

## CHAPTER 6

### **The case of Norman Mhuka: 'The maths of oranges and bananas'**

*Maths literacy is about teaching maths in context.*

*It is the maths of oranges and bananas.*

*Unfortunately the pupils are not finding it easier and many of them are still failing.<sup>13</sup>*

#### **6.1 Introduction**

In this chapter I explore Norman's understandings and perceptions with respect to the new mathematical literacy curriculum, and the bearing this has on his actual instructional practice. The emerging themes from the data collected, following the methodological strategy outlined in Chapter Three, are identified, explored, interrogated and analyzed, building an explorative case study that embodies Norman Mhuka's understanding and enactment of the mathematical literacy curriculum.

Contrasts and similarities between the findings and the *National Curriculum Statement Grades 10-12 (General) Mathematical Literacy* are further described and discussed (DoE 2003). I begin by describing how I came to know Norman, I offer a snapshot of Norman's *curriculum vitae* and who Norman the person is, and I conclude with a depiction of the context in which he teaches and a profile of his Grade 10 mathematical literacy class. Having detailed the implementation context, I proceed with an in-depth analysis of his understandings and perceptions of mathematical literacy as concept and subject. The discussion ends with narrative report on his actual instructional practice. The reasoned logic informing his understanding and practice will be provided in Chapter Eight of this dissertation, together with the theoretical analyses of this data.

---

<sup>13</sup> Excerpt from interview with Teacher Norman in the course of conducting this research (July 2006).

## 6.2 Finding Norman Mhuka

After the first two unsuccessful attempts to find respondents to this research, which I explained in Chapter Four, I was pleasantly surprised at the ease of finding Norman. I had made an appointment at East Rand High School and went to meet the principal. Telephonically I had already explained the purpose of the study to the principal, to which he had responded, what seemed at the time, very enthusiastically. On arrival, and after a few minutes of talking, my first impression of his willingness was justified when after the short discussion he called, over the intercom, the two teachers teaching mathematical literacy at East Rand High School.

I explained the research to these two teachers, with the principal occasionally interjecting, and then I proceeded to ask the educators to think about participating in the study and getting back to me if they would be willing. The one educator, Norman Mhuka, immediately responded that he was willing to be part of the research study. The second educator was friendly but unresponsive. The principal printed a copy of Norman's timetable and we agreed, on the day, that the research would commence.

At this point it is important to mention that during my application for ethical clearance it was drawn to my attention by one of the reviewers that approaching the principal first might raise questions of ethical concern. The reviewer pointed out this may include an obligation that an educator may feel on been approached by the principal and also that the eventual results would at a later stage be available to the principal which may pose difficulties for that educator.

Being aware of this and the fact that the principal's enthusiasm was evident to the educator I made it very clear when I met up with Norman, the very next day, that he could at anytime withdraw from the study and that the principal would be informed by me that my research at his school was complete. Norman seemed at ease with having volunteered and his willing participation may be a reflection of his own academic interests in further studies, which I was to find out at a later stage.

### 6.3 Curriculum Vitae - Abridged

NORMAN MHUKA

#### DATE OF BIRTH

---

2 April 1968 (38 years old)

#### EXPERIENCE

---

1990 – 1999 Zimbabwe High School

- *Mathematics Educator Grade 8-10*

2000 – 2003 Johannesburg City Center College

- *Mathematics Educator Grade 12*

2000 – Present East Rand High School

- *Mathematical Literacy Grade 10*
- *Mathematics Grade 10 & 12*
- *Life Orientation Grade 10*
- *Life Science Grade 10*

*Other duties:*

Tennis Coach & Hockey Coach

#### EDUCATION

---

1986–1988 Zimbabwe Teacher training College

3 Year Teaching Diploma: Majors, Mathematics & Biology

1989 Zimbabwe Teacher Training College

Further Diploma-High School Teaching

#### INTERESTS

---

Art, Hockey, Tennis

Norman is a thirty eight year old male who is well groomed and what would be called a 'gentleman' in the old-fashioned way. He is extremely respectful and polite. He has been teaching mathematics for the past seventeen years. His career began at a high school in Zimbabwe, which was then followed on his arrival in South Africa with teaching at a college in the city center of Johannesburg, which mainly focused on grade twelve learners that had at previous attempts failed their grade twelve year or had not attained a pass in higher-grade mathematics.

This experience he explained was very taxing and although he felt rewarded when several of his learners, on repeating grade twelve, passed mathematics on the higher grade, the lack of resources and crime in the area forced him to apply to other schools. When the opportunity to teach at East Rand High School was given to him he was excited to teach at what was previously a 'white' school. This was grounded in what he believed would be a safer school and much better resourced.

On arriving at East Rand High School he soon experienced what he refers to as 'black on black racism'. Most of the parents, irrespective of their race, wanted 'white' educators teaching their children. At the time, there were two other mathematics teachers, both white, and he repeatedly received complaints, particularly from the 'black' parents who always asked for the 'white' educators. Over the next couple of years the two other educators left ERHS and 'black' educators were appointed in their place.

This however did not alleviate the complaints Norman was getting and he soon experienced harsh xenophobic attitudes to Zimbabwean nationals from many of the parents and learners. He persevered through this, and has found that over the past two years that the attitudes of both parents and learners have changed towards him, his nationality no longer being an issue. In his opinion the complaints that he does receive now are mainly rooted in the fact that he is not willing to compromise his standards. He proudly explains that his learners achieve the results that they are worthy of, as he will not lower his standards to appease complaining parents.

Norman loves art and while studying to do primary school teaching in Zimbabwe took Art as one of his major subjects. He would like to start an art club at the school for he finds interacting with learners outside the classroom to be very important in forging relationships with the learners that are conducive in the actual classroom. He is also a sport enthusiast, having played both hockey and tennis during his secondary and tertiary studies in Zimbabwe. Both these sports are offered at East Rand High School but Norman finds it difficult to field any one team as the learners, he says, lack both motivation and commitment to extra-mural activities.

Norman left Zimbabwe at the end of 1999 together with his wife, for he felt that he could not support his family in a way that he would like to. He left his two young daughters behind, to be temporarily looked after by their grandparents with the intention of bringing them to South Africa once he and his wife were financially secure and settled. This has taken longer than initially expected, but believes that he needs to do this soon for now they are of school-going age and he would like them to attend an urban school in South Africa. Furthermore his wife has recently also managed to secure work doing AIDS counseling in one of the country's large banks that pays substantially more than her first job at the Grain Board. Norman freely talks about the difficulty of being separated from his children and on how on a monthly basis he sends food parcels to his family in Zimbabwe which include fresh milk and bread, through a truck driver that he was introduced to while working in the Johannesburg city center.

Norman's home language is Shona; however he is very proficient in English. He received his initial training in primary school teaching at a Teacher's Training College in Zimbabwe. He studied mathematics, biology and art. On completing his teaching diploma he decided that he would be better suited to a secondary school environment and proceeded to study for one more year, which entitled him to teach mathematics and biology to high school learners. In recent years he has attended an outcomes based education workshop, an assessors course and, during 2006, a workshop on mathematical literacy.

His teaching experience spans seventeen years at three different schools, two in South Africa and one in Zimbabwe. He is currently teaching Mathematics to Grades 10 and 12, Life Sciences to Grade 10, Life Orientation to Grade 10 and Mathematical Literacy to one Grade 10 class. Apart from his teaching duties Norman is also responsible for a homeroom class, which he sees on a daily basis, monitoring absenteeism and the schools code of conduct on learner dress and appearance.

The school timetable consists of twenty-five one-hour periods of which he teaches sixteen periods. He uses the nine remaining hours to do his marking, administration,

setting of assessment tasks and general academic planning. His school day begins at ten to eight in the morning and ends at five past two in the afternoon, with two twenty minute breaks in the course of the school day. His classroom is situated on the lower level of the school and the learners' come for both registration and teaching to his classroom.

He is again looking to leave his current workplace but this time the reason is that he believes that he is in line for promotion. At the time of the study Norman was a level one educator<sup>14</sup> and he hoped for a Head of Department promotion or even a Deputy Principal position. Furthering his studies is another option but has not managed as yet to register for a course of his choice due to the financial constraints.

This profile of Norman was informed by casual conversations over the six-week observation period and also by the questionnaire (Schedule A), which had the objective to gather information on the educator's background. This outline is indispensable to establishing the core to such a study since individual and professional qualities are inextricably connected to what people declare and practice. As such, this individualized context enriches the study by providing a more holistic lens for interpreting the findings of the research, as does the environment in which Norman teaches. This is described below.

#### **6.4 Norman's teaching environment**

East Rand High School (ERHS) is situated forty-five kilometers east of the Johannesburg city center. It is an urban school located in a predominantly Afrikaans speaking town that opened its doors to all races in 1992. Since then its racial identity has grown to ninety five percent black. It is still, and has always been, the only English medium high school in this town.

---

<sup>14</sup> A Level 1 teacher is an educator that does not have a promotion position. The levels in primary and secondary schools range from 1-5, with level 2 being Heads of Department, level 3 Deputy Principals and levels 4 and 5 Principals the difference being learner number dependent (Employment of Educators Act - 1995).

A principal, two deputy principals- one female and one male- and thirty-three teachers constitute the academic staff at ERHS. Interestingly, of the thirty-three academic staff twenty-seven are female with the six remaining male staff either teaching mathematics or science. The mathematics department itself is four educators strong, all of them black male. The racial composition of the remaining twenty nine academic staff members, in terms of race, is majority black South African, with four white South African female teachers and three black Zimbabwean males. The description of Norman's teaching environment in terms of race and ethnicity is provided, as it was a basis for the hostile experiences, in terms of xenophobia and racism that Norman experienced for several years at ERHS.

Male educators with the exception of the one female deputy, hold all the promotion posts, which include one principal, two deputy principals and five heads of department. The administrative staff is all white and female. There is a general secretary, the principal's secretary, the school typist, the school financial controller and a second typist who is also the laboratory assistant. The auxiliary staff includes a kitchen worker, a caretaker and several ground staff cleaners whom he supervises.

ERHS has a governing body, which is democratically elected by the parent body. However there is general consensus in the staff room that the governing body oversteps the boundaries and involves itself in areas that they should not. These areas include actual teaching ability and staffing. The principal is aware of his staffs' feelings and readily admits that he absorbs a lot of the complaints so that his educators are not demotivated or feel threatened even further. There are also grievance procedures in place for both the educators and learners which both parties can make use of through their respective elected representatives. Several staff is of the opinion that a procedure should also be put in place for the parents, as they are a major source of staff unhappiness and unease.

ERHS runs from grades eight to twelve and has eight hundred and seventy three learners registered on its school records. The learners attending the school are mostly from the surrounding two townships with a small minority that actually live in the town itself. A

neighboring squatter camp<sup>15</sup> also feeds some learners to ERHS but this is only a handful, as these parents cannot afford the required school fees. Racially the percentage of black to white learners is ninety-five to five, with the five percent having English as their home language and the majority an African home language. Most of the learners at ERHS did however receive their primary school tuition with English as the medium of instruction.

ERHS is on the northern outskirts of the town in which it is situated. It is easily accessed by any of the four tar roads that surround it as it occupies an entire street block. The school building and grounds have a high-wire mesh fence that encloses it and an electric gate at its main entrance. The intercom at this gate was not functioning during the entire research period and one was required to either hoot for it to be opened or to phone the secretary of the school on arrival. A walk-in gate is situated near the electric gate and this was found to be always open during the duration of the study. A steady trickle of learners, in and out the school, was visible at most times during the school day.

The school is a two story brick building with a tin roof, thirty seven classrooms, one library, one computer laboratory, two science laboratories, one biology laboratory, four learner ablution blocks, two upstairs one for males and one for females and two similarly distributed downstairs. The staff toilet facilities are on the downstairs level only, male and female separate. These are kept locked with staff having a key to prevent theft of soap and towels, which has occurred in the past. In addition there is a carpeted staff room with several round tables and chairs and an adjoining kitchen with a fridge and a microwave. There is also a tuck shop where the learners can purchase lunch or snacks at either of their two breaks. Vendors selling sweets and cool drinks dot the pavement area outside the schools main gate every weekday afternoon and the learners make prolific use of the vendors' trade.

The computer laboratory was funded by a nationwide project for government schools which provided for twenty-five computers and two printers, all still in good working

---

<sup>15</sup> Squatter camps are informal settlements that have mushroomed all over the South African urban landscape reflecting the poverty that the majority of South Africans still find themselves in.



order. These may be used only by the learners who take Computer Studies as a subject from Grade 10 onwards, with the room been out of bounds to all other learners. During this study it translated to approximately seven percent of learners being allowed to use the computer laboratory. The Internet is only accessible to the Principal and the Deputy Principals who have got dial-up connections in their offices. The learners may at no time use the Internet facility and staff needs to motivate in writing if they require the use of the Internet. If deemed necessary, the research is then done by either of the two Deputies and the relevant material is printed out for the staff member.

The library in turn is well stocked with many shelves of books neatly arranged with codes and a catalogue. On closer inspection, however, it was found that most of the books were dated and were last used in the late 1980s with the new reference books being mainly free copies of new OBE and FET textbooks from various publishers. The library remains closed to the learners to prevent theft, and only staff may check out books that they require for planning and or teaching. There is also an outbuilding, the old woodwork center, however this subject is no longer offered to the learners due to the cost of running the center. The caretaker and his staff use this part of the building to do repairs on broken chairs and desks for it is still stocked with many tools and several machines.

The administration block is situated centrally in the school and is accessed via an open foyer decorated sparsely with antique pieces, a ball and claw sofa, a ball and claw table and two 'Singer' sewing machines, all evidence of the past affluent history of the school. The principal's office has an adjoining secretary's office outside which, a spacious reception area is situated, furnished with two chairs and a sofa. The typist's room on the opposite side of the reception area houses the two photocopiers that service the entire school. The deputies also have their own offices as does the schools financial assistant.

The classrooms are relatively big and accommodate on average thirty-five single wooden tables and chairs. The classrooms like the rest of the building are wired with electricity, have good lighting and have at least one plug point. Furthermore all the classrooms have a green chalkboard in the front, a teacher's desk and chair, a locking cupboard for storage

of learning and teaching material and many burglar barred windows. All of the laboratories also have burglar gates on the doors, as do the sides of all the corridors. These are kept open during the day and locked up at four o' clock on a daily basis. This has reduced the vandalism and theft that use to occur prolifically in the mid 1990's.

In nearly all lessons, learners have their own chair but in some of the bigger classes learners share the single desks. Norman's class is no exception barring the lack of graffiti on both his desks and walls than in many of the other classrooms.

The school has extensive fields, with an athletics track, two soccer fields, three-hockey fields and an area demarcated for cricket. The fields need minor maintenance in terms of painting the lines that differentiate the various positions and areas on the fields. There are also three tennis courts that need some surface maintenance and a shooting range that is no longer used. After the apartheid government, the rifles that the education department provided the school with for a subject that was then know as Youth Preparedness was discontinued. The parking facilities for the staff and visitors are extensive and neatly cemented, and several trees can be used for car park shading.

All in all the school is in a relatively good condition and conducive to learning, with some painting and minor repairs needed in various parts. Even the litter is maintained to a minimum as cleaning the school is one of the disciplinary measures that the principal has introduced. Instead of suspension, after a series of infringements on the school code of conduct, the learners are giving orange overalls to wear and they spend the day cleaning up the litter.

Educators need to be at school by five to eight as registration takes place at eight o'clock and may leave school at three o'clock. Most of the staff however leaves at five past two, which is also the end of the school day. The academic staff is not expected to do extra mural activities, as these are optional for both the learners and the staff. Priority is given to academics and the educators are expected to stay twice a week offering free tuition until three o'clock for learners requiring academic assistance.

### 6.5 A Snapshot of Norman's Grade 10 F Mathematical Literacy Class

There are thirty-eight learners in Norman's mathematical literacy class. The majority of these learners either failed Grade 9 Mathematics or attained a promotion mark that was a pass mark but failed the end of year examination. The learners that failed mathematics on the promotion mark were condoned to Grade 10 on condition that they do Mathematical Literacy and not Mathematics; for those that failed the end of year examination but passed on the promotion mark mathematical literacy was highly recommended by both the Head of Department and the Principal. ERHS has two more mathematical literacy classes with thirty-five learners and thirty-eight respectively, which Norman's colleague teaches. Together the three classes represent a seventy one percent majority of Grade 10 learners doing Mathematical Literacy instead of Mathematics.

The home language of the learners in Norman's class is varied and includes Sotho, Zulu and Sepedi. However, the learners are relatively proficient in English and most of them attended the neighboring English medium primary school. Absenteeism is minimal and during the six-week observation period the highest absenteeism on any one-day in Norman's class were four out of the thirty-eight learners. The ratio of boys to girls was nearly even and, with the exception of two white girls, all the learners were Black African.

The learners do not have mathematical literacy textbooks nor do they have scientific calculators of their own. They have a writing book, which is used by many to take notes in at least two learning areas. From front to back the mathematical literacy notes are evident, from back to front the notes of other subjects appear and in some of them from the middle of the notebook onwards the notes of a third subject are also apparent. The learners are outspoken and there is an overwhelming sense of disrespect for the educator. Continuous talking throughout the lesson is common as is the 'back chat' when Norman attempts to discipline the class.

The learners are taught in Norman's classroom, which is a typical example of most of the ERHS classrooms barring the distinct absence of graffiti, as previously mentioned. The walls have no posters and the only writing includes faded formulae of three trigonometric identities. The desks are arranged in tightly packed horizontal rows and once the learners are all seated it becomes difficult to move around the room as the desks, chairs and school bags occupy most of the floor space.

Norman Mhuka claims that this is one of the better schools in terms of resources and academic offerings in the surrounding area and often points out that many of his colleagues from neighboring schools would like to work at ERHS. This is also evident by the large number of learners that are on the waiting list to attend this school. As a government school the school fees are manageable for most of the parents of the learners that attend ERHS and it is preferred over the township schools that both the educators and learners of this community believe to be worse off.

Having sketched the context in which Norman operates as a mathematical literacy educator, I will now proceed to discuss how and why he teaches as he does. The three research questions posed in this study will be sequentially addressed through descriptive analyses of the findings.

## **6.6 Norman's understandings and perceptions of the purposes, problems and possibilities contained in the mathematical literacy curriculum**

In this section I explore and describe Norman's understandings and perceptions with regard to the new mathematical literacy curriculum, as a response to the first research question: What do teachers understand to be the purposes, problems and possibilities contained in the mathematical literacy curriculum? The evidence is elicited from the semi-structured interviews that preceded the classroom observations (Schedule C), casual conversations and the semi-structured interviews that were held after classroom observation (Schedule D), the questionnaire containing both open and closed ended questions (Schedule A), an in-depth document analysis of curriculum and related

guidelines (Schedule G), and notes from the researchers journal (Schedule J). An explanatory theoretical analysis of the findings will follow this description and exploration in Chapter Eight.

### 6.6.1 Identity dilemma

Norman received his teaching timetable for 2006 on the first school day of that same year, which is also the time at which he became aware of the fact that he would be teaching mathematical literacy. He had heard about the subject in the latter part of the previous year but was unaware that this new subject was going to be offered at ERHS and that he was going to be asked to teach it. He received a personal copy of the mathematical literacy curriculum from his head of department and was told to conduct weekly planning as he was going to be in charge of the subject for the year.

Norman's head of department also gave him three mathematical literacy textbooks that he was to use to teach the class assigned to him. That was the only discussion that Norman had about the teaching of mathematical literacy with his head of department, or any other member from the mathematics department at the beginning of the school's academic year. He was not particularly concerned at the time because he had heard that this was an easy subject for the learners that could not do mathematics, and he had textbooks from which to teach. What was of concern to him was why he was given mathematical literacy to teach in the first place:

*It did not worry me that I had to teach mathematical literacy, I knew that this was an easy subject. I did wonder however why I was told to teach it. I would rather teach mathematics that is what I am qualified to do. If it does not matter who teaches the subject why did my head of department not take a class? As long as they do not think that I am going to become the maths literacy teacher at the school. Then I will leave to pursue further studies, which is something I have always wanted to do.*

Norman's response indicates that he felt offended at having to teach mathematical literacy. This cuts to the core of how he views the subject, possibly as a subject with little

academic standing or at least lesser than mathematics. Inquiring deeper on why he did not want to be known as a mathematical literacy educator Norman explained:

*Because the subject is for the 'doffies'<sup>16</sup>, you know all those pupils who cannot do mathematics, and I do not want to be the teacher thought of in the same way, the teacher who cannot do mathematics. The parents, they will think like that, he is teaching mathematical literacy because he cannot teach mathematics properly.*

This perception of Norman's that teaching mathematical literacy somehow reflects on his inability as a mathematics educator, raises more fundamental questions. Why does he harbor such negative feelings and perceptions with regards to teaching the subject? Are they founded in insecurities established at the onset of his teaching career at ERHS as a product of the complaints that he received from both parents and learners or are they a manifestation of his beliefs and understandings of what mathematical literacy as a subject symbolizes?

### **6.6.2 Broad understanding of implementation**

In the questionnaire Norman indicated that he understood the mathematical literacy curriculum to a large extent but was not sure of whether it provided guidelines for implementation; at the same time, he considered its implementation as flexible. He further indicated that he did not have copies nor was he aware of the corresponding Subject Assessment Guidelines, Learning Programme Guidelines and Teacher Guide. This did not seem to matter to him and at no stage of the study did he ask for copies or a way to acquire these documents. He seemed more preoccupied with the exemplar paper<sup>17</sup> that he had obtained from another colleague at a cluster meeting:

*Before I got this paper I was not sure if I was doing the work in enough detail or too much detail. This is the best thing that the department could have done; give us a copy of an example on how to set a paper. If I look*

---

<sup>16</sup> A colloquial South African word used to describe people with an inferior intelligence.

<sup>17</sup> The Department of Education during the course of the year posted exemplar papers on its *thutong* website in all the FET Grade 10 subjects.

*at this paper I know that what I have taught this year is right. I have taught all these sections, if the pupils cannot do it, it is because they are weak and struggle in mathematics not because I did not teach them properly. As long as the pupils and their parents do not think that because now their children are doing maths literacy they will simply pass. They still have to work; it is definitely not an easy subject.*

He continued excitedly:

*But the exemplar shows that what I am doing is correct. We keep talking about implementation and now that I have seen the exemplar I know I have successfully implemented the subject.*

Once again Norman returned to justifying his teaching ability, which was never questioned or inquired about during the interviews. Yet his insecurities seem to be deeply ingrained, even overpowering, as he kept bringing them to light. What did become clear was that Norman worked in a much pressured environment.

During a conversation with the principal he revealed that there was an expectation from the parents that having been told to do mathematical literacy because it was the easier option to mathematics somehow had led them to believe that this subject would not pose any difficulties and that their children would all pass. The principal had compounded this expectation when he admitted that he had reassured the parents that it was more difficult to fail mathematical literacy than it was to pass it, in order to encourage them to allow their children to take a subject that would ultimately be more useful to them and create less anxiety than mathematics. In so doing the expectations of both learners and parents was of an easier and stress free curriculum.

Moreover Norman clearly did not view the implementation of a curriculum as a dynamic process that can develop and unfold over a period of time, but rather as something he had already successfully achieved. His rationale was mainly based on the premise that since he had covered all the work in the sections that he had already taught with reference to the exemplar paper, he had successfully implemented the curriculum.

Norman attended a mathematical literacy workshop during the course of the year, which he had found to be of little benefit:

*We wasted our time attending this workshop. All that they spoke about is in the curriculum; we do not need the learning outcomes read to us, it is something we can do for ourselves. They also told us what we as teachers should do but this is no different to what we do in all our classes. The only part that helped was some of the examples they did. But for me, well I can do this maths, perhaps the workshop should in future be for teachers that are not properly qualified, maybe they need to learn the maths. Once you know and can do the maths all you have to do is make sure that you are teaching it in a real life context.*

On viewing the notes and handouts that Norman had received at the workshop I found that the following topics had been covered:

- What is Mathematics Literacy?
- The Mathematics Literacy Learning Outcomes and Assessment Standards
- The Mathematics Literacy Learner and the Mathematics Literacy Teacher
- Overcoming Maths Anxiety
- Language and the Mathematics Literacy Learner
- Assessing Mathematics Literacy

What is of consequence is that Norman did not see any value in any of these as he had further described the course as a 'waste of time' and he seemed to focus more on his ability to teach the content, which he was well aware, had to be done within a 'real life context'. This phrase 'real life context' became Norman's pivotal focus on all that mathematical literacy entailed. To what extent he understood this and made use of it in his actual teaching, will be explored further in the ensuing discussion.

The curriculum document, the exemplar paper and the textbooks that Norman was using, were the only sources that Norman Mhuka consulted, and as such were initially assumed to have played the more significant role on his understanding of the new curriculum. However, psychological and emotional factors seemingly also impacted significantly on his responses and ultimate understanding. This finding, illustrated the complexity of implementation as a personal response. Norman's understanding of what mathematical



literacy meant was similarly embedded in understandings that he had acquired over the course of his teaching life.

### 6.6.3 Concept Definition

As discussed in Chapter One, the definition of mathematical literacy varies widely even though it does have many commonalities. Norman's response to this question on the questionnaire was a brief 'real life maths'. During the interview he added, "A practical maths that enables you to get by with figures". The curriculum document shows his response to be partly aligned with the intended definition when it states that, 'Mathematical Literacy is a subject driven by life-related applications of mathematics' (DoE, 2003:9).

What is omitted however is a deeper understanding of an unambiguous 'awareness' of 'the role that mathematics plays in the modern world' and the requirement of 'critical analyses' of situations that may arise. Both the awareness and the critical analyses are explicitly stated in the definition of mathematical literacy in the curriculum document. This narrow understanding of the concept poses serious considerations on the impact this understanding of the defining feature of the new curriculum will have on how Norman proceeds to implement mathematical literacy.

What is further of interest is the confidence with which Norman responded to this question. There was no hesitation but a definite feel that he had given the correct answer to the question. This begs the question as to whether he will ever revisit his understanding of the definition and take the time to probe beneath this surface understanding in the absence of a reflective practice. What is more, does this understanding of the concept necessarily imply that the purpose will be understood in a similar way?

Norman's understanding of the purpose of the curriculum is given below, as it goes towards understanding what it is that he believes the reason for the introduction of this new curriculum was. This is important; for if he does not have a clear awareness of why

mathematical literacy was introduced as a mandatory alternative to mathematics he may not proceed to implement this curriculum as intended.

#### 6.6.4 Curriculum Purpose

The purpose of a curriculum normally specifies the value and reasons why a new curriculum has been introduced. Understanding this on a deep level may go towards understanding not only what it is that is to be implemented but also why.

Norman's understanding of why mathematical literacy was introduced was based on assumptions that he had made as nobody had explained the purposes of the curriculum to him:

*I am not sure why it was introduced; nobody has explained this to us. But it may be because it is now compulsory to do either Mathematics or Mathematical Literacy and not everybody can do Mathematics. I suppose that they (Education Department) realize that maths is not like other subjects, not all pupils can do it. Therefore they have to offer another subject that is easier. So it is their way of keeping like a standard grade maths for the pupils. Mathematical Literacy is for the weaker pupils and they can use it in their everyday lives. It is not like the mathematics in the Mathematics syllabus, which is more like the old higher grade. That syllabus is mostly abstract and the pupils cannot understand why they even do some of the sections. For example, who uses geometry once they leave school? Hardly anybody not even those doing maths at university. The financial maths that is a new section in the Mathematics Literacy syllabus is much more beneficial to the pupils. They (pupils) will at some point or another have to use a bank and understanding their bank statements is very important.*

He continued:

*Mathematics Higher Grade is too difficult for most learners and the government wants the pupils to do some mathematics so that more pupils are doing the subject. I do not know why they changed from mathematics standard grade because that was much easier. It had less reading and because of this the pupils found it easier. With all the reading the pupils now have to do; mathematical literacy confuses them even further. I wish they (education department) would ask us what we think. I do not know of any school in our cluster that feels that this*

*(Mathematical Literacy) is easy. Standard Grade Mathematics was already for the weaker pupil and most of the pupils doing standard grade did not go to university anyway. Now we have been told that they can go and do some careers at university with Mathematical Literacy, but how will they be able to pass this when it is harder than standard grade? Like I said we are all confused why this subject has been introduced, but I do see that it can have real life application, but not for the pupils who are already weak.*

Norman's response appears confused and convoluted. This may be because having admitted that he was not aware of why mathematical literacy was introduced, he attempted on the spur of the moment to supply an answer. An analysis of the response is however warranted as it reveals the following points of note, which are of relevance to this study.

Firstly his understanding that offering mathematical literacy is an alternative to mathematics is in line with the structure of the new FET requirements as is his continually repeated understanding of its application to 'real life' mathematics. Secondly, his response does not correspond to the purposes described in the curriculum document, which he has a personal copy of and claims to have read and understood. This includes addressing the poor quality of numeracy and high levels of innumeracy in mathematics in this country which are both elaborated on considerably in the curriculum document.

Thirdly several of his responses to the questions intended to explore his perceptions and understanding of the purpose of the curriculum were found to differ between the questionnaire and the account he gave above. In the interview as already declared he disclosed not having thought about why mathematical literacy was introduced and yet in the questionnaire he agreed that the subject was introduced because of the low levels of numeracy in the country.

Furthermore he indicated that he agreed that the reasons were political, and strongly agreed that the curriculum must be viewed in relation to the larger agenda of transformation. On probing deeper and asking him what he understood by the larger

agenda of transformation as it relates to mathematics, he simply said, "I have no idea; my reply would be a guess".

The comparison of mathematical literacy, in his response, to standard grade mathematics further adds to the confusion that his response has already elicited, for in the questionnaire he clearly indicated that it was in no way the same as standard grade mathematics. And yet to some degree his reply shows that he does think of Mathematical Literacy and Mathematics having the same divisionary line as the old Standard Grade and Higher Grade Mathematics. What then becomes pertinent is not only the impact such possible confusion and superficial understanding will have on the road of implementation in his instructional practice, but also his acceptance of his own justifications and perceptions. Furthermore, how and why had Norman come to have this understanding?

Having indicated that he was not aware of the reasons why mathematical literacy had been introduced, he did not endeavor to inquire about this any further during this or any further interviews. This raises questions with regards to the implementation of this curriculum: If Norman's views and insights into the purposes of the curriculum remain unquestioned and unchanged, how will they impact the implementation of the curriculum as intended? And if they were to change what would bring about this change? Does holding a surface level awareness of the curriculum's purpose affect its implementation? Does holding a surface level awareness of the curriculum's purposes significantly affect understanding its possibilities?

#### **6.6.5 Curriculum Possibilities**

Working on the assumption that a deep understanding of what possibilities a curriculum can offer, significantly contributes to aligning the implementation of a new curriculum with its intentions, I proceeded to explore the possibilities on two levels. Firstly on a macro level inquiring about the possibilities that Mathematical Literacy as a subject has to offer, and secondly on a micro level which represents the possibilities contained in each of the outcomes.

### 6.6.5.1 Macro Level

On the questionnaire Norman indicated that he strongly agreed that mathematical literacy could enable learners to 'become numerically self-managing persons', 'contributing workers to society' and furthermore that it empowers them with 'democratic participation'. During an interview he had the following to say:

*It gives the weaker pupils some skills that they can use in real life examples that require mathematics. It is a problem if you cannot understand situations that involve numbers.*

Although the response from the interview is brief, taken together with the evidence from the questionnaire, it seems probable that Norman can recognize the broader possibilities that the curriculum can provide for, even though he may not be able to articulate them as succinctly. Wanting to explore this further I selected the following sentence from the curriculum and asked him to explain to me how he understood it, 'To be a participating citizen in a developing democracy, it is essential that the adolescent and adult have acquired a critical stance with regard to mathematical arguments presented in the media and other platforms' (DoE 2003:10). After some thought Norman answered:

*Skills to tackle everyday maths problems. For example been able to calculate what percentage of your income you spend on groceries and other such expenses. The world revolves around money, and money is about numbers, so these skills are very important. There are many more, in just about everything you encounter on a daily basis.*

Norman's response, although in many ways accurate, lacks the depth that is actually required by the curriculum document. His focus is on the skills that are requisite for the actual calculations, whose importance can not be overstated, for there is always the danger that the mathematics will be overshadowed by the context when teaching 'mathematics in context' such as is required in Mathematical Literacy. However the exclusion of an understanding of critical discussion with 'regards to mathematical arguments' is noticeable, for the critical analyses of situations involving numbers is one of the empowering opportunities that this subject offers. On the other hand he did yet

again recognize that mathematical literacy 'supports critical thinking' as evidenced in his response in the questionnaire but yet again was not able to convey this verbally.

This discontinuity in depth between his verbally articulated responses and those from the questionnaire are indicative of the lack of a holistic ownership of the curriculum. Having only been exposed to this curriculum for less than seven months this would not be a point of discussion if Norman in any way showed or expressed that he still used this document in any way other than to ensure that he had covered all the mathematical topics, for example; surface area, volume or compound interest. This absence of ownership becomes pivotal in the implementation for unless something or someone initiates Norman into making a further inquiry into parts of the document other than those discussed above Norman's perception and understanding will remain at this thin level.

Norman's understanding of the possibilities contained in the actual content of the curriculum was further also looked at, in order to establish whether he believed the curriculum content held any value. The supposition being, that if he valued the curriculum content, he may come to believe that the curriculum that he was implementing was worthwhile. This line of inquiry may help to further establish why he was feeling that mathematical literacy was the mathematics of "oranges and bananas".

#### **6.6.5.2 Micro Level**

I then proceeded to explore Norman's understanding of the possibilities that each of the four learning outcomes in the curriculum document could provide for. The inquiry around this was done with considerable scaffolding in the sense that each of the learning outcomes were read to Norman first as was their brief definition as given in the curriculum document. This scaffolding was provided because the use of outcomes in Grade 10 was only introduced in 2006, and the mind shift required of thinking in terms of these and not in terms of Algebra, Trigonometry, and Geometry will require some time for many educators, particularly those who have not taught Grades 8 and 9 in recent years (where outcomes have been in use), as was the case with Norman.

Interviewer: *Learning Outcome 1 Number and Operations in Context*  
*The learner is able to use knowledge of numbers and their relationships to investigate a range of different contexts, which include financial aspects of personal, business and national issues' (DoE, 2003:11). How do you understand this outcome with regards to learner opportunities?*

Norman: *This section is the financial maths section and provides many benefits to the learners as it teaches them how to use compound and simple interest and how to do their own personal budgets. This is new and was never dealt with in the past. The pupils find it interesting because they can relate to it. It is a very beneficial section in that way.*

Norman's response was not surprising, as he had already made several references to the financial aspects of the mathematical literacy curriculum. He seemed to enjoy and understand this section and from his response so did his learners. The curriculum document continues with delineating the focus of this learning outcome to be, 'on the investigation and solution of problems that require a sound understanding of numbers and their use in calculations, especially in financial contexts, ranging from personal to international issues' (DoE, 2003:p11). Norman's response is considerably similar to this explication particularly in terms of personal finance.

It is important however to point out that the contexts used need not only be financial. For example the curriculum document does not talk about simple and compound interest but more encompassing of 'simple and compound growth' (DoE, 2003:p38). The distinction is made here not because of the terminology itself but because of the opportunities that the learners may be deprived of if contexts are not used more broadly. Having said this however, the fact that Norman believes that his learners are finding the teaching of compound growth in teaching compound interest, interesting, is important for it further shows continuity with the curriculum documents discussion on how educators are to decide on contexts. The NCS Mathematical Literacy states:

Contexts are central to the development of Mathematical Literacy in learners. Mathematical Literacy, by its very nature, requires that the subject be rooted in the lives of the learners. It is through engaging learners in situations of a mathematical nature experienced in their lives that the teacher will bring home to learners the usefulness and



importance of mathematical ways of thought in solving problems in such situations (*emphasis added*) (DoE, 2004:42).

Norman viewed this outcome in a similar manner, as both useful and beneficial to his students. This valuing of *Learning Outcome 1* was however at odds with the lesser value that he had ascribed to the curriculum as a whole. Was this disparity a reflection of his unease at having to teach mathematical literacy and the broader implications this had on his 'status-identity'? How did this conflict between what he did value and what he believed others valued affect the implementation of this curriculum in his actual classroom? Did this deeper sense of what possibilities this outcome could offer run through into the other learning outcomes, like *Learning Outcome 2*?

Interviewer: '*Learning Outcome 2 Functional Relationships. The learner is able to recognize, interpret, describe and represent various functional relationships to solve problems in real and simulated contexts.*' (DoE, 2003:12). *What possibilities in terms of real life applications does this outcome afford the learners?*

Norman: *The application of this outcome to real life examples is more difficult; it does not lend itself as easily as the previous outcome. It is about sketching and interpreting graphs. To sketch them is a matter of learning how, it needs to be taught, and I do not feel that this is of much importance in later life. What is important is once they know how to sketch a graph that they use this insight to interpret already sketched graphs. This can come in handy when interpreting the graphs in a newspaper that indicate the fluctuation of say the rand price.*

Norman's difficulty on seeing the real life application of this outcome and possibilities other than again financial ones is indicative of a shallow understanding of what the outcome can provide for. The curriculum document unequivocally states that, 'Functional relationships pervade our society' (DoE, 2003:12), and then it proceeds to list numerous examples, such as:

- ❖ critique information about functional relationships in media articles such as telephone costs before and after rate changes,
- ❖ calculate relationships in speed, distance and time (DoE, 2003:20),



- ❖ draw graphs of: mass against time when on a diet,
- ❖ draw graphs of amount of savings against the investment period,
- ❖ interpret graphs that: compare the incidence of AIDS over time,
- ❖ indicate trends in road fatalities (DoE, 2003:22).

Why Norman was not able to express any of these was somewhat unanticipated, because not only had he claimed to have read the curriculum document and understood it but also many of these examples were articulated in the textbook that he continuously referred to. These examples are relevant and of importance to the lives of many South Africans, the use of which one would expect to be considered both important and more obvious. What may be operative however is that functional relationships were also present in the Mathematics curriculum prior to the FET curriculum, whereas the financial mathematics he is using and refers to in *Learning Outcome One* is new to the curriculum.

This may play a role, for he already has a preconceived idea on how functions are taught which may not have included context. Relinquishing the way he use to teach may be difficult as the reason as to why he should do it differently is not apparent to him, again perhaps due to the limited understanding he has holistically of the curriculum. He may as such be finding it easier to view the topics that are new as a process where context and content are intertwined whereas the old sections he differentiates between teaching the content and then introducing a context to which the mathematics can be applied. This is discontinuous with the curriculum that states that 'context-free algebraic manipulations are not expected' (DoE, 2003:12). What is significant however is that he has recognised, in this outcome, the importance of interpretation which in turn may lead to critical discussion and the possibilities that this in turn may encompass.

Learning Outcome Three, which is 'Space, Shape and Measurement', states that, 'The learner is able to measure using appropriate instruments, to estimate and calculate physical quantities, and to interpret, describe and represent properties of and relationships between 2-dimensional shapes and 3-dimensional objects in a variety of orientations and

positions.' (DoE, 2003:12). Norman had the following to say on the significance of this outcome to his students every day lives.

*It is very significant as it involves working out areas and volumes and doing the necessary conversions between the different units. I found this section easy to teach because we have always taught this type of work. I teach the learners all the formulae and once I have done this I use various examples.*

He continued:

*The new section on plans is very interesting, which you will see as we are going to be doing this soon. The pupils learn to sketch floor plans and also top, side and front plans of objects. This can be of use to them in planning their homes or understanding already sketched plans.*

Norman seemed comfortable with teaching this outcome and indicated that he believed it was of significance to his learners and proceeded to furnish two examples of the usefulness of the section. What is worthy of deeper analyses however is the explanation on how he undertakes to teach this section, first by teaching the formulae and then allowing them and showing them how to apply these to different contexts. Although this approach may seem acceptable it is discontinuous with the curriculum document that forwards the following approach (DoE 2003:42):

The approach that needs to be adopted in developing Mathematical Literacy is to engage with contexts rather than applying Mathematics already learned to the context. Research done internationally and in South Africa confirms this approach for young people as well as for adults.

How will these incongruities with the required approach affect the implementation of the curriculum in terms of the possibilities it has to offer? And even if it does, will Norman ever be aware of this?

These questions are fundamental to this study for if they are not addressed by either Norman himself on an external influence that intervenes on Norman's understanding and beliefs he is more than likely to continue with this approach, and the deep change that is

required in his pedagogy may never materialise. Not because Norman may not want to change, but because he does not know what he should be changing towards.

In addition his reply also lacks any reference to the cross-curricular possibilities that this outcome lends itself to. These amongst others include 'design, art, and geography' as stipulated in the curriculum document. Not affording his learners the opportunity to explore the mathematics present in these various fields does limit the engagement of skills that these students are taught. Furthermore, also missing in his response is comment on the aesthetic appreciation of form that this outcome can be utilized to develop and encourage. (DoE, 2003). These finer nuances of this learning outcome seem to have evaded Norman, as they are not reflected in any of his responses. The bearing this has on the implementation pathway the curriculum follows in his actual classroom practice may be that this new curriculum is being taught in a way similar to that of his previous mathematics instructional practice.

The fourth and final outcome of the curriculum is Data Handling, which to a degree like learning outcome one deals with content that is new to senior grade mathematics. This outcome states that, 'The learner [be] able to collect, summarize, display and analyze data and to apply knowledge of statistics and probability to communicate, justify, predict and critically interrogate findings and draw conclusions.' (DoE, 2003:12). The possibilities in terms of real life applications that this outcome may afford were explained as follows by Norman:

*This is like the finance section. It is new to mathematics in Grade 10 and provides the learner with so much that is relevant to their daily lives. Understanding data from various sources and making sense of them is important as it helps the pupils understand a lot of what is written in the newspapers. It also allows them to use probability and see that the chances of winning are not as many as they might think. This is so important for it may prevent them from gambling their hard earned money. It also enables them to understand how numbers can be manipulated in the way that they are represented to give the message that is wanted, like using pie charts in different ways.*

In this reply Norman shows a comparatively deeper understanding of the possibilities that this outcome can provide for. His account is very much aligned to the curriculum document both on a content level and on the deeper core contextual requirements, such as an awareness of data manipulation'. His reference to using the newspaper for examples is topical and rings true with the stated requirement that 'the media frequently provide resources that will assist in making what is currently happening locally, nationally and internationally available to the Mathematical Literacy classroom' (DoE, 2003:42).

Worthy of note is also the relatively deeper understanding of the possibilities that this outcome can offer than the previous two outcomes. This deeper understanding also surfaced with outcome one. Data handling like financial mathematics is new to mathematics grade ten and this may be a reason for his deeper engagement with the curriculum in these two outcomes, in particular with reference to his teaching approach. As new sections, it would be reasonable to assume that he teaches them using the prescriptions of the textbook more closely, than simply relying on past teaching experiences.

By comparing his responses to the curriculum possibilities and learning outcome opportunities it can be argued that Norman has a rather surface level understanding of the curriculum. This limited understanding raises the following issues. Why has Norman not engaged with the curriculum document holistically as seemingly he understands some parts better than others? What are the consequences of his unawareness of his own lack of deep understanding on both his actual classroom practice and on future change? Will his limited understanding play a role in limiting the possibilities that mathematical literacy affords his learners? Will this level of understanding play a role in the problems that he encounters in implementing this curriculum?

#### **6.6.6 Problems**

I examine the problems that Norman has encountered during the implementation of mathematical literacy in order to determine if they are of sort to affect the implementation

pathway of the mathematical literacy curriculum as intended. In so doing this case study may provide some form of evidence that can inform staff development programs and or educational directives.

In the questionnaire Norman indicated that the curriculum was easy to implement, but examples in the contrast came from an interview during which he expressed several difficulties he was experiencing in implementing the curriculum. I will interpret the contradiction to be nothing more than feeling comfortable during the interview and speaking freely as opposed to answering a questionnaire at the beginning of the study where maybe the boundaries of trust between me the researcher and Norman the respondent had not yet been established. One of the first problem areas he raised was the lack of resources that both he and his students had at their disposal.

#### **6.6.6.1 Resources**

Three vignettes from Norman's discussion provide the initial evidence on the problems Norman was experiencing in implementing the new mathematical literacy curriculum:

*It is not an easy subject to implement in a big class. The pupils are very weak in mathematics and they continuously require individual attention. I cannot give the pupils this attention when there are so many of them (thirty eight), if I do I will not finish the syllabus. I am already behind because I had to go back and re-teach percentages and scientific notation, because the nearly all failed the test on that section. Now I am going a little bit faster so that I can get through the syllabus but the pupils are complaining that I am going too fast. It really is difficult working with only weak pupils in one class. Maths literacy classes should be kept small, at about twenty, and the government should provide for more teachers to teach in schools.*

He added:

*It makes it even harder when the pupils do not have textbooks of their own. I know that this subject is new but if the government makes something compulsory surely they should provide the necessary resources, like textbooks for all the pupils. The time wasted in writing the exercises and homework on the board could be used to help the*

*pupils that are struggling. I don't know how schools with even less resources cope, at least we have scientific calculators that I can give the pupils at the beginning of a lesson and collect at the end.*

Norman concluded:

*Also not having unlimited access to the Internet is a big problem. You need this to do research and find new examples so that you are not only using the textbook all the time. The exemplar paper is also from the Internet, from the Thutong website. If I had access I would have found this paper earlier and not learnt about it at the cluster meeting. This paper has been very helpful; it shows you what is expected in a test that makes it easier to understand what exactly you should be teaching.*

These extracts from Norman's reply have as their broader theme resources or more accurately the shortage thereof. And although the lack of adequate resources is a serious concern for education in developing countries such as South Africa, such problems are not exclusive to the Mathematical Literacy classroom. Besides which, they have been extensively documented in the extant literature, as outlined in Chapter Two. To discount this broader theme in Norman's response and not to depict it, would however be evading the reality in which Norman believes himself to be operating in.

It would be unlikely however to assume that if these 'problems' were dealt with, that Norman would understand and deliver the curriculum significantly different, particularly with regards to his understanding on how his students ability does not allow him to teach the curriculum as comprehensively as he should be doing.

#### **6.6.6.2 Learner Ability**

I continued with this line of inquiry into the problems Norman was experiencing, hoping to glean a deeper understanding on his reference to the weaker learner and the education department (government). Norman explained his earlier reference to his student's ability more expansively:

*The pupils doing mathematical literacy think they are stupid, or at least more stupid than their friends who are doing mathematics. So already*

*they are negative and are complaining about how difficult this actually is. Their parents do not understand why they are not passing this easy subject and blame it on the teacher. But they do not understand, maths literacy is difficult, very difficult for the learners doing it, and there will still be pupils who will never pass this. How can they? They have no idea about some basic mathematics concepts. Now they [Education Department] have to compound this problem by asking the pupils to do the maths and also understand long paragraphs of writing. We are not language teachers also, let us focus on the mathematics. That is hard enough, considering that they cannot all do maths.*

It is not clear whether it is the actual learners that feel they are 'stupid' or Norman's perception of their ability. It seems unlikely that a class of thirty-eight learners would express themselves in that way. It is more probable that Norman has formed this opinion of them based on their failing mathematics results from the previous year. Irrespective it is Norman's slant that is of importance for it is this that ultimately intrudes on his actual teaching. For if he believes this to be true how will it impact on what he chooses to teach and what he selects to ignore? Will his beliefs become a justification transposable with the so-called difficulty of the curriculum to justify his learner's achievements? Or, will he accommodate the learners so called weaknesses by adapting his teaching pedagogy and style to suit their learning needs? How does his view assimilate with the assertion that 'all learners can and should do some form of mathematics'?

Norman did at no point specify that any of the outcomes were difficult or included content that was unduly challenging. He did convey that contexts sometimes were long and that the learners experienced difficulty in reading and understanding these. As such his recurrent reference to the difficulty of the curriculum is confounding for once again it is not clear on whether this is his actual view or a reflection of how his learners are experiencing mathematical literacy. Even though language of instruction is a significant point of interest in research on the teaching of mathematics it seems unlikely that in Norman's class this would impinge radically on why the learners were finding the subject difficult, as most of them were fairly proficient in English having received their primary school tuition in this language of instruction.



What may be more likely is that Norman is avoiding introspection of his understanding of the actual teaching required and looking for ways to justify the problems which his learners are encountering, and which ultimately affect him and his teaching practice. His fatalistic attitude of already having judged some of the learner's ability is also striking as it exemplifies his view with reference to the previously mentioned assertion. This is considerable for if he believes that not all students can learn mathematics he is making this obstacle a function of the students learning rather than a function of teaching. As such it exonerates him from taking responsibility for his students learning. Being a mandatory curriculum for those not taking mathematics this becomes pertinent for the purpose of this curriculum, which includes empowering all students with skills to access mathematics in everyday contexts.

#### 6.6.6.3 Mandatory Curriculum

In a conversation with Norman I asked him if these problems he was finding in implementing the mathematical literacy curriculum had caused any stress or anxiety for him. It was the first time that Norman appeared to show some form of discomfort with a question. Listening to what he had to say somewhat made this unease that I was sensing clearer:

*I do not know if I would call it stress, maybe anger, anger directed to the powers that be that made this curriculum compulsory. They do not understand what we teachers are faced with, they make a decision that will allow the education departments statistics to look good, and avoid coming into the actual classrooms and really seeing what is happening. We have no choice; it is compulsory to offer mathematical literacy. If they came into the classroom they would realize that the pupils are struggling with this even more than they were with standard grade mathematics, and that they do not even have textbooks that can help them. In the meantime it is we the teachers who get a bad name with the pupils and their parents.*

Uninterrupted he added:

*As for anxiety, not really. I know that I am teaching properly, the exemplar paper is proof of this. The pupils who listened and did their*



*homework would have no problem answering the sections from this that we have already covered. This year's group is also not really in danger of failing when they get to Matric (Grade 12). We have heard that for the first two years the education department will not fail anybody in Mathematical Literacy in Matric because it is such a new subject. So until then we can relax and find our feet. It will only be with the Grade 10's of 2008 that we will have to worry about them failing matric. Perhaps until then they will change the syllabus and make it easier, who knows they may even go back to standard grade mathematics. Or even realize that they cannot make mathematics compulsory for everybody. Why is Science not compulsory, because they know not everybody can do Science? How is Mathematics any different?*

Norman's anger is directed at the education department which he blames for the implementation problems he is faced with. These include a difficult curriculum, a non-negotiable mandatory curriculum and a considerable lack of resources, all of which he places at the door of the Department of Education. He is also in possession of information on how learners will be promoted in Mathematical Literacy once they reach Grade 12, which appears to put his mind at ease somewhat, with his current group of learners. This information that Norman has is however unofficial and not in alignment with the promotion requirements stipulated in official promotion documentation<sup>18</sup>.

I attempted to clarify this discrepancy by contacting several officials in the education department were I was twice referred back to the official promotion document I had in my possession. Despite this I found the rumor about all learners being promoted in the first year of writing the grade twelve mathematical literacy examinations to be out of the ordinary as there was no reason for it to be in existence unless a person in the know somehow started it. On my third attempt, during a telephonic interview with a prominent member of the South African Mathematics teaching community, my suspicions were confirmed when the interviewee concurred that this was the thinking in the higher echelons of the Department of Education. How this discussion had got out and how it reached a small town on the East Rand remained a mystery. What is clear however is that

---

<sup>18</sup> During the time of the study it was mandatory to pass Mathematical Literacy as a subject for promotion purposes in Grades 10-12. Subsequently, in 2007, this requirement was changed and although doing Mathematics or Mathematical Literacy remains compulsory, a pass is not required in either for promotion in Grades 10 -12.

this information was explicitly impacting on Norman's motivation to drive his students' success which in turn played a role on how the curriculum was unfolding in Norman's classroom.

It may even be argued that this single piece of information contributed to Norman's surface level understanding of the curriculum as it prevented him from further exploring the curriculum by denying tension and anxiety to be felt by him as a result over his students' low achievements. If a change is required in his instructional practice, this may not be pursued if he believes that ultimately his students will pass Mathematical Literacy because the Education Department needs to right the wrong and difficult standard of the curriculum.

Furthermore, Norman's constant dependence on the exemplar paper suggests that the pre-1994 struggle idealism of a teacher constructing their own curricular ideas, from guiding was just that-political idealism. Why did Norman respond this way? With reference to the official support Norman had received was enough being done to assist Norman with the knowledge and skills required for said construction?

The above report and analyses account for the reported problems that Norman was faced with relating to the implementation of the curriculum. In the curriculum document there is a conspicuous absence of any guidelines that assists educators working in resource-deprived conditions or with learners that have acquired mathematical difficulties throughout their schooling.

These two conditions are not inimitable to Norman's teaching environment and pervade many South African classrooms .Why this is not addressed in the curriculum then becomes a point of contention. It is one thing for the document to say that the curriculum addresses social justice and another for it to explain how this is to be done in the actual classroom by the teacher. Granted, the workshop that Norman did attend which was provided for by the Department of Education did cover an area described as 'The Mathematical Literacy Learner', however the timing may have been too soon and

Norman may not have, at that early stage been able to identify with the problems that he was to later encounter. This speaks to such staff development programs that need not only take into account what needs to be covered but also perhaps when it needs to be covered. Educator responsiveness is crucial to the learning process and to change, and an overload of information at the onset of an implementation phase may work against a deep realization of this.

The exploration of Norman's understanding of the Mathematical Literacy curriculum within the framework of the first research question revealed confusion, anger and a generally thin understanding of the curriculum document. How this cluster of understanding and emotion informed Norman's practice will be explored through the framing of the second research question, which follows in the next section of this Chapter.

### **6.7 How does Norman proceed to implement the mathematical literacy curriculum in his classroom?**

In this section I describe and explore Norman's instructional practice as a response to the research question; how do teachers proceed to implement the mathematical literacy curriculum in their classrooms? I compare the claims he makes with regards his instructional practice to both his beliefs and the curriculum document, and then further against the observed classroom practice. As explained in Chapter Four, the data points drawn upon to construct the portrayed findings include the Questionnaires (Schedules A&B), Classroom observation protocol (Schedule E), Document analysis schedule (Schedule F), casual conversations, and notes from the Researchers journal (Schedule J).

The casual conversations were not included in the original design but as the draft of the write up of the findings occurred at the same time as the actual research I found that some of the responses from the questionnaire warranted further discussion to further clarify and identify the emergent themes. These conversations were normally brief and mainly

revolved around one or two of Norman's responses on the questionnaire which I asked him to further explain.

I begin this section with a discussion of Norman's claimed teaching practice and the alignment this has with the curriculum document.

### 6.7.1 Claimed Instructional Practice

Establishing how Norman understood his instructional practice in his mathematical literacy class, and his beliefs on the traits that an effective mathematical literacy educator espouses, was an important starting point to this line of inquiry. The intention of which was to offer up the framework in which Norman understood he had to work in.

Norman wrote that the teaching of mathematical literacy was different to that of teaching mathematics as the former included using contexts and 'everyday maths problems' whereas this was not a requirement in the latter. He further indicated that his understanding of the nature of teaching mathematics had not changed since implementing the new curriculum with the exception of using contexts. He strongly agreed that the teaching of mathematical literacy was an opportunity for educators to redefine their thinking about the nature and teaching of mathematics, that mathematical literacy teaching should delay formal methods (algorithms) in favor of extended opportunities to engage mathematics in diverse contexts, and agreed that instructional practice should include issues related to human rights, environmental and social justice as well as the valuing of indigenous knowledge systems. He disagreed that the teaching of mathematical literacy should support only lower order skills and knowledge and also disagreed that teaching allows for no real abstract thinking only practical application.

As for the traits of an effective mathematical literacy educator, Norman strongly agreed that the educators should be confident in their own knowledge and agreed that they should possess the following traits and behaviors:

- have high but realistic expectations of all learners

- promote and value learner effort
- focus on key mathematical ideas
- modify teaching as a result of lesson reflection
- believe that mathematical teaching and learning should be enjoyable
- vary their roles as teachers
- connect mathematics ideas to various contexts
- make the mathematical focus clear to the learners
- use teachable moments as they occur

He also further noted that educators teaching Mathematical Literacy should be qualified and have some form of tertiary training in mathematics.

Contexts and the use thereof was once again the only point around which Norman believed teaching practice should change. His beliefs and perceptions of what mathematical literacy instruction should be as well as the effective traits of mathematical literacy teachers were on the most part continuous with the requirements of the curriculum and the literature on effective mathematical literacy teachers. Did his beliefs reflect his claimed practice?

Norman indicated that his current teaching practice mirrored the following statements; engages with real-world problems, uses various contexts, affords high levels of numeric skills, lessons engaged learners both critically and creatively and addressed issues of social justice. He admitted that there was room for improvement, in integrating lessons with other disciplines and making his teaching sensitive to indigenous knowledge systems. Charts, tables, data from media, newspaper articles and debates were tools and techniques that he said he often used in his teaching practice. Whereas textbooks and scientific calculators were always used, but no other technology was ever used. Reflection and learner chosen contexts were also often used.

Collective analyses suggest that Norman's beliefs and claims are generally well aligned not only to each other but also to the curriculum document. Two points worth mentioning that seem to be at variance include, one the non-use of technology other than scientific calculators, which will be taken to be as a result of the lack of resources in the school,

and two that there is a discrepancy on what his actual expectations of his students are. For although he claims that these should be 'realistic but high', Norman's 'realistic', as he has previously stated, includes only basic mathematics knowledge. As this is only one part of the curriculum, what he chooses to deliver to his students is restricted by what he believes that they can achieve and understand. This affects the implementation of the curriculum, as delivery of basic mathematics and knowledge is not the only curriculum requirement. Despite these two observations, there is a sense that Norman's instructional practice has embraced the curriculum as intended to a considerable degree.

### **6.7.2 Observed Instructional Practice**

As indicated, Norman's claims and beliefs line up with several of the provisions made by the new curriculum. The classroom observation will provide the direct evidence that can be used to corroborate, refute or augment this evidence further. By inquiring deeper into the dynamics of his classroom practice I will also explore how Norman's understanding of the curriculum has effected his practice. In this way I can assemble a more holistic representation, which I hope will grant a preliminary understanding of the relationship between the mathematical literacy curriculum and Norman's instructional practice.

I observed lessons in Norman's classroom over a period of six weeks. Five continuously starting in the last week of July 2006 (Schedule E), and one follow up week in mid-October 2006. In total nineteen lessons were observed, each lasting one-hour. The class observed was the Grade 10C Mathematical Literacy class at East Rand High School. I begin the account with a description of the first lesson observed.

#### **6.7.2.1 Observed Lesson: One**

Learners started arriving to the lesson ten minutes before the lesson was scheduled to start, with the last learner arriving five minutes after the scheduled starting time. Norman explained that this happens often as the different lessons allow the learners out at various times especially if they are busy been assessed. Once all the learners had arrived Norman

asked for silence and then proceeded to greet them as well as to introduce me. Barring a glare or two my presence was surprisingly ignored and the lesson began.

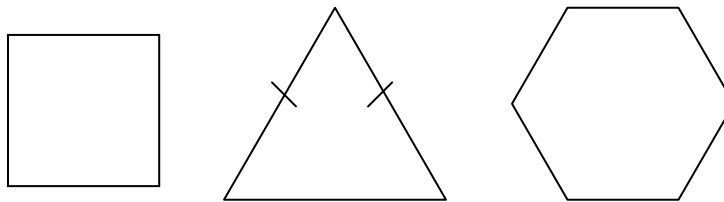
Norman asked the learners if they had done their homework to which they unanimously responded to with a no, justifying themselves by complaining that they did not have time to copy it down from the board the previous Friday. Norman began his lesson by writing up the days work on the chalkboard. The lesson is given below in its entirety so as to begin to establish his instructional practice and hence glean his understanding of teaching for mathematical literacy.

### Symmetry

Question 1) Make cuttings and drawings of a daisy with 4 circular petals and an oval center and a butterfly with 2 similar wings attached to an oval elongated body with a circular head and 2 straight feelers protruding from the top of its head. Find the number of lines of symmetry for each drawing.

Question 2) How many lines of symmetry do the following have?

A square, an isosceles triangle and a regular hexagon.



*Mr. Mhuka: With regards to question one, marks will also be allocated for the diagrams drawn. Remember lines of symmetry are easiest of all. Once you have drawn in your lines of symmetry fold your drawing on these lines and see that they work.*

The learners then proceeded to copy the questions from the board and Norman went and sat at his desk. The next twenty-minutes were taken up by Norman continuously asking the class to stop talking and calling individuals to his desk and recording their names for been disruptive. The one learner was told that this is his third infringement and was sent

to the Grade Controller who in turn would meet out the necessary sanction. Most of the noise was emanating from learners asking and calling for the one pair of scissors that was been used to make the cuttings.

Another source of disruption was that the learners did not want to cut up the drawings in their books and started to look for loose paper, which then further wasted time for they redrew all the diagrams on the loose paper, most of them tracing their original butterfly and daisy. The last ten minutes of the lesson were used to mark the lines of symmetry for the butterfly and the daisy.

Norman drew one line down the center of the butterfly and four lines of symmetry for the daisy. He told the learners to mark their work and asked them if they had any problems. Not one learner indicated that they needed anything explained. By now the lesson had come to an end and the learners were once again asked to finish question two for homework. The interview that followed this lesson indicated that Norman was mostly satisfied by the lesson and what his students had learnt.

Interviewer: *What was the purpose of this lesson?*

Norman: *We have been doing symmetry for over a week now and this was a short assignment I gave the pupils to do over the weekend. Unfortunately they did not finish taking down the questions and we had to continue with it today. The cutting out is important because it helps them to see how the lines of symmetry work. In the past, the examples used would have only been of shapes, the square, etc. But now we are also using examples of flowers and butterflies so that they can see the symmetry in nature.*

Interviewer: *In your view was this a successful lesson?*

Norman: *Yes, definitely! The pupils seemed to enjoy it and also learn from it.*

Interviewer: *Do you believe that the pupils acquired the skills and knowledge you expected of them before the lesson?*



Norman: *Yes. They have understood symmetry and have learnt to test the lines of symmetry by folding their cuttings on these lines and seeing that the two sides line up with each other.*

Interviewer: *In future would you do anything differently?*

Norman: *I would give the learners, photocopies of the drawings because this way we wasted a lot of time.*

Lesson one revealed that several of the claims that Norman made about his instructional practice actually took place. He engaged the learners creatively, used various contexts and his cuttings and folding afforded the development of higher order skills. In the post-lesson interview his reply that 'the pupils seemed to enjoy' the lesson also rang true with his belief that mathematical literacy lessons must be enjoyable.

Comparison to the curriculum document however reveals that his practice is only a reflection of the surface features of the document. The assessment standard dealing with symmetry in the curriculum document states (DoE, 2003:28):

We know this when the learner is able to:  
Recognize, visualize, describe and compare properties of geometrical plane figures in natural and cultural forms.

For Example:

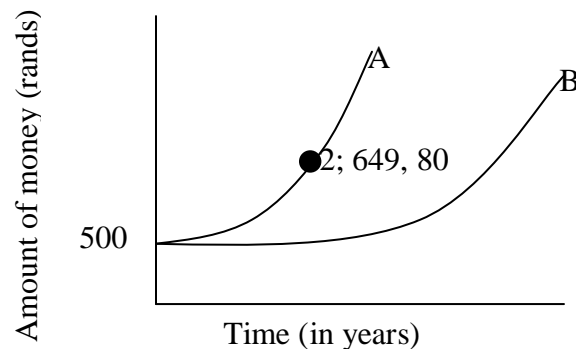
- ❖ Use the concepts of tessellation and symmetry in describing tiling, Zulu beadwork and other artifacts.

Taking the natural form, Norman had dealt with the visualizing and perhaps the recognizing but at no stage did the discussion include 'comparison' or 'description'. The use of symmetry and its application in everyday contexts was substituted with the use of two pictures that by no means represent the intentions of the curriculum. This surface level use of a picture to represent context is further verification of his lack of a deep ownership of teaching 'mathematics in context'. Ignoring a discussion on the aesthetic value and application symmetry has is further evidence of his limited understanding, especially when one considers his passion for art. This thin and disconnected level of understanding with the curriculum continued to surface in most of Norman's lessons.

### 6.7.2.2 Observed Lesson: Five

The normal ritual of learners arriving over a period of approximately ten minutes, being greeted and finally settling down was followed once again during this lesson. Two lessons earlier Norman had started using the compound interest formulae and this was the first time, in this section of work, that the example on the board was not only numerical calculations. The problem Norman posed to his students was the following:

Below are two graphs. Graph A represents the amount of money Andile has in the bank in relation to the number of years he has invested it for. Graph B represents the amount of money Bhavini has in the bank in relation to the number of years she has it invested for. Both Andile and Bhavini are earning compound interest:



- a. How much money did Andile and Bhavini invest originally?
- b. Who is getting the higher rate of interest?
- c. Calculate the interest rate Andile is getting

The learners were then given time to copy the question down and were asked to work in groups and come up with the answers. In the next twenty minutes the learners seemed to finish as the noise level had once again climbed considerably. Norman returned from his desk to the chalkboard and asked the learners for the answers. Shouting out of five hundred rand and Andile confirmed that the learners were able to use the graph to answer the first two questions correctly. However calculating the interest rate seemed a much greater problem.

After an explanation from Norman that the initial amount of five hundred rand had grown to six hundred and forty nine rand and eighty cents in two years he wrote the equation that needed to be solved on the board. What happened next is evidence of the difficulties that under-resourced classrooms can be faced with. The learners required calculators to solve the equation further which Norman had forgotten to hand out at the start of the lesson as he had done during the previous two lessons. The learners started complaining that now as they were seated they could not easily move around and that the calculators should be passed from the front to the back. Norman usually hands these out at the beginning of the lesson to learners who do not have a scientific calculator of their own as they enter the classroom. The learner then signs next to his or her name on a class register and then when leaving they return the calculator and Norman ticks against the name. Norman did not want to pass the calculators back during this incident, as he feared that he would not have a record of who actually took one. Having decided against handing out the calculators Norman verbally explained to them how the calculation should be done and wrote the answer on the board. They were told that they would have an opportunity the next day to do the calculation themselves. This brought the lesson to a close. Once again Norman was pleased with his instructional practice of the day, barring the incident with the calculators.

Interviewer: *What was the purpose of this lesson?*

Norman: *To show the learners how this information can be used in a different context.*

Interviewer: *In your view was this a successful lesson?*

Norman: *Yes, other than the chaos with the calculators, which was very disturbing?*

Interviewer: *Do you believe that the pupils acquired the skills and knowledge you expected of them before the lesson?*

Norman: *I am sure that they can do the calculator work; anyway they will get another opportunity tomorrow. Analyzing the graph, yes. They managed to interpret the information for the first two questions nicely.*

Interviewer: *In future would you do anything differently?*

Norman: *I will remember to hand out the calculators at the beginning of the lesson. The rest was fine.*

None of the claims that Norman had made with respect to teaching compound interest had materialised over the three lessons that he spend on teaching the concept, which included the lesson above. Compound interest was introduced using the formula, which was then manipulated to solve various numeric examples for a period of two one-hour lessons, and then the section was concluded with the lesson illustrated above. Its use in real life context was a brief explanation from Norman during the first lesson when he said the following, "this is the formulae that banks use to calculate the interest on the money you deposit, or vice versa the interest on the money you owe them".

The attempt at using some form of context on day three was neither authentic or of relevance to the learners lives and was also devoid of any relevant discussion other than tackling the mathematics itself. The curriculum requirement, which includes the application of 'mathematical knowledge and skills to plan personal finances so as to enable effective participation in the economy' (DoE, 2003:26) was once again met superficially at best. The content dealt with was 'naked' of relevant context.

Similar observations became a pattern over the next eleven lessons and I became pleasantly surprised when during observed lesson number fourteen Norman announced to the class that the next days lesson would be different and they must arrive on time as otherwise they would find the classroom empty. This did not seem to inspire the learners in any way that continuously complained about the speed of the lessons and the difficulty. I was however intrigued to see what Norman had in store for his next lesson- Observed Lesson Fifteen.

### **6.7.2.3 Observed Lesson: Fifteen**

Despite their lack of enthusiasm on the previous day the learners somehow managed to arrive relatively together and a couple of minutes before the designated start of the lesson. Once they were all at Normans' classroom, he handed them each a piece of paper

and asked them not to unpack anything other than a ruler and a pencil. The class was then lead out to the field and Norman explained to them that they were going to spend this lesson drawing and measuring one of the sport fields. They were told that it was a floor plan and that they should sketch it and indicate on it the various measurements. He had four measuring tapes and as such asked them to divide themselves into a similar number of groups. The learners spent the rest of the lesson taking the measurements and sketching the plans, some of the hockey field and some of the athletics track. At the end of the lesson they were told to draw up their plans neatly for homework and to bring these to school for marking the next day.

This lesson was the only lesson that I observed over the entire research period that did not begin with homework being marked or an explanation given of some mathematics formulae or concept. I was not yet quite sure as to what the purpose of the lesson was as Norman was unable to give a post lesson interview that day, but it certainly was aligned to the curriculum in terms of favoring process over content. It was such a promising start to a new section of work that as the follow up lesson will show ultimately delivered the curriculum intentions on a different and a deeper level than any of the other lessons I had observed thus far, despite the fact that it still lacked the depth of what was required by the curriculum document in terms of 'plans'. The curriculum states (DoE, 2003:26):

Draw and interpret scale drawings of plans to represent and identify views.

For example:

- ❖ Draw and interpret top, front and side views or elevations on a plan

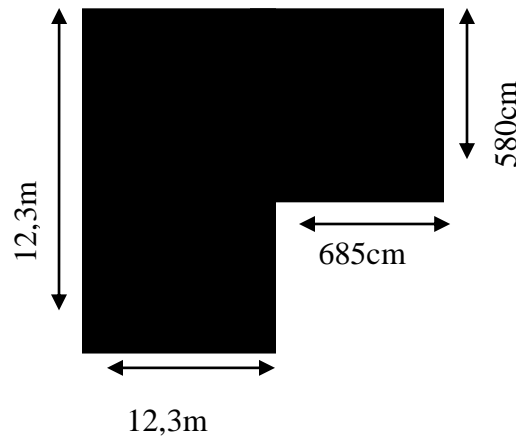
#### **6.7.2.4 Observed Lesson: Sixteen**

Norman began this lesson by asking for the previous day's homework to be handed in. From the thirty-six learners present that day eleven learners handed the previous days work in. The excuse for the rest seemed to be a unanimous "we did not understand what

to do". Norman accepted this and gave them another two days extension explaining that after today's lesson they would know exactly what to do." After all", Norman announced, "this is the maths of oranges and bananas ". He then turned his back to the class and put up the days lesson. The connection to the previous days work was left unexplained.

*Look at the plan of a plot and house on the left.*

- a. *Convert the lengths of the boundary of the plot to centimeters.*
- b. *Calculate the perimeter of the plot.*
- c. *Calculate the cost to build a wall that costs R180 per meter around the plot.*
- d. *Calculate the area of the house in square meters.*
- e. *Convert the area to square centimetres.*
- f. *It costs R2500 per square metre to build a house. Calculate the cost to build the house.*



Instead of going to sit behind his desk, this time Norman remained at the board and asked the learners to copy down the plan only and not the questions. Having given them time for this he continued by asking the learners how they would solve the very first question. Once again the noise level rose but soon an order was established between learners and educator. The class gave answers and ideas and Norman either used these as they were given or explained how they had to be corrected. Having worked through all the

questions together the learners were finally told to copy down the questions. This change in approach, Norman acknowledged in the post-lesson interview had made a difference.

Interviewer: *What was the purpose of this lesson?*

Norman: *To allow learners to apply the knowledge they have learnt to a context relevant to their everyday lives.*

Interviewer: *In your view was this a successful lesson? Why?*

Norman: *Yes. It was different and the pupils did not seem bored. It also kept the noise levels down. Discipline is a problem with weak pupils, because they do not understand they loose focus and start to talk, which then disrupts the entire class.*

Interviewer: *Do you believe that the pupils acquired the skills and knowledge you expected of them before the lesson?*

Norman: *I really think so. When they hand in the plans from the day on the fields I will be able to see if this worked, but at least in class they seemed to understand what the plan was about.*

Interviewer: *In future would you do anything differently?*

Norman: *I am not sure; I think this lesson worked well.*

This interaction of allowing and using student ideas and answers was a unique feature of this particular lesson, and as explained by Norman was an attempt to control the disruptive noise levels. However, his awareness that the pupils in his class became talkative because they did not understand the lesson raised three important questions. Firstly, why did Norman not establish who these 'weak' students were and offer them assistance with the task of the day? Secondly, did his beliefs on what they could and could not do, prevent him from trying to assist them? And thirdly, if this curriculum was meant to provide for knowledge and skills to all students who do not do the subject of mathematics did Norman's behavior affect the implementation of such a mandatory curriculum intended for all?

Furthermore, even though Norman did not provide an explanation for the link between the two lessons explicitly, and the floor plan was not a scale drawing, taken together the

above two lessons had managed to successfully integrate several curriculum requirements. The learners had been shown how to 'convert units of measurement within the metric system', used some of their pre-knowledge in revising Area and Perimeter, calculated cost within a context, and were exposed to floor plans both in the sketching of a real world example, and in recognizing a given plan. Having succeeded in doing this the lesson still did not match up to the curriculum document with the required depth as described before this lesson depiction, in that it did not allow for interpretation and description of the plans. The focus was once again on the mathematics required in measurement and calculation.

Another point of significance that arose out of this lesson was the comment Norman made to the class on mathematical literacy being the 'mathematics of oranges and bananas'. During the interviews Norman had repeatedly said that mathematical literacy was too difficult and yet in this lesson his comment was evidence that he believed this curriculum to be a mathematics curriculum that was open to ridicule. Did this perception he had of the curriculum contribute towards why Norman did not want to be known as the mathematical literacy teacher? For if he believes that the mathematics in this curriculum can be ridiculed does he believe that teaching it opens him up to similar derision?

Additionally, it shows that Norman considers this curriculum as a mathematics curriculum through his constant comparison to the core mathematics content. He has not understood this new curriculum as something distinctly different from the mathematics that he is used to teaching. That is, with a purpose and nature that is dissimilar to that of the core mathematics curriculum and also past mathematics curricula, in that the emphasis is not on learning difficult mathematics but being able to deal with and comprehend contexts in which mathematics is required.

Another of Norman's claims was that other than using context he had not needed to change his instructional practice with regards to teaching mathematical literacy. To understand this claim further I decided to observe some of his lessons in the other



subjects that he taught. I sat in on four of his Grade 10 Mathematics classes, three Grade 11 Mathematics classes and four Grade 10 Life Orientation lessons.

The grades ten and eleven Mathematics lessons afforded the most insight, for during these lessons it became evident that his instructional practice did not vary in any considerable way between how he taught mathematics and how he taught mathematical literacy. Not even in the use of context, which was as artificially used in the grade ten mathematics class as in the mathematical literacy class- as a 'dress-up' to the content, either through the use of a picture or some form of word problem. This provides for further evidence for the surface understanding that Norman had of the curriculum in terms of teaching 'mathematics in context'.

The pattern of marking homework, using the textbook to put up a worked example, discuss it and then give the learners similar problems to tackle was also repeated in his instructional practice in the mathematics classes and was only broken in the observed Life Orientation lessons. Here there was less writing and a significant amount of discussion. Views, expressions and debates were commonplace and the learners felt free to express and challenge each other and Norman. His ability to engage with a class was evident in these lessons; the question that arises is why did he not encourage this in his mathematical literacy classroom? Was this because of his surface level understanding of the nature of mathematical literacy, and his understanding that the mathematics should be the focus?

Synthesis of the observations of the nineteen Mathematical Literacy lessons result in the following findings that are of significance both to his claims and the curriculum document:

- teaching does not support student engagement with a variety of mathematically rich contexts;
- use of contexts are either not authentic or are textbook dependent;

- teaching does not support guided discovery of mathematical rules and procedures;
- students are not encouraged to seek understanding;
- mathematical life skills taught are at a surface level;
- no reflection or discussion on solutions occurs;
- instructional expectations of learners are low;
- teaching does not encourage critical engagement with regard to mathematical arguments;
- instructional practice is teacher-centered;
- order of daily lessons is entrenched;
- content and context are independent events.

These findings reveal significant discontinuities not only between the curriculum document and Normans' instructional practice but also between his practice and his claims. The lack of congruence between the curriculum document and Norman's instructional practice may be evident to the researcher and the reader but does not seem to be evident to Norman. This then becomes a point of discussion, for if Norman's instructional status quo is not recognized by him how will the required changes come about? Who will address Norman's depth of understanding and confusion with him? What dialogue or action is required to bring about the necessary understanding and hence change?

The learning material of the students was also looked at in order to ascertain further substantiation for the emerging understanding that the previous data points provided for.

### **6.7.3 Learner Work Books**

Throughout the observation period, when time and circumstances permitted I scrutinized the workbooks of the learners who without fail had them with them in all the observed lessons. The majority was neat and had the lesson of the previous day copied out. What

was striking is that the solutions were nearly all-identical, evidence that the learners were not attempting the problems set on their own but copying the solutions from the board.

There was no evidence of any hand outs in terms of worksheets and the like, and other than the two tests that the learners had stuck in their books, the learner work books were a reflection of the days chalk board lesson and the answers given. This workbook record of the lessons showed that, lessons did not have an explicit purpose other than the teaching of mathematical formulae and algorithms, did not provide for opportunities of real life application, had a limited and forged use of context with many having none, and lacked a strong correlation with the Critical and the Developmental Outcomes of the curriculum document.

There was also no significant difference, with respect to 'teaching mathematics in context' between the work done earlier on in the year and that observed during the research period. This was indicative of an instructional practice that was not attempting any further change, possibly because the change agent did not know that change was required.

What Norman did know that he should be doing differently was to present his students with assessment tasks other than tests. However, as he considered that this took time away from his actual teaching of mathematical content he opted to delay it for a year.

#### **6.7.4 Learner Portfolios**

There was no record of any portfolio files having been kept or the requisite tasks for these other than summative testing. Norman reasoned this by explaining that he would begin with this in the following year so as to give himself time with his students to focus and build their basic mathematical knowledge.

As portfolio work is integral to the teaching process in that it provides various methods for instructional and assessment purposes his reasoning was once again not connected to

the requirements of the curriculum document. He viewed the alternate tasks<sup>19</sup> as tasks that would take time away from his teaching of mathematics, and did not understand that this could be achieved through the use of tasks other than textbook exercises.

This focus on building the basics prevented him from providing his students with opportunities to engage with mathematics in a wider range of contexts, which is one of the main purposes of the curriculum. Why he chose to do this is twofold. Firstly, Norman did not have a deep understanding of the nature of mathematical literacy, as he believed that it was a mathematics curriculum with lower order mathematics concepts. And, secondly, he wanted to teach mathematics because he valued mathematics, as he knew it, and valued himself for having the ability to teach it. This is what he was trained to teach, what he wanted to teach, and most significantly what he believed was important to teach.

### 6.7.5 Tests

The learners had two tests stuck in their workbooks, which had several questions with no context but an overwhelming majority that did make use of real life applications. I will depict a segment of one of the tests below in order to raise the following question? Why is there a deeper understanding of the nature of mathematical literacy in Norman's summative assessment practice than in his instructional practice?

*Grade 10  
Mathematical Literacy  
Date: 3 March 2006  
Time: 1 hour  
Total: 60 marks*

*...*

*Question 7*

*7.1 Thabo earns a salary of R400 per month. He pays 22% PAYE (tax), 5% for medical aid and 6% for pension fund contributions.*

*What actual amount in rands does he pay for in?*

*a) PAYE (2)*

---

<sup>19</sup> These include; interviews, case studies, debates, assignments, research tasks and projects (DoE, 2005).

b) Medical Aid (2)

c) Pension Fund (2)

7.2 What is his net monthly income after deductions? (2)

Question 8

The workers in the mining industry agree to an annual wage increase of 7%. If a miner was earning R3 500 per month, what will he earn after the increase? [3]

Question 9

The label on a bottle of milk says that the concentration of fat in the milk is 2%. How many ml of fat will there be in a 250 ml glass of milk? [3]

Question 10

Which is the better value for money?

250g of coffee for R17, 49 or 600g of coffee for R37, 77 [2]

Question 11

An advertisement in a clothing store says:

a) 1/5 off regular price items. What can you expect to pay for a pair of shoes that normally costs R780?

b) 25% off our regular price of any items. What is the regular price of a jacket that now costs R56? (3)

The answer is simple, because Norman uses the textbook that his students do not have to take his tests from. If Norman's assessment practice was an integral part of his instructional practice this answer would not be important. But as Norman practices the two as separate events further explanation to this will be pursued in response to the third research question, which forms the final part of this case study.

### **6.8 Why does Norman implement the Mathematical Literacy curriculum in the way that he does?**

Having explored Norman's perceptions and understanding of the curriculum as well as his claims and actual instructional practice I will now deal with the third research

question, namely, why do teachers implement this curriculum in the ways they do? In other words, what explains the implementation pathways followed by the mathematical literacy curriculum in real classroom contexts?

The evidence for the response to this research question is obtained from five data points namely the, Interview Schedules (Schedule C&D), Questionnaire Schedule (Schedule B), Document Analysis (Schedule F) and the Researchers Journal (J).

### **6.8.1 Educator Documents and Records**

Norman's arsenal for mathematical literacy included the curriculum document, three mathematical literacy textbooks, weekly schedules, notes from the workshop and the exemplar paper. The curriculum document and the three textbooks were given to Norman at the beginning of the year by his head of department, the workshop notes he acquired later on in the year and the exemplar paper seven months into the year from one of his colleagues.

#### **6.8.1.1 Text Books**

Norman used one of the three textbooks he had in his possession on a daily basis. The other two were used to set the tests and examinations for the year. His decision on which textbook to use was indiscriminate and he could not recall why he had decided to use the particular one he did for classroom instruction and the other two for assessment. His weekly modus operandi in planning for his lessons was to refer to the work schedule at the front of the textbook, adapt this where necessary in terms of time allocated to a particular outcome or learning unit and then select several examples from the textbook as units of teaching. Selection of what was to be taught was not normally pre-planned and the examples used were more often than not based on decisions made during the teaching of a lesson. He explained his selection process as follows:

*I look for the easy examples first, the ones that do not have a lot of reading, only basic mathematics, and I begin with these. Then I select a slightly harder one with maths and reading and continue doing this until I have worked through several levels of difficulty. It is important that I do easy examples and difficult ones because not all the pupils have the same ability. In this way there is something for all of them.*

What is striking in this comment is that although it appears that Norman's practice caters for individual learners needs he had somehow decided that the questions that had less reading were the easier questions. In other words, teaching mathematics without context is what he believed needed to be delivered to the pupils with less mathematics ability.

Adding reading he saw as synonymous with adding context and further understood this as developing the level of difficulty of a question. How he had arrived at this which is a perception misaligned with the curriculum document was undisclosed and can only be interpreted to be part of the thin level of understanding he had for what it meant to teach 'mathematics in context'. It also further raised the question that if he believed that most of his students were weak in mathematics, which he continuously stated, would this prevent him from teaching in context, as he believed this to be a higher order skill which his pupils should or could not learn?

The two other textbooks were used to set the assessment tasks to date. The questions in the test that I presented earlier were all taken from these two textbooks with the mark allocation being the only contribution that Norman had made. What Norman understood assessment to include was then not a reflection of his knowledge and understanding but that of the authors of the textbooks. A concession can be made that the actual examples chosen are a reflection of his understanding of what was required, however the process showed his lack of ownership of the curriculum, which ultimately impacted on the implementation pathway that mathematical literacy followed in his actual classroom. Ownership of the curriculum or the lack thereof was evident in Norman's following comment:

*The textbooks are really good and the work has already been done. It is quicker and easier for me to use these examples than setting a test from scratch by myself. Then I would have to worry if I was doing it correctly,*

*if I had set it at the right level. This way, I know that what I am testing is what is required. The pupils do not have access to these books so I am not worried that they will have seen these questions before.*

Observations from Norman's other classes further showed the use of the textbook to be the predominant source of reference in those classrooms as well. This support demonstrates that Norman proceeded to implement mathematical literacy as he would any other mathematics curriculum that is, by using the instructional material that was ingrained in his practice.

What seemed to have resulted in the textbook becoming the frontrunner reference document is that it not only required the least effort from Norman, but also more importantly provided him with security that what he was doing was correct. This is important because Norman is a hard working teacher, and even though he admits it is quicker and easier to use the textbook he is also concerned with knowing that what he is doing is correct. His reliance on the textbook over the curriculum document, that is his reliance on the textbook author's interpretation of the curriculum over his own, can be ascribed to his experience with textbooks of the past-which had served him well.

#### **6.8.1.2 Mathematical Literacy Curriculum**

In the questionnaire Norman indicated that he understood the curriculum document to a large extent. This was refuted by the evidence from the other data points that showed that he had only read parts of one of the chapters of the entire document, namely Chapter 3: Learning Outcomes Assessment Standards, Content and Context. He had referred to this in the beginning of the year for several weeks in order to draw up the weekly schedule that his head of department had requested until he realized that an example of a weekly schedule was also in the textbook. He then never saw the need to refer back to the curriculum as he felt that the textbook had been based on the curriculum and was more than a sufficient reference point.



He did however keep a copy of the curriculum on the book case behind his desk in case the need arose for him to further use it. Why Norman gave preference to the textbook over the curriculum document seems to be based on his entrenched classroom practice of seventeen years. Textbook use dominated his instructional practice in the past, evidently dominated his current practice, and there was no indication that it would not dominate his future instructional practice. The significance of this is that he had never read the curriculum document as a whole and other than realizing that he had to use context in his mathematics teaching continued with the pedagogical style he had always used to date. Furthermore his beliefs with regards to the nature of teaching mathematical literacy also remained unchallenged, since his reading and ultimate understanding of the curriculum was on a surface and disconnected level.

The implementation pathway that mathematical literacy followed in his class was thus mostly based on beliefs and understandings Norman always held, and partly on the textbook interpretation of the curriculum document. The curriculum document provides comprehensive guidelines on the purpose, scope and possibilities of mathematical literacy, however even if read, without appropriate support and explanation it does not imply that it will be understood as intended. Such support could be provided for in teacher workshops, one of which Norman had attended earlier on in the year.

### **6.8.1.3 Workshop Notes**

As discussed earlier, Norman had attended a workshop on mathematical literacy, which he at the time found to be of little relevance. His views were based on the assumption that if you can do the mathematics in the new curriculum you did not require undergoing staff development in the subject. Norman assured me that all he had to do differently was to ensure that he was using contexts in his teaching of mathematics. Norman further admitted that he had never again referred to any of these notes.

Analysis of these notes revealed several sections that may have been useful to Norman in the difficulties he was experiencing with teaching the 'weaker mathematics learners'.

However he did not refer to these, because his focus was the actual mathematics that he believed he knew and did not need to refer to workshop notes to be taught. This narrow approach to teaching can be assumed to be based on years of experiencing similar teaching practices both in how he was taught and how he had taught to date.

Having used the word context in so many of his responses to my questions I wondered how he had come across the term as this might go towards providing an understanding of how he had come to understand it in the way that he did. Once again he replied that he was unsure of when he first encountered the term but indicated that it may have been in discussion with colleagues at the workshop. The following explanation provides an insight on how Norman understands 'context':

*In the past mathematics was taught with examples and formulae and the pupils did not know how any of this was relevant to their lives. With mathematical literacy the mathematics has to be taught with examples that come from real life that is contexts that are of relevance to the pupils.*

His explanation showed a relatively deep understanding of 'context' in mathematics, which raised the question as to why his actual classroom practice lacked this depth? Answering this question may require considering that Norman's instructional practice separates the teaching of content from the context in that once algorithms and formulae have been established they are only then extended into a context. The curriculum requirement is that both content and context are considered as a process and are not to be taught separately. The impact of Norman's pedagogical understanding of the use of context in mathematical literacy is evident in his instructional practice, in the limited use he makes of it. However, this is not the case in his assessment practice.

#### **6.8.1.4 Exemplar Paper**

The exemplar paper that Norman acquired from a colleague a week before the research study began seemed to give Norman the confirmation that he needed in terms of what he was teaching to be right. This perception of Norman's was confusing for an analyses of

the exemplar paper revealed it to be aligned with the curriculum 'mathematics in context' intentions that were not visible in his instructional practice. The exemplar paper questions embraced themes, which were explicitly stated as headings and were of relevance to the learner's lives, engaged mathematics in context throughout, and allowed for reflection in analysing answers.

None of these distinctive traits of the curriculum were used by Norman in any of his lessons, and even his test that showed a somewhat deeper appreciation of the curriculum lacked this obligatory profundity. Had Norman's reaction to the exemplar paper included any sign of questioning his practice it may have resulted in drawing upon the findings differently as his questioning may disrupt Norman's instructional status quo which in turn may have lead to a different and deeper understanding. Lacking in this however, Norman's reaction seemed to further establish evidence that his assessment practice and his instructional one varied considerably in terms of what was taught and what was assessed.

What was taught is content, and what was assessed or would be assessed, as he indicated that he would be using the exemplar paper as the assessment task at the end of the year, was the process of understanding contexts that involve the use of mathematics. Norman believed that this application could be done by his students, despite the fact that they were not presented with similar situations in class. His belief was based on his perception that the ability to do the mathematics implied an ability to transfer this knowledge to contexts that required it.

Why Norman understood the curriculum in the way that he did can also be explained through the way that this curriculum was introduced to him and to his school.

### **6.8.2 Introducing Mathematical Literacy to ERHS**

Mathematical Literacy was introduced at ERHS based on a decision that the school principal took in consultation with the head of the mathematics department. These

discussions did not include Norman and as indicated earlier Norman was given the curriculum document and told he would be teaching the subject at the beginning of that same year. No further discussions took place at the time and Norman said that the departmental meetings never included dialogue on mathematical literacy other than planning to complete the Grade 10 curriculum by year-end. Norman's response was matter of fact and not a grievance, adding that discussion was not really essential, as he understood what he had to teach.

The reason for the absence of dialogue during the introduction of the curriculum between Norman and his departmental head is unclear. Was it simply based on Norman's understanding that he could teach the required content, or was it also an indication that his departmental head did not understand the curriculum any differently? If the later were to be conceded it would raise an important point. If the leadership at Norman's school is not in a position to guide him in implementing the new curriculum, who will?

## **6.9 Learner's Views**

Initially, the design of the study did not include questioning the learners, however several of Norman's responses pertinent to the research questions expressed views on the learner engagement with the curriculum. Wanting to explore if these beliefs of Norman were founded in the actual learner experiences, as they seemingly played a part on how he proceeded to implement the mathematical literacy curriculum, I designed a questionnaire which with Norman's permission and been an option for the learners was distributed to his entire class. Of the thirty-eight learners thirty-six were present that day and thirty-three stayed and responded.

The reactions of the learners challenged several of Norman's judgments. Firstly they all expressed that they were finding mathematical literacy difficult, but opposing what Norman had said they did not point toward reading and context as the problem but rather the actual mathematics itself. They listed symmetry, proportion, graphs and percentages as sources of difficulty with only one learner writing 'the sums are too long'. Secondly, of

the thirty-three respondents only three believed that they could use the work they were doing in the mathematical literacy class in real life, with the balance communicating that they could not see any real life bearing. Thirdly their encounter with the subject did not echo the enjoyment that Norman had spoken about, it spoke about anxiety and stress. I provide some of the responses that take in the governing themes that became apparent in order to lay bare the depth of negativity and stress that the seeming difficulty of the subject was triggering in Norman's learners.

### 6.9.1 Learner Transcriptions

Some people say this is similar to real Maths because Mathematical Literacy is becoming harder and harder. I do not understand what we are doing; it causes so much stress for us.

This year is very different<sup>20</sup>. I cannot understand. Can you please talk to government about this situation of maths, because it gives us stress?

No difference, just much difficult.

No different, in the first term this year I was doing Mathematics and failed so I changed to Mathematical Literacy thinking it would be easier. It is not, I am still failing and now I understand nothing.

It's kind of the same as mathematics from last year, but only much harder. I hate coming to class because I know I won't understand anything.

I think that there is no difference, it is very difficult and upsets me.

*Very difficult and causes me a lot of stress.*

*No difference, but then again maths is not one of my favorite subjects. I hate it.*

It is suppose to be easier but it is not, it is so much harder.

---

<sup>20</sup> The use of 'different' is to previous mathematics instruction.

Its just like maths to me, I understood Mathematics better than literacy, I took literacy to make life a little easier, but it is harder.

Maths has its own people, not us; we cannot even do this easier subject.

It's supposed to be easier for the kids that can't do maths but actually it's just as hard and it's hard for me to do something I don't understand.

*This is a bigger monster than mathematics; we are not robots or geniuses like our teacher.*

Mathematical Literacy is for the people who cannot understand math, some people are not smart enough but now I feel even stupider because I still can't do it.

**That it does not really help and it does not help me because I clearly can't do maths.**

Having read the anonymous student responses Norman looked at me, smiled, and simply said, "I told you so, the subject is way too difficult". Having earlier told one of his classes that this is the 'mathematics of oranges and bananas' his opinions and views seemed to be confused. Was the curriculum easy in comparison to Grade 10 Mathematics of the past, but still having a standard too difficult for the learner's in Norman's class that created this binary viewpoint? How will Norman address the level of difficulty his learners are experiencing? Will all this negativity affect the implementation pathway in Norman's class?

## **6.10 Synthesis**

This chapter described Norman's understandings and perceptions with regards to the new mathematical literacy curriculum, depicted his observed instructional practice, and explored why the curriculum is implemented in the way that it is. When unpacked collectively, these findings point to discontinuities between Norman's understandings of the mathematical literacy curriculum and the actual intentions of the official curriculum.

The continuities that are evident are understood at a surface level; but there are also divergences between his claims and his instructional practice. Additionally, a positive correlation also seems to exist between his surface understanding of the curriculum and the implementation of the curriculum in his classroom.

The understanding Norman holds appears to be firmly rooted in his interpretation of the textbook he is using, the interpretation in turn a by-product of beliefs and pedagogy entrenched in his instructional practice. A further in depth analyses of the findings will be provided in Chapter Eight, which will also include the theoretical underpinnings for these findings.

The next chapter looks into Michael Michaels understanding and perception with regard to the mathematical literacy curriculum and the way in which he proceeds to implement this in his actual classroom practice.