradigm, as well as the methodology that includes research instruments, sample, data collection and data analysis methods employed in answering the research questions that structure the basis of my study. As highlighted in the first chapter, the study seeks to answer the following research questions:

- What teaching strategies are used by mathematical literacy teachers in teaching shape, space, and measurement at grade 11 level?

- Why do Mathematical literacy teachers use these strategies when teaching shape, space, and measurement at grade 11 level?

These questions would be answered through identifying and analysing Grade 11 teachers' strategies used when teaching this concept. This study employed the mixed methods which are qualitative in nature. The methods will be discussed in depth in the chapter. All information that pertains to trustworthiness, ethical issues, and considerations will be provided. I will then discuss limitations and delimitations of the study.

### 3.2 RESEARCH APPROACH

In research, data collection can either be primary or secondary. In this study, data collection was mainly of a primary nature in order to assist me in gathering information that would lead to the answering of the research questions.

When one is conducting research, it is possible to use the qualitative, quantitative, or mixed approach. In conducting this study, I applied a qualitative research methods and the choice was influenced by (Schwandt, 2001) who declares that qualitative research covers a range of techniques that seek to describe, decode, translate and come to terms with meaning, instead of the measurement of phenomena in the social world. In order to produce textual data for interpretation, I observed and interviewed the participants. Johnson and Onwuegbuzie (2004) noted that as a qualitative researcher, the role of a detective searching to understand the phenomenon (teaching strategy) by examining possible clues and attempting to rule out each rival explanation generated, has to apply. Merriam (1998) also puts it that an assumption concerning qualitative research is that of holistic reality which is multifaceted and ever-changing. It is not a sole objective phenomenon that needs to be discovered, to be observation and measured as in quantitative research.

Olds, Moskal, and Miller (2005)point out that qualitative research owes its genesis to the behavioural and sociological sciences. Olds et al. (2005) further argue that qualitative research entails the collection of textual data using instruments like the focus groups, the questionnaire, interviews, participant observation, as well as ethnography. The context within which the study occurs is an important aspect of qualitative research. Qualitative research is interpretive and / constructivist in nature, while the emphasis is on understanding the world through the perspectives of participants (Bryman, 2012). I have chosen the qualitative methodology because of the eagerness to understand the processes that led the teachers to select the strategies they used in teaching this concept in particular.

### 3.3 RESEARCH PARADIGM

In this study I employed interpretivist paradigm. Mackenzie and Knipe (2006) are of the view that this paradigm has its research aiming at understanding human experiences of the world, relying on the view of the participants within the situation being studied. This was an appropriate paradigm for this study since the aim was to observe teachers in their classrooms, with a view to interpreting and understanding their choice of teaching strategies. This study included observation, interviews and content analysis, the methods which according to Wahyuni (2012) promote interaction and dialogue amongst its participants. Klein and Myers (1999) suggest that in interpretivist research, there should be an intimate relationship between

me and the situational constraints shaping the process. I had hoped to establish a positive working relationship with the participants so as to better understand the teaching strategies that they used while teaching the concept of space, shape, and measurement in grade 11.

### 3.4 DATA COLLECTION PROCESS

Data was collected during the second and third week of June 2015 from two Kwa-Zulu Natal schools at Umlazi District. After getting verbal permission from the participants whom I met at our opening workshop in January, I then personally approached the principals of both schools. I discussed with them what my study entails and gave a detailed explanation as to how the study would be conducted and assured them that I would not disturb the running of the lesson during the entire period. I then asked for an appointment to meet each principal and participant so that they could sign consent letters. The participants were Va* in school A and Minky* in school B. Each principal also granted me permission to discuss arrangement of periods and classes to use during the participants' observation. As stated in Chapter 2, I observed ML teachers teaching the same concept in grade 11. I observed 6 lessons per teacher including the last session for formal assessment of the concept observed.

### 3.5 SAMPLING AND SAMPLING METHOD

Sampling is a process whereby a portion of the population is selected when conducting a study. As a qualitative researcher, sample sizes that were most compatible with the purpose of the research were selected. I made use of purposive sampling in this study, which was a deliberate choice of choosing the participants based on the fact that they both taught Mathematical literacy. Onwuegbuzie (2007) maintains that "One of the goals of qualitative research is to obtain insights into particular educational, social, and familial processes and practices that prevail within a specific location (Onwuegbuzie, 2007, p. 106)". Tongco (2007) also maintains that I in purposive sampling "decides what needs to be known and sets out to find out people who can and are willing to provide the information by virtue of knowledge and experience" (Tongco, 2007, p. 147).

Researchers primarily use purposive sampling techniques in qualitative studies and these may be described as a selection of units for example, individuals, groups of individuals, for a

particular purpose associated with answering a research questions. Another reason why purposive sampling has been used for this study was due to that it was the most appropriate method for my study. In conducting a study of this nature, it is not easy to randomly or statistically select representative sampling.

Purposive sampling also enabled me to have an initial understanding of the situation and to identify and differentiate the needs of one or more groups. This study pursued stratified purposive sampling since I needed to use a selected criterion, which would be relevant. Choosing stratified purposive sampling was also suitable since I had limited time available for conducting the study. Tongco (2007) asserts that "choosing purposive sample is fundamental to the quality of data gathered, thus reliability and competence of the informant must be ensured" (Tongco, 2007, pp. 147-158).

In this study, I purposefully selected two Mathematical literacy teachers who would be under observation whilst they were teaching the chosen concept. I selected schools located in different environments, one in an urban area and the other one in a peri-urban area, since the need to explore whether or not the strategies used in teaching the concept would be similar or the environment and the type of learners taught also influence the choice of the strategy used. Both schools were at Umlazi District and comprised all black learners and all black teachers. Another reason for choosing these schools was convenience; the schools were within my easy reach to conduct the observations. Qualitative research method also does not have specific rules for establishing sample size. It is better to seek quality over quantity.

Qualitative researchers are encouraged to consider what they want to know when deciding a sample size hence; sample size requires that one should carefully consider the number of participants to involve, in achieving the goal of the final product. The choice of participants was based on the fact that I had met with them at a Mathematical literacy workshop, so their contributions during the workshops were identified and this convinced me that they would positively contribute to this study.

### 3.6 METHODOLOGY

In conducting this research, I used a case study with its multiple meanings. Merriam (1998) describes the fact that a case study does not necessarily mean that only one site has to be studied, but also by the fact that it is a bounded system. This idea supports the fact that my exploration would not only be in one teacher and one school. A case study can also be defined as "a system of inquiry into an event or a set of related events which aim to describe and explain phenomena of interest" (Bromley, 1991, p. 302).

According to Yin (2013) a case study is, "an empirical inquiry that investigates a contemporary phenomenon within its real-life context when the boundaries between phenomenon and text are not clearly evident" (Yin, 2013, p. 23). A case study is used mainly to answer the 'how' and 'why' questions and this is the reason for my choice. Case studies open possibilities of giving a voice to the powerless and voiceless. Using a case study therefore helped me to have an even deeper understanding of the dynamics of the situation.

I specifically used exploratory and multiple-case studies. Exploratory case study can be used in exploring situations where interventions being evaluated have no clear outcomes. I anticipated that when conducting this study, the participants might at the end provide different strategies used during their teaching. I selected 2 participants from 2 different schools. By coincidence, both my participants were females and this was not a purposeful choice though, but the location of the two schools was convenient for me. Multiple-case study was also a suitable choice to this study since there was more than one case involved. Multiple-case study enabled me to explore differences within and between these cases. This was based on the fact that "because comparison will be drawn, it is imperative that I can predict similar results across cases, or predict contrasting results based on a theory" (Baxter & Jack, 2008, p. 548).

#### 3.6.1 RESEARCH METHOD

It is characteristic of qualitative research that data are collected verbally or in visual form rather than numeric form. The main method of collecting data in this study was through lesson observations, individual and group interviews. I was a non-participant in each

classroom, observing the teachers teaching the entire section on shape, space, and measurement. When a researcher employs the participant observation method, this is a distinctive method since I approaches participants in their environment. This enabled me to be familiar with the cultural milieu that would prove invaluable throughout the research process. The duration of these observations was equal to the number of lessons taken by the teacher to complete the section, so that an attempt could be made to identify the strategy/strategies used in teaching the concept. The lessons were video and audio recorded so that they could be analysed at I's own convenience. Since this is a qualitative research project, I made use of non-structured observation using audio-visual recording. This enhanced the capacity for a complete analysis and comprehensive material, whilst the dependence on prior interpretations was reduced. By video recording I was also able to do several playbacks to scrutinise data more fully. While video recording, I also took notes that would assist in formulation of specific questions for the interviews. Both participants were informed before the commencement of the whole observation session.

The table below outlines a detailed description of my data collection process:-

| Date | Instrument | Participant | Period(Time) |
|---|---|---|---|
| 10 June | Observation 1 | Va | 8:50-9:40 |
| 10 June | Observation 1 | Minky | 12:00-12:50 |
| 11 June | Observation 2 | Va | 10:30-11:20 |
| 11 June | Observation 2 | Minky | 12:00-12:50 |
| 12 June | Observation 3 | Minky | 7:50-8:40 |
| 12 June | Observation 3 | Va | 10:40-11:30 |
| 17 June | Observation 4 | Minky | 8:40-9:30 |
| 17 June | Observation 4 | Va | 10:40-11:30 |
| 18 June | Observation 5 | Minky | 8:40-9:30 |
| 18 June | Observation 5 | Va | 11:20-12:10 |
| 19 June | Observation 6 | Minky | 7:50-8:40 |
| 22 June | Observation 6 | Va | 10:40-11:30 |
| 11 July | Individual interview | Va | 14:00-14:45 |
| 18 July | Individual interview | Minky | 18:00-18:30 |
| 24 July | Group interview | Minky & Va | 15:00-15:45 |

While observing, I also took into consideration three applicable characteristics of an effective teacher as set out by Stronge (2010), that is, classroom management; implementing instructions and professionalism. Observations also afforded me an opportunity to see how each participant engaged the learners in this concept, due to its practical nature. After completion of the observation sessions, I summarised what had been observed during each lesson and each participant was later given a hard copy of the observed lessons in order to read on what transpired during each lesson. The interpretation of lessons was shared with the teachers to enhance trustworthiness of the data.

After analysing and interpreting the observed lessons, individual interviews were set up with each teacher at a time and place that was convenient to both the participant and I. An interview schedule was designed such that approximately 45 to 60 minutes was spent. Interviews were appropriate for this study in that they allowed each participant to give their perceptions, insights, and opinions. An interview is a conversation between the respondent and me, but is different from everyday conversation. In an interview, I sets the agenda and asks questions. I aims at getting specific information from the respondent. In interpretivist research, the interview allows me to ask probing questions and also to clarify them to the participant. Gay, Mills, and Airasian (2011) and also Creswell (2013) are in support of these research methods when used in qualitative research. Interviews allow one to gain in-depth data from a small number of people. Interviews yield a higher response rate and are adaptable enough to any context. These ideas are supported by (Creswell, 2012, pp. 218-219).

I made use of semi-structured interviews even though these have their advantages and disadvantages. They allowed I to formulate questions around particular areas of interest but still retained considerable flexibility and depth. As an advantage, interviews allow me to clarify questions. It is easier for the respondent to talk than to write. Since this was a follow up to the observations, the questions focused on what was observed in the lessons. The individual interviews were then followed by group interviews between the two participants and me to further corroborate the data obtained in the observation and individual interviews, as well as to enable a comparative analysis of the data. More detailed and descriptive data

was tape recorded. As a disadvantage, interviews may result in participants being reluctant to speak honestly. Interviews can also be influenced by power relations. Creswell (2012) also maintains that an interview is a social personal encounter.

### 3.7 STRUCTURING OF INTERVIEWS

Before the commencement of each individual interview, the participants and researcher viewed all video-recorded lessons and during this session, there were informal questions asked pertaining to all actions that were captured while each lesson was in progress, including what the participants might not have been aware of. The viewing session was later followed by a hard copy comprising questions for the interview. Each participant was given an opportunity to go through the questions then indicate when ready for the interview.

All questions were decided upon by me. I had an intention to use similar questions during interviews, but based on the fact that the participants gave different responses, there had to be variation. This variation was as a result of some areas of interest that transpired and I needed to discover more on such issues. Both participants allowed me to conduct individual interviews over a chosen weekend and the group interview was conducted on a Friday afternoon at a venue convenient to both participants, since I had noted from them that they break earlier than usual. The following are examples of some questions used during each interview:

#### 3.7.1 INDIVIDUAL INTERVIEW QUESTIONS (sample)

- What strategy have you been using in teaching this concept of shape, space, and measurement?

- Do you always make use of this strategy when you teach this concept? If yes/no, why have you specifically chosen this strategy?

- Do you think that the strategy enabled you to achieve the aims/objectives of your lessons? If yes/no, can you briefly explain why you make that conclusion?

### 3.7.2 GROUP INTERVIEW QUESTIONS (sample)

- The topic that I have observed both of you presenting requires more practical activities for learners. Why is it that you do most of the practical work as a teacher and learners do less?

- Most of your learners do not have calculators and yet Mathematical literacy requires that each learner uses his/her own calculator to improve calculator skills, and also to enable you as teachers, to easily identify learners experiencing problems. Does this not impact on learner performance during assessment?

- Every year each school is allocated a certain amount of fees for Learner Support Material. Do you as a Mathematical literacy teacher get an opportunity to requisite enough material that will be of help to you in your subject or the management do the requisition?

### 3.8 DATA ANALYSIS

Each observation session for all participants was video- recorded audio- recorded and memoired so as to have all necessary information to use in data analysis. At the end of observation for each participant, all gathered information was transcribed and a hard copy given to each participant. This is when an opportunity was afforded to make changes, where the participant felt he/she needed changing. Information that was generated from interview transcripts was organised into categories and themes. This was done through coding so as to compress information to enable interpretations of findings.

Thematic analysis was used in order to enable me to draw interpretations and be consistent with data collected (Boyatzis,1998). Thematic analysis also enabled me to link various concepts, opinions and interpretations that might have emerge in data analysis. This was done to ensure that the data could be treated so as to build a body of knowledge.

### 3.9 TRUSTWORTHINESS AND AUTHENTICITY OF THE STUDY

Guba and Lincoln (1994) assert that trustworthiness is the act of acknowledging how researchers establish confidence in the research findings. Trustworthiness also explains practices used throughout the research process in ensuring internal and external validity, reliability and subjectivity of the study and subsequent findings. Maxwell (2012) maintains that validity, refers to qualitative research which is plausible, credible, trustworthy and therefore, defensible. In order for me to ensure trustworthiness in this study, all findings will be properly outlined.

In order to increase credibility, I needed to spend enough time observing the participants while teaching the concept, to identify the strategies employed in each and every lesson. Guba and Lincoln (1994) refer to such acts as prolonged engagement. The method of data collection also helped in strengthening trustworthiness and credibility to this study. Prolonged engagement allowed me more time to identify these strategies.

### 3.10 ETHICAL ISSUES

McMillan and Schumacher (2014) express the idea that ethics are about peoples' beliefs of what is wrong or right. Wassenaar and Mamotte (2012) maintain that in research, people are involved and that is the reason why I observed principles of respect for dignity of persons, non-maleficence, and justice. Informed consent was sought from the participants who agreed to participate in the study. Cohen, Manion, and Morrison (2011) claim that an informed consent is a procedure whereby individuals choose whether or not to participate in the research process after being made aware of the facts that might influence the decisions they make.

I considered ethical issues when conducting this research. A letter to request permission for conducting research in schools was sent to the Head of the Education Department (H.O.D.) in KwaZulu Natal Province and permission was then granted (see attached Appendix). I also obtained permission letters from the gatekeepers (the principals) of the two schools. After discussing the whole process with the participants, they also signed consent letters. All these

documents were submitted to the Ethical clearance office at the University of KwaZulu-Natal to do research was then granted by the ETHICS clearance office.

I ensured that the rights, sensitivity, and interests of all the participants were protected as stated by Mouton (2001) and this was solely based on common trust. Participants were informed that the information obtained would be kept confidential. Tape recordings and data were kept under lock and key in my supervisor's cabinet, to be later destroyed after completion of the research study. In all transcripts, the names of participants and their schools have not been used to ensure that their identity remains protected. Only different codes to identify the schools and participants were during transcription.

### 3.11 LIMITATIONS OF THE STUDY

These include subjectivity and generalisability of the research. I also ensured that objectivity was kept in check when observing and interviewing participants. I took note of the fact that findings could not be generalised to a larger population of teachers since this study concentrated on particular individuals. The fact that qualitative research involves a small number of participants might invalidate the findings of the study. Academics, practitioners and policy makers might not regard the findings seriously. This depicts a weakness of this kind of research but which, on the other hand, has been an advantage for me.

The employment of the observation strategy in this study gave me an advantage of checking whether there were any errors that the teacher made from the teaching strategy/ strategies, and might have an impact on learners' understanding of the concept. In Chapter 2, I presented literature which revealed that the type of strategy used while teaching a concept, may impact on learner understanding. Another advantage of doing observation is that it was not easy for each participant to give false responses since I observed each one of them present lessons in class. Viewing of lessons in my own space and transcribing them into hard copies afforded me an advantage of constructing questions that would lead the answering of the said research questions.

The sample was restricted to only two schools in one district. A greater sample could have been used to provide more generalisability to the results of this research. However, time constraints as a part time student were binding me to use a small sample.

**3.12 CONCLUSION**

In this chapter, a case study has been identified as the research design and I have explained how the qualitative method was used to collect data. I also focused on some ethical issues that pertain mainly to this study. In the next chapter I will present and discuss the findings of this study.

# CHAPTER 4

## DATA ANALYSIS

### 4.1 INTRODUCTION

In Chapter 3, I described the techniques that I used in gathering information that specifically answers the research questions. The questions of the research and related objectives are developed and described in Chapter 1. As described in Chapter 3, the two schools will be referred to as School A and School B respectively and I will use pseudonyms when referring to participants, that is, Va for School A, and Minky for School B. School A was situated in a rural area and school B in a peri-urban area. There is mainly a single category of respondents which is teachers. Interview questions given to teachers were of the same content but what makes them different is the nature of each school. Description and analysis of the collected raw data as it appears in the responses to the items in the instruments is displayed in this chapter. Reliability and validity of the responses of the participants are later checked in the chapter.

As indicated earlier on in Chapter 3, Section 3.4, a thematic analysis applied by Artzt (2008) will form the framework in presenting the analysis in this chapter. Even though Artzt et. al describe teacher's teaching strategies using three observable aspects namely tasks, discourses and learning environment, I will borrow from their ideas describing the themes that emerged from my observations as follows:-

- Teaching strategies
- Effectiveness of the teaching strategies

Sub-themes

- Resources
- Learning/classroom environment

Creswell (2003) asserts that thematic analysis enables one to identify factors and variables that influence any issue generated by the participants. Thematic analysis is also appropriate

since I needed to understand the current practices (strategies used by teachers in the concept under study) and whether or not these have an impact on learner understanding. Creswell (2009) further maintains that the use of thematic analysis also enables one to compare and contrast the dataset**.** My data analysis is based on my main research questions as presented in Chapter 1:-

## 4.2. RESEARCH QUESTIONS

(i) What teaching strategies are used by Mathematical literacy teachers in teaching space, shape, and measurement in Grade 11?

(ii) Why do Mathematical literacy teachers use these teaching strategies when teaching space, shape, and measurement in Grade 11?

## 4.3 DATA COLLECTED DURING OBSERVATIONS

These will be discussed by presenting what each participant did in all observed lessons.

### 4.3.1 TEACHING STRATEGIES-DIRECT INSTRUCTION vs COOPERATIVE APPROACH

| Lessons | Strategy used by participant |
|---|---|
| 1 | -Va used direct instruction and was in front of the class for the entire period, writing and explaining on the board. This lesson was entirely teacher- centred. The last five minutes was spent on copying of homework from the board by learners.<br>-Minky used cooperative approach and learners were already organised into groups. Introduction of the concept was practical and learners were active participants representing their groups. Learners were given a task to bring items from home so as to use in lesson 2 to apply knowledge gained in lesson 1. This lesson displayed learner-centredness. |

| | |
|---|---|
| 2 | -Va marked homework given the previous day but only a few learners had done the task. This was still reflecting teacher- centredness as in previous lesson. No form of punishment was given to the culprits though. Handouts were issued for use in groups that were setup in class according to learner preference. Each group consisted of four members. Work was done with the guidance of the teacher. Partially some form of cooperative approach could be observed here.<br>-Minky's learners brought shapes as per teacher's instruction and the knowledge gained on the previous day had to be applied, and that was measuring and calculating area and volume of the containers. Learner-centredness continued taking place in this lesson as in the previous one. |
| 3 | -Va used direct instruction and no handouts were given on this particular day. She wrote all example activities to be done in class on the chalkboard. Teacher-centredness could still be observed on this day.<br>-Minky brought two bathroom scales and two measuring tapes for this day's lesson. Three learners from each group of six had to weigh themselves while one recorded. Same learners' heights also had to be recorded using either the teacher's measuring tape when available or apply their skill of using a ruler. Handouts for each learner were given at the end of this practical lesson. Learner-centredness continued to take priority in this lesson. |
| 4 | -Va used a combination of direct instruction and cooperative approach. She first demonstrated through examples on the board and thereafter, learners had to do the rest of the activities in their respective groups.<br>-Minky first checked whether all learners had done homework which was then marked with the learners. It was observed that learners were kept active in most lessons even in homework marking. Answers were written on the board |

| | |
|---|---|
| | by volunteers. Handouts were thereafter issued for each learner though learners had to work in pairs doing the activity. She moved around ensuring that the task was done and whilst doing that, for the group that had done part of the task, marking was done. |
| 5 | -Va gave prepared worksheets to each learner in their respective groups. The activity was in preparation for the formal assessment that was to take place the next day. I could observe that the task took longer than anticipated since only a few learners were in possession of calculators.<br>-Minky first marked homework together with the learners and they had to do a 20 minute activity in preparation for formal assessment. Most learners finished on time and I could observe that this was due to the fact that each learner was in possession of a calculator. |
| 6 | This was formal assessment day.<br>-Va had prepared question papers for each learner. She had to move around explaining to most learners who were experiencing difficulties in understanding some of the questions. I could observe that this was due to language barrier, but the teacher continued to use the Language of Learning and Teaching when giving clarity. Not all learners had calculators on this day too and borrowing still took place.<br>-Minky's learners came earlier on this particular day for assessment before normal school periods. The entire session took one hour and 30 minutes. The last 30 minutes was part of the first period. |

In all lessons conducted by Va, there was a predominance of teacher-centred teaching. This is evidenced by the fact that in the first lesson there was no interaction with the learners. In the second lesson, she distributed handouts with some activities on it, showing some free communication between teacher and learners. However, in the third lesson, it went back to

direct instruction since no handouts or textbooks were given or used. The entire lesson was about learners copying from the board. In the fifth lesson, learners were mostly involved due to the fact that this was a preparation towards formal assessment. As stated in Chapter 2, this strategy used by Va is in line with the ideas of Clarke et.al (2003) who assert that the strategies used by a teacher impact on the conceptions of students.

Minky entirely aroused learner interest in all her lessons, and they (learners) were continually being involved in the entire learning process. Tasks and activities given on a daily basis ensured that learners understood the concept of measurement as applied in various scenarios. Homework and handouts given were also for reinforcement of the concept learned. The strategies used by Minky are highlighted by Pogrow (1988), as discussed in Chapter 2 who maintains that challenging tasks are important for all students. Minky had her groups mixed, thereby protecting the self-image of the under achieving learners.

### 4.3.2 EFFECTIVENESS OF THE TEACHING STRATEGIES

#### 4.3.2.1 VA'S TEACHING STRATEGIES

In most of her lessons, Va used more of traditional teaching strategy, which is direct instruction. The strategy mostly worked for her since it was more teacher-centred than learner-centred. She displayed knowledge of the subject but there was no evidence of learners showing how much knowledge was gained on the concept under discussion. No practical work was done, only on a few occasions when she gave class activities Homework was also not given on a regular basis. Due to the fact that Va used direct instruction, I would want to believe that learners missed out on some information since it was only verbal and less practical. Va's usage of the traditional teaching strategy is in line with what is maintained by Joyce et al. (2000), as discussed in Chapter 2, that this strategy is more effective when one teaches basic and fundamental skills across all content areas. Va continuously used traditional teaching strategy even after teaching the basic and fundamental content.

#### 4.3.2.2 MINKY'S TEACHING STRATEGIES

As displayed on the table above, Minky involved her learners from her very first lesson and learner involvement occurred in all lessons. She used a non-traditional way of teaching by

grouping learners, then monitored their involvement by visiting groups each time an activity was in progress. As much as she displayed knowledge of her subject and the concept, learners also had an opportunity to show how much they understood. This could be observed when an opportunity for each group's chosen member was afforded, so they could show how they tackled a particular given problem on the board. Minky's use of cooperative strategy ensured that learners gained a lot of information while doing practical work in their groups and the teacher visiting each group for assistance where necessary. Brown and Cluffetelli (2007), as explained in Chapter 2, maintain that cooperative learning fosters learners' academic and social growth as they work with and learn from their peers. This is exactly what Minky practised in her class.

**4.3.2.3 RESOURCES**

Va seemed to lack resources from within the school, to enable her to involve learners through activities. There were no books used by learners and only on a few occasions did she bring handouts for activities to be done by her learners. She mostly used the chalkboard to write class activities or sometimes homework. There was no modern technology like computer or data projector used to assist learner involvement. Much of her time was spent writing on the board. Very few of her learners had calculators, even though the subject requires that each learner is in possession of one. This also caused delays when there were class activities and mostly answers were given by those learners with calculators. Learners thus did not have time to practice calculation skills involved in this concept. Lack of resources led Va to use the traditional teaching strategy and this kind of teaching is called a "mindless mimicry" (Kirschner, Sweller, and Clark (2006). The paradigm shift now requires that as teachers, we should now move away from teacher-centred to learner-centred methods of teaching. This strategy used by Va is also criticised by Davis et al. (2008) who noted that a decontextualized environment results in limited ability to remember ideas and knowledge, Chapter 2.

Minky displayed that the school has adequate facilities since handouts with class activities and homework were brought on a daily basis. Instruments like bathroom scales and measuring tape were brought to class to assist learners during lessons. Even though no textbooks were used in my presence, the prepared handouts ensured that learners were

continually being involved during lessons. All learners were in possession of calculators and that ensured that each learner practised the skill of using the gadget all the time. There was also no modern technology used but this did not impact negatively on learner progress. Minky's strategy was also in line with the kind of learning that Pedaste and Sarapuu (2006) refer to as inquiry-based learning, since her learners were hands on all the time.

#### 4.3.2.4 LEARNING/CLASSROOM ENVIRONMENT

Va seemed to have a problem with the environment. Neighbouring classes were always noisy throughout my observation period since most of the time they were not occupied. They would walk on corridors talking at the top of their voices even though lessons were in progress. This posed some challenges in the audibility of the voice recorder used. Learners seemed to be used to this kind of an environment even though Va was soft spoken. There were also some learners who would come to class long after the commencement of the period but Va and the other learners already in class seemed used to this kind of behaviour and there were no disciplinary measures taken by Va. In general, learners were well behaved and took teacher instruction all the time. Va's method of teaching was a give and take since she mostly used a textbook and was the only one in possession of a textbook. This is exactly what is highlighted by Christie (2005) in Chapter 2 that in traditional teaching, there is a strict adherence to fixed curriculum, textbooks and workbooks, where teacher gives and learners receive.

Minky's environment was conducive to learning. Learning in the whole school took place and learners were always attentive in class and actively participated in their respective groups. Discipline when necessary was applied, particularly learners who would be late for the lesson. Learners took instructions all the time and a good working spirit was also displayed by learners themselves. All learners were well behaved and the immediate responses given from each group displayed that the learners enjoyed and understood the concept well. On assessment day, learners came on time even if it was long before commencement of normal teaching periods and this was also a symbol of love for the subject and teacher having control of her class. In each of her lessons, Minky maintained a positive rapport with learners and would always comment positively in all attempts they made. She was more of a facilitator as she let them to work independently in groups. As maintained by

Dickey (2005), the pattern of classroom instruction should be non-routine/non-traditional. This could also be observed in Minky's class.

## 4.4 DATA COLLECTED DURING INTERVIEWS

### 4.4.1 INDIVIDUAL INTERVIEW SESSIONS-TEACHING STRATEGY USED

Va maintained that she was using direct instruction in her lessons since in Grade 10 she used discussion method. Her reason for using direct instruction was that the method worked well for her learners based on the fact that the learners had done practical work in Grade 10. When asking Va what strategy she was using, she said:

> *I was using instruction method which is a traditional strategy.*

When asked whether this strategy is always used when teaching this concept of measurement, she replied:

> *Yes in grade 11 I use this method. It is so because in grade 10 I used the discussion method. I grouped them in pairs because I was introducing the topic, then in grade 11 it is a continuation of the topic from grade 10. So in grade 11, I just remind those ways of calculating, so I deal with calculations.*

For slow learners to be on par with the rest of the class, she also claimed that she attended to them in their small groups so that they would not feel embarrassed in class.

> *For those who struggle, I normally go over the same activities, explain them in simpler terms, so it does help me in that way though I know that partly those who struggle might be at a disadvantage. I give them extra time and that is why I explain terms in simpler language.*

Minky maintained that she was using a combination of strategies, that is, Question and answer, as well as the group strategy. This she would do since she believes that her learners are not empty vessels and should display the knowledge they already have.

> *I was using question and answer strategy, involving learners, sometimes group strategy. I involve learners since I believe that they are not empty vessels. I wanted to find out what they know and then develop my lesson from there.*

### 4.4.2 EFFECTIVENESS OF THE TEACHING STRATEGY USED

Va maintained that her teaching strategy was effective in teaching the concept of measurement and she was able to achieve the goals at the end. When Va was asked as to whether the strategy used was suitable for learners with varying cognitive abilities, she said:

> *The answer is NO. I have to mix strategies or use different strategies in order to accommodate these varying cognitive abilities when the learners start doing activities. I visit all groups sometimes they are in pairs and I give more explanations and allow them to ask questions.*

When Va was asked whether she saw her strategy as appropriate for her to achieve her aims and objectives she responded:

> *I used this strategy because it enabled me to achieve the aims, may be is because the practical part was done in grade 10.*

Minky believed that these strategies are the best for her learners since she can see at the end that her objectives are being achieved. Minky also maintained that the strategies only work partially for her slow learners since they do not want to participate fully. When Minky was asked whether her aims and objectives were achieved, she replied:

> *Yes, this strategy enabled me to achieve my objectives because I could see that my learners could differentiate between the terms easily. They could see as we were working with concrete objects, measuring length and prisms. They could differentiate between diameter and radius easily since they were hands on. It also helps me if the learners are hands on, for them to grasp the concept easily.*

Minky almost had the same feeling as Va on the use appropriateness of her strategies for learners with varying cognitive abilities and she said:

> *I can say both yes and no because some of the slow learners do not want to participate fully in group activities but at the same time they do get help from their fellow group members to work on that particular activity.*

When asked how she instilled love for the subject, Minky maintained that it was through fully involving the learners during lessons which I also observed.

**4.4.3 RESOURCES**

Va explained that the absence of resources like calculators and textbooks was due to theft and also less support given to her by the school management.

> *I have to make copies or write on the board since there are very few books bought by the school at the moment and learners are not prepared to buy their own books. We as a school sometimes are without ink or paper or the photocopier has a problem. Learners bring calculators only when they will be writing a test because they say these will be stolen by fellow school mates if brought on a daily basis.*

She also maintained that there was a negative attitude by the management on the subject in general.

> *Unfortunately in my institution, ML is looked down upon by fellow colleagues. This has resulted in learners themselves having low self-esteem due to negative comments from mathematics learners.*

Va was asked whether she had any future plans on improving the situation and learner performance in the subject, and her reply was:

> *Well if we can have enough books and motivate the learners to bring calculators, the situation would be much better. We are still trying to have books and let the principal see the need for increasing the number of books ordered, I will then have to ensure that I manage the books properly.*

When Minky was asked how she achieved her objectives, she pointed that all her learners had calculators and they display good calculating skills. She maintained that the management gave her support in ensuring that at the beginning of the year, learners buy themselves calculators as required in the subject. She would then conduct lessons on the use of the calculator as from grade 10.

> *Whenever I get in class at the beginning of the year, I tell my learners that if they want to excel in ML, they should buy calculators. I then insist that they should bring their calculators on a daily basis. I always conduct lessons on calculator skills so that they use them with ease.*

### 4.4.4 LEARNING/CLASSROOM ENVIRONMENT

Va pointed that the reason why she was always faced with a problem of noisy neighbouring classes was because some teachers were not in class during their teaching periods as they were supposed to, since some management members had left the department and the principal was unable to move around all the time to see to it that learners are regularly attended to, due to the huge size of the school. There are many buildings at the school and the principal also has some administrative duties to attend to.

> *I do not have a choice at the moment. I have to teach my learners to be able to work under various circumstances; otherwise I will not finish my work. We just close the door and learn.*

Minky's class was always conducive for learning and she claimed that this was due to a well set tone of the school from the top management; as a result, learners in the whole school are always occupied.

> *Involvement of learners in activities makes them disciplined and participate fully, and it arouses more interest particularly when they do measurements themselves using different measuring instruments.*

### 4.4.5 GROUP INTERVIEW SESSION-TEACHING STRATEGIES

Both participants maintained that they were using a combination of strategies while teaching the concept of shape, space, and measurement. The fact that we are now implementing CAPS has not made them change their strategies. Minky said:

> *There are no changes in strategies used. CAPS is still similar to the curriculum we were using before.*

Va added*:*

> *Not exactly. I used strategies like the discussion method; in fact I can say I have added some strategies on top of those used previously.*

Minky also said:

*As my colleague has said, we are improving year by year for the learners to adapt; and to clarify terms for learners. In my own understanding, I think if the learners are doing and seeing some of the instruments, it becomes easier to understand. The terms used are broader and practical work enables them to have a better understanding. This is the reason why I involve them in all activities.*

### 4.4.6 EFFECTIVENESS OF THE TEACHING STRATEGIES

Va said that sometimes the strategies used are not always effective. Some learners experience challenges in understanding the concept:

*Some learners experience difficulties where they have to do conversion though this depends on the type of activity given to them.*

Minky also had more or less the same feeling on the effectiveness of the strategy:

*Learners sometimes have a challenge on the use of measuring instruments and in understanding some concepts like BMI (Body Mass Index). They forget to use some of the characters on calculator to get the correct answer.*

## 4.5 CONCLUSION

In this chapter, I presented and analysed the data that was collected in Umlazi District during the second school term of 2015. I used the information from both participants whom I observed while teaching and assessing the same topic which is within my research area. I then discussed what transpired from all observations and interviews done. I used a deductive approach of which two main themes and two sub-themes were identified. The main themes were: teaching strategies and effectiveness of the teaching strategies. These were mainly based on conceptual framework as adapted from Artzt et al. (2008); Franke et al. (2007); and Hill et al. (2008), and I have presented raw data from the participants without being judgemental of what had transpired. I will then present my findings, conclusion, limitations, and significance of the study in Chapter 5.

# CHAPTER 5

## FINDINGS, DISCUSSIONS AND RECOMMENDATIONS

### 5.1 INTRODUCTION

The previous chapter presented the results of the study. The results were also analysed based on the strategies and their effectiveness. In this chapter, I will be presenting my interpretation of the teaching strategies used by the teachers that were under observation, based on my own beliefs as well as the experiences gained throughout the period of my teaching ML; and also a summary of the four previous chapters. I will then present conclusion, recommendations, and limitations of the study, together with potential contributions of the research. The chapter also highlights which areas I thinks need priority by the Department of Education which among other things are provision of the resources for schools and intensive educator training for curriculum implementation.

The purpose of this study was to explore strategies used by Grade 11 Mathematical literacy (ML) teachers when teaching space, shape and measurement. The sample for the study comprised 2 Mathematical literacy Grade 11 teachers, one from rural and the other from peri-urban schools in Umlazi district. This qualitative investigation was conducted in two schools in Kwa-Zulu Natal with the aim of finding out which strategies are used by grade 11 teachers in the chosen topic. Data were collected through several lesson observations and interviews. The discussion of findings, recommendations and conclusion of this research are based on the research questions:

(a) What teaching strategies are used by Mathematical literacy teachers in teaching space, shape and measurement in grade 11?

(b) Why do Mathematical literacy teachers use these strategies when teaching space, shape, and measurement in grade 11?

The objectives of the research were:

(a) To identify teaching strategies used by mathematical literacy teachers in teaching space, shape and measurement in grade 11.

(b) To understand the reasons why Mathematical literacy teachers used these strategies when teaching space, shape and measurement in grade 11.

In Chapter 1, I introduced what the research study entails, that is its purpose. The study focused on the exploration of teaching strategies used by ML teachers when teaching space, shape and measurement in grade 11.The different meanings for ML internationally and nationally have also been outlined. I have also given the research questions guiding this study, together with the objectives of the study. In Chapter 2, I reviewed literature related to the study. Chapter 3 had its focus on methodology and explained how the study was conducted including the number of participants involved and the period during which the study was conducted. In chapter 4, data analysis is presented, stating exactly what happened during observation in class and also what transpired from individual and group interviews. I presented the data using thematic analysis and tabulation method showing what each participant did in class. I further presented what transpired from the interviews by quoting the actual words from each participant. This chapter therefore presents the findings of the study, focusing on the teaching strategies used by each participant as maintained by each one of them and also as interpreted by I.

## 5.2 RESEARCH FINDINGS

Any teacher teaching space, shape and measurement in grade 11 should always be as practical as possible since this is where learners have to display the background knowledge obtained during introduction of the topic in grade 10. Learners have to show their measuring skills using instruments like a ruler and or showing how creative they can be by improvising with certain objects if not in possession of a ruler. This section of work is wide and needs to be taught with extra care since there are a number of sub-sections that link. The teacher should let the learners discover most of the things all by themselves due to the practical nature of the topic. The topic is introduced in grade 10. Most of the learners in grade 11 are

expected to display that they have prior knowledge. The findings of this study revealed that at times teachers would choose to use a particular strategy based on the classroom situation and or availability of resources for that particular subject, or resources in the school as a whole. There is a list of resources or materials that Mathematical literacy teachers should utilise as per recommendation by the DoE. These include textbooks, calculators, and whiteboards.

Besides these recommended basic resources, the topic on which this study focuses is mainly practical. It is not the DoE that provides schools with the materials for practicals. Each individual teacher needs to be creative and also involve the learners through guidance in bringing some materials that would help them in understanding calculations involved, looking at the various shapes. Cresswell (2005) maintains that since the curricula have been revised, there is also a paradigm shift which now requires one to depart from traditional teaching strategies that are primarily teacher-centred, and engage the learner-centred strategies.

Va only had her own textbook whilst all learners had none. There were no tangible objects brought to class either by learners or her. She only relied on examples extracted from her textbook and would draw some of the shapes that she managed to draw. She had to write most of the activities on the board, which was time consuming. Very few learners also had calculators and this also delayed progress in all lessons since learners had to borrow one from another. This also meant that most of them could not practice calculations in class. Va explained that there were very few textbooks provided by the school yet the percentage of learners doing Mathematical literacy was higher than that of mathematics learners. Va stated that the textbooks available for learners had to be shared by three or four learners and this posed problems when one learner had lost a copy and the group of learners sharing had to take responsibility and buy a new one. She also stated that most learners did not buy or bring calculators due to theft by fellow classmates. Va's lessons were mostly theoretically presented in this practical concept. She used examples which she copied on the board from her textbook, or would occasionally bring handouts, still photocopied from the book, for learners to work on in their small groups. When interviewed, Va also claimed that she was using a variety of strategies in all her lessons, which was not the case during my observations. Most of her lessons were teacher-centred. There was not a single instance where she would

come to class and arouse interest in learners through exciting educational activities in class. Vaiyavut and Clements (2006) assert that traditional teaching by elicitation or expository mode separates concepts, ideas, and skills and also does not pay attention to connections between concepts. Absence of suitable resources could have resulted in Va adopting the traditional teaching strategy.

Minky also had her own textbook and whilst learners had none, she always prepared handouts for all class activities. This fulfilled the Department of Education recommendation of resources for helping learners, which Minky's school provided. All of Minky's learners were in possession of calculators and this led to a smooth running of all lessons. Minky always ensured that she organised learners to bring shapes for discussion prior to commencement of each lesson. Minky also brought additional shapes just in case a group did not have enough. This organised way in which Minky's lessons were structured maintained order in class and continued learner participation could be observed.

**5.3 TEACHING STRATEGIES**

Only Minky based her lessons on real-life problems. This could be observed from all activities given to her learners. All activities were practical and learners had to measure various- shaped objects, some of which were written what their sizes and capacity was and learners had to prove that using formulae. During the interview session, Minky maintained that she was using a question and answer teaching strategy. This clearly shows that she was not certain of the teaching strategies that she was using. Minky actually taught in a modernised way, through grouping learners and facilitating the activities. A cooperative teaching strategy was being used but the teacher was not aware of the strategy. All her lessons were learner – centred and Minky was there to guide her learners. I could also observe from the participation of learners that the foundation of the concept was laid in grade 10. Minky also maintained that she always considered the fact that the learners are not empty vessels and the way in which she conducted her lessons were a living proof to that.

Va's activities were only those photocopied from different teacher's textbook and so they were all theoretical but in a practical concept. Although Va maintained that she was using a combination of strategies during the interviews, in my observation, the most prominent

strategy that she used was the traditional teaching strategy, whereby the teacher gives information and the learners are recipients. No objects/shapes for practical work were brought to class either by the teacher or the learners. The activities done in class were all based on what Va had taught in class and the learners then had to practice calculations based on that information. All shapes involved in the topic were only on the photocopied activities and nothing tangible was ever brought to class.

**5.4 EFFECTIVENESS OF THE TEACHING STRATEGIES**

For both participants, learners seemed used to their teachers' teaching style and were comfortable. The case study revealed that practical work in this topic yields positive results in that since learners are hands on, they also have a chance of communicating among themselves using their mother tongue in cases where they need clarity. If there is no practical work done, where learners are able to identify the various shapes and can do measurements in differently shaped objects, all by themselves, the concept becomes boring and learners are unable to identify its value in their daily lives, which is the main aim of ML. Va's lessons were mostly teacher-centred and less productive. There was minimal learner participation throughout her lessons. Minky's lessons were mostly learner-centred. She allowed learners to explore and that enabled them to easily do calculations using formulae. Mathematical literacy teaching is different from mathematics teaching since examples always relate to context. This is further maintained by Brombacher (2006) that "the FET curriculum is designed in such a way that Mathematics and Mathematical literacy are different 'in kind and purpose' and thus Mathematical literacy is not subsumed in Mathematics." Va had a tendency of telling the learners and could not give them an opportunity to discover or ask questions. Minky's lessons always had content related to context thus enabling learners to apply in their daily lives. Her lessons were always built on learners' prior knowledge and this proved what transpired during interviews that she always take into consideration that learners are not empty vessels. Minky also promoted learner-learner interaction as stated by the DoE (2003a) that learners need to develop the ability to communicate mathematically and teachers should create such opportunities. During the group interview session, Va described the topic as of great value to the lives of learners even though during my observation, no practical work was being conducted to instil such value. Comparing this to what happened in Minky's class, it was clear that the value and importance of the topic was instilled from the onset of my observation right till the end since various objects with different shapes were measured in

class such that learners could even easily identify the various formulae for the different objects due to this continued practice.

**5.5 SUMMARY**

I can summarise relating to the research question, "What are the teaching strategies used by grade 11 ML teachers in teaching shape, space and measurement" that teachers use both direct instruction and cooperative teaching strategies. Why these strategies are used could mainly be based on the fact that if the teacher uses direct instruction only, that could be as a result of lack of support from the management, hindering them from using a variety of strategies. Absence of resources as per Department of Education recommendation that help in promoting the practicality in the subject, particularly in some rural schools as in Va's case, also prevents some teachers from having productive lessons. The study also revealed that some teachers, as in Va's case, are sometimes faced with challenges that are beyond their control, particularly if the management is not functioning as a team. Where learners (as in Va's case) in some classes are unattended while other classes having lessons in progress depicts a picture of a malfunctioning management. During teaching periods, all learners should be in class and being attended to so that even if there are unlimited or no resources, the traditional teaching strategy used might have a positive impact in learner understanding a practical lesson conducted theoretically. Another reason as observed in Va's case is that being unqualified, particularly in a new subject like ML, could also yield to unproductive lessons. From what Va said during interview session, she is not qualified in ML but the subject was given to her based on the fact that she can teach mathematics even though the subjects are taught differently. According to Yasukawa and Johnston (2001), "Mathematical literacy is not the same thing as mathematics, which provides learners with decontextualised mathematical skills. Numeracy is no less than or even part of mathematics" (Yasukawa & Johnston, 2001, p. 280). Msibi and Mchunu (2013) further assert that "this new curriculum requires that teachers change the way they teach and learn new teaching methods" (Msibi & Mchunu, 2013, p. 23). Mji and Makgato (2006) also argue that "The poor standards have been exacerbated by a large number of under-qualified or unqualified teachers who teach in overcrowded classrooms" (Mji & Makgato, 2006, p. 252).

Teachers' knowledge strongly influences what they practice in class. The teaching strategies used by the participants according to my interpretation, are strongly influenced by the fact that one teacher (Minky) went through ML ACE program where she managed to attain knowledge on how to implement the various concepts contained in the subject while the other teacher (Va) clearly displayed that she had not been through any teacher development program on the subject. This can further make one conclude that she was assigned to teach Mathematical literacy only because it is a mandatory subject and not because of a strong conviction of the inherent value of the curriculum.

## 5.6 LIMITATIONS

When studying a limited number of cases in depth, that usually provides an understanding and description of people's personal experiences of the phenomena in a specific context, like for example, the context for this research in particular was local. This presents the reasons why the findings cannot be generalised. Qualitative studies therefore often have their limitations based on this limited number of participants involved. However, generalisation was not the aim of my study. The findings can also be based on the fact that a participant, knowing that he/she will be observed, might change the method of teaching so as to impress me and that would also influence the results of the research.

## 5.7 RECOMMENDATIONS

The transition from Nated 550, to the National Curriculum Statement to Curriculum Assessment Policy Statement, posed challenges to the culture of teaching and learning in many South African schools. Educators experience challenges like inadequate resources, financial constraints, and lack of training by the education department. These often impact not only on our education system, but also on the type of learners that will be produced and on the economic growth of the country. One cannot overemphasise the importance of the use of mathematics effectively or to be 'numerically independent' in this twenty-first century technologically driven world.

The Department of Education needs to ensure that there are continued programs in which teachers will advance their teaching strategies to use while presenting various Mathematical

literacy topics in class. This is even more important since Mathematical literacy is still a new subject and also that the curriculum has advanced further to CAPS while teachers were still trying to get used to the initial ML curriculum with its own needs. In such programs, it should also be taken into consideration that there are teachers who are not qualified to teach ML, but are teaching the subject. Training programmes need to prepare all ML teachers to help learners develop the ability of becoming future adults, self-managing persons, contributing workers and participating citizens as stated by the department of education documents (Education (2003a). These programmes should prepare prospective teachers of Mathematical literacy to teach the subject in such a way that it does not become the "watered-down" version of Mathematics that people in the mathematics education fear it might become (AMESA, 2003:1).

Another important aspect is that of teacher reflection, which still requires emphasis by the Department of Education through subject advisors. This aspect has been discovered to be an important and indispensable element in the learning process. As asserted by Jaworski and Gellert (2003), it is important that teachers should time and again analyse their own teaching practices. McDuffie (2004) poses an idea that prospective teachers should always consider how they make use of their pedagogical content knowledge in solving problems that are identified from the classroom. Teacher reflective strategies need to be developed by all teachers so that they can take ownership of their own practices. This will enable each teacher to easily identify any problem arising in class that may affect teaching. ML teachers also require an understanding of basic skills topics done in grade 9 mathematics so as to build up on Mathematical literacy grade 10-12 since these form the foundation.

## 5.9 POTENTIAL CONTRIBUTION OF THE RESEARCH

This research explored strategies used by grade 11 ML teachers teaching shape, space, and measurement. The choice of a particular strategy is dependent upon an individual teacher, the environment where he/she teaches, the type of learners taught and the resources made available to the teacher either by the school or DoE. However, factors like environment and availability of resources are beyond the teacher's control, but an experienced teacher will always have ways and means of improvising to ensure that each scheduled concept is successfully taught. This research may also provide the DoE or ML teachers with information

regarding the importance of practical work in teaching shape, space, and measurement. Some teachers that have encountered challenges based on why they cannot successfully teach the topic may acquire ideas from the findings of this study. The Department of Education can also realise the importance as to why subject advisors have to work closely with subject teachers, through regular meetings to re-skill them in this concept and other concepts posing challenges. This in turn might also help in increasing teacher morale. Having observed and interviewed the two teachers, there are some important issues that I think teachers should take into consideration, like choice of a suitable strategy before the concept is presented in class, choosing activities that would arouse learner interest and are context-based for learners to identify the value of ML in their lives and finally, maintenance of a proper learning environment.

## 5.8 CONCLUSION

Being a teacher for both mathematics for General Education and Training and Mathematical literacy Further Education and Training, I learnt from both research participants, how important it is for the teacher and also for learners to have attained proper pedagogic content knowledge in GET mathematics, which forms the basis of Mathematical literacy, since this knowledge assists learners during transition from GET mathematics to Mathematical literacy. During my observation in Va's class, learner participation made it evident that there was this gap in pedagogic content knowledge but, in Minky's class one could observe that a good foundation had been properly laid. Shulman (1986) asserts that part of pedagogic content knowledge is based on the fact that one needs to understand what makes the learning of a specific topic difficult or easy, since learners of differing ages and backgrounds bring conceptions and preconceptions in class. Teachers thus need to know which strategies are suitable and will be fruitful when teaching a particular concept since this will aid in reorganising learners' misconceptions. Bansilal, Webb, and James (2015) pose an idea that teachers need to design appropriate and relevant tasks to enhance learner understanding and participation in class. All such actions imply that a suitable strategy is necessary.

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**APPENDICES**

**APPENDIX 1: ETHICAL CLEARANCE LETTER**

**APPENDIX 2: H.O.D LETTER**

**APPENDIX 3: QHELANI PRINCIPAL'S PERMISSION LETTER**

Qhelani High School

P O Box

Umlazi

4066

14 April 2015

**Dear UKZN HSSRE Committee**

Mrs Gwendoline Phumzile Dlamini is a teacher at Nomavimbela High School. She will be conducting her Master's Thesis project on Mathematical literacy Teaching Strategies in Shape, Space, and Measurement.

I am aware that her project involves observing Mathematical literacy Teacher in a Grade 11 classroom setting. I understand that the study involves the collection of data from school records (i.e. samples of Lesson Plans). Such records will be provided to me in a de-identified manner, such that data cannot be traced to a particular participant.

I support these planned activities which involve normal classroom activities and curricular content.

Yours sincerely

*[Signature]*

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*[First & Last Name]*

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*[Designation]*

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**APPENDIX 4: SAMPLE OF LETTER TO THE PRINCIPAL OF THE SCHOOL**

P O Box 660

Umbongintwini

4120

10 March 2015

The Principal

Qhelani Secondary School

Umlazi

4031

Dear Sir

**RE: Request for permission to conduct research at Zuzumqhele Secondary School in Umlazi District.**

I, Mrs G. P. Dlamini (student no. 214 581 868), currently an Educator, kindly request permission to conduct research at the above school. As part of my professional development, I am presently enrolled for a Master in Education Degree at the University of KwaZulu-Natal (Edgewood campus). In order to successfully complete my studies I am required to compile a dissertation. I therefore humbly request you to grant me the permission to conduct research in your school.

The title of the project is **"An exploration of teaching strategies used by Grade 11 Mathematical literacy teachers in Umbumbulu Central Circuit of KwaZulu-Natal".** My study will focus on observing one of your Mathematical literacy teachers presenting a lesson on a specific topic.

Please note that this is not an evaluation of performance or competence of the teacher in your school and by no means is it a commission of inquiry. The identities of all who participate in this study will be protected in accordance with the code of ethics as stipulated by the University of KwaZulu-Natal. Pseudonyms will be used instead of real names in the reporting of data. I undertake to uphold the autonomy of all participants. Participation is voluntary; therefore, participants are free to withdraw from the research at any time without negative or undesirable consequences to themselves. Participants will be asked to complete a consent form. In the interest of the participants, feedback will be given to them during and at the end of the study. The observation will be video recorded and voice recorded. Data and all documents will be incinerated once the study has been completed and submitted. The school and participant will be contacted well in advance about the time of observation.

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

**My contact details:**

Cell: 071 246 3630/ 082 454 2288

Email: ncane.dlamini66@gmail.com.

**Supervisor's details:**

Dr. L.R. Maharajh,

Curriculum Studies, School of Education,

Edgewood College, University of KwaZulu-Natal

Tel: 0312602470

Cell: 0822022524

**HSSREC Research office details**

Ms P. Ximba

Tel: 031 260 1870

Email: ximbap@ukzn.ac.za

Yours faithfully

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Mrs G.P. Dlamini

Thank you for your contribution in this research.

**Declaration**

**I, (Please *print your full name clearly*) _____ have read the letter requesting access to conduct the research project at this school and I understand all the issues in the letter. I hereby grant permission for the research project to be undertaken by me.**

_____ _____

**Signature (Principal)** **Date**

_____ _____

**Signature (Witness)** **Date**

**APPENDIX 5: Participant information sheet**

I would like to invite you to take part in a research study. Your decision will be based on understanding why this research is done and why have I chosen to involve you. Please read the following information and feel free to ask anything that is not clear.

Study Title

*Exploration of teaching strategies used in teaching shape, space, and measurement in Grade 11.*

Purpose of the study

*To explore the teaching strategies used by Grade 11 teachers in teaching shape, space, and measurement in Umbumbulu Circuit, Umlazi District.*

Why have you been chosen?

I have chosen you because you teach Mathematical literacy, and I believe that that you would help me succeed in collecting data required for the purpose of this research. Please note that there is another participant in another school but in a different environment. It is then up to you to decide whether or not you should be part of this research. You are free to withdraw at any stage without giving any reasons for your decision. The information that I shall have collected if you decide to withdraw will NOT be used in the research but discarded.

How long will the research take place?

This research will take place from the time you start teaching the topic until you do assessment. Please note that during lesson presentation, a video-tape and voice recorder will be used. Thereafter, arrangements for interviews (individual and group), will be made. Each one of you will view the video before commencement of individual interviews, and there will be no video-viewing during group interview.

Disadvantages and risk of taking part

There are no disadvantages or risks of taking part in this research. You will remain anonymous and data collected will be kept safe in my supervisor's lockable cabinet, only as

proof that research has been conducted. This information will be then be discarded after 5 years.

Benefits of taking part

I cannot promise that this study will help you, but gathered information will help me identify strategies used by different teachers to successfully teach the chosen topic.

What if there is a problem?

If you have any concern about anything in my study, you are free to contact the Research Office in the institution where I am registered.

HSSREC Research Office contact details:

P. Mohun

HSSREC Research Office

Tel: 031 260 4557

E-mail: mohunp@ukzn.ac.za

**APPENDIX 6: Class Observation Tool**

**Confidentiality considerations:** In order for this observation to be effective, it is crucial that I establish and maintain an environment of mutual respect and trust. Therefore, all critiques given on this form should be done in a constructive manner, and the raw data gathered through my observations in each other's classes and recorded on this form is to be kept confidential. Only three copies of this form will be made, one to be given to the participant observed, one to be kept by the observer, and one to be given to the supervisor. Under no circumstances should copies of completed Class Observation Forms be shared or distributed outside the department.

**Faculty Member Observed:** Participant A, Department of Mathematics and Science

**Observer:** Mrs G. P. Dlamini

**Class Observed:** Grade 11

**Date and Time of Class:**

**To be completed by the observer:**

1) Describe what happened in this class session. What was done by the participant? What teaching methods did you observe? How effective were these activities and methods in achieving the goal or participants outcome that he/she had set out for this class session? Explain.

2) What "worked" particularly well during this class session? Were there any teaching strategies that you think the participant should share with you after this session?

3) Was there a point during this class session when the participant "lost" student attention? If so, what do you think caused it?

4) How did the physical surroundings or environment of the class session affect the learning experience, if at all? (For example, the temperature or set up of the classroom, the time of

day, number of students in the class, outside noise, lighting, problems with equipment or technology such as VCR, COW, etc.)

5) What suggestions do you have for the participant you observed, in terms of expansion of particularly effective teaching strategies, improvement of teaching strategies that didn't work well, solving problems you observed, etc.?

**APPENDIX 7: EDITOR'S NOTE**

**28 JANUARY 2016**

**TO WHOM IT MAY CONCERN**

**Re: LANGUAGE STATEMENT**

I, THE UNDERSIGNED, hereby confirm that I have language edited the thesis titled **AN EXPLORATION OF THE TEACHING STRATEGIES USED BY MATHEMATICAL LITERACY TEACHERS: A CASE STUDY OF GRADE 11 TEACHERS IN UMLAZI DISTRICT** by **GWENDOLINE PHUMZILE DLAMINI,** for the degree of Master of Education, at the University of KwaZulu-Natal.

Regards

*HMapudzi*

Hatikanganwi Mapudzi (B. Applied Communications Management; B. Soc. Scie (Hons), Communications; PGDip in Media Management; M.A. Journalism and Media Studies).

**APPENDIX 8: TURNITIN REPORT**