LIST OF ABBREVIATIONS and ACRONYMS

ACE	Advance Certificate in Education
ANA	Annual Numeracy Assessment
BA	Bachelor of Arts
B Tech	Bachelor of Technology
CAPS	Curriculum Assessment Policy Statement
DBE	Department of Basic Education
DBST	District Based Support Team
DoE	Department of Education
EASA	Education Association of South Africa
FFLC	Foundation for Learning Campaign
FP	Foundation Phase
GET	General Education Training
GPLMS	Gauteng Province Literacy Mathematics Strategy
HDE	Higher Diploma in Education
HoD	Head of Department
ILSTs	Institutional Level Support Teams
(LDs)	Learning disabilities
(LSEN)	Learners with Special Educational Needs
LoLT	Language of Learning and Teaching
MD	Mathematical Difficulties
MLD	Mathematical Learning Disabilities
MRP	Mathematics Recovery Programme
NCESS	National Curriculum Education Special Needs and Support

NCS	National Curriculum Statement
NCSNET	National Curriculum Special Needs Education and Training
NLS	National Literacy Strategy
NNS	National Numeracy Strategy
NPDE	National Diploma in Education
OBE	Outcomes Based Education
PD	Professional Development
QSCC	Queensland School Curriculum Council
RNCS	Revised National Curriculum Statement
RT	Reaction Time
SBST	School Based Support Team
SEC	Secondary Education Certificate
SEN	Special Educational Needs
SIAS	Screening Identification Assessment and Support
SLI	Specific Language Impairments
SOEID	Scottish Office of Education Department
STD	Secondary Teachers Diploma
UNICEF	United Nations Children’s Fund
ZPD	Zone of Proximal Development

TABLE OF CONTENTS

Page

APPENDIXES

LIST OF TABLES AND FIGURES

ABSTRACT

This investigation emanates from the realization that Grade 3 children at schools in disadvantaged areas perform poorly in basic mathematics computations such as addition, subtraction, multiplication and division. The aim of the research was to establish the approaches teachers use when teaching mathematics computation. The qualitative approach, together with the research techniques commonly used with it, namely observation, interviews and document analysis was deemed appropriate for the investigation.

The outcomes of the investigation revealed that the multilingual Grade 3 classes made it difficult to assist all children who experienced mathematics problems because teachers could not speak all the other languages that were not the language of learning (LoLT) of the school. Another obstacle that prohibited teachers from spending adequate time with children with mathematics problems was the time teachers were expected to spend on intervention programmes from the Department of Basic Education (DBE) aimed at improving schooling in general. Teachers could not make additional time that could afford children the opportunity of individual attention.

With regard to the approach used for teaching mathematics, this study established that the teachers used the whole class teaching approach which is not a recommended approach because each child learns differently. It is recommended that teachers use a variety of teaching methods in order to accommodate all children and also encourage children to use concrete objects. It is also recommended that teachers involved in the SBSTs should consist only of members qualified in the subject and once these children are identified, remediation should take place promptly by their being enrolled (children) in the proposed programme.

Finally, this study could benefit foundation Phase teachers in teaching mathematics based on the proposed strategy outlined after teachers' challenges were identified. The outcome of the study could also be of value to the DBE, especially with curriculum designers

CHAPTER 1

ORIENTATION TO THE STUDY

1.1 INTRODUCTION AND BACKGROUND

There has been a growing recognition of the importance of the early years for the acquisition of mathematical skills in South Africa. The realisation that a strong foundation is needed if children are to be successful in learning mathematics at higher grades prompted the Department of Basic Education (DBE) to conduct systematic evaluations in mathematic competency at primary schools. Although the poor outcome of the Annual Mathematics Assessment (DBE 2012) is symptomatic of dissatisfactory performance levels in the Foundation Phase research at this level remains scant indicated good mathematical skills later in the school in numerous studies (Department of Basic Education, January 4 (2012:3).

Numerous studies in mathematics (Fricke, Horak, and Meyer 2008; Le Roux 2008; Themane, Monyeki, Nthangeni, Kemper and Twisk 2003) have been conducted in South Africa but the focus has always been on secondary schools. Often the investigations concentrated on classroom variables such as teaching resources and text books that could influence performance but not on teacher attributes that could impact negatively on successful learning. The contention is that the cumulative effect of this oversight can compound into serious mathematics learning problems at higher grades and needs to be addressed early in the child's schooling. It is also important to pay attention to specific difficulties experienced in teaching or learning mathematics in order to propose effective solutions to the problems.

This study emanates from the recognition of problems in the teaching and learning of mathematics in Grade 3 classes of some schools at disadvantaged areas of the Tshwane South District. The particular problem noted is the children's inability to perform basic operations in mathematics. They lack the ability to perform computations such as additions, subtractions, multiplication and division. The concern is if the problems are not addressed in the Foundation Phase it might be too late to deal with them in the higher school grades. In fact it is known that the performance in mathematics at Grade 12 is poor as seen from the TIMMS results (DBE 2012).

With regard to problems in addition operations, a significant number of children are unable to carry units over to tens and tens to hundreds. An example of the error they commit is illustrated below:

247 + 165 = 302.

The error is a reflection of the children's inability to carry over from the units to the tens. The child correctly add 7 + 5 to get 12 but fail to carry 1(ten) over to the tens. This explains why in the *tens* the answer is 0 and not 1. The child add 4 + 6 to get 10 (with a loss of 1[ten] from the units). The child also fails to carry from the tens to the hundreds. The addition 2 +1 = 3 is not wrong but it is not the correct answer because the children do not carry to the hundreds.

The correct answer to the above computation is as follows:

247 + 165 = 412

A similar error emerges when subtraction is performed. The child is unable to borrow from the tens to the units and from the hundreds to tens. A common mistake in subtraction is to subtract the smaller number from the bigger number irrespective of the position of the number in the computation. For example:

365 – 129 = 244

The above computation is incorrect because the child subtracted 5 from 9 and not vice versa as should have been. Although the child could subtract 2 from 6, the computation is incorrect because the child did not borrow 1 (ten) from the 6 to the units. The correct answer to the above computation is as follows:

365 – 129 = 236.

When children continuously make the same mistakes as referred, the mistakes compound into major problems that persist into the higher standards. The children incorrectly generalise productions and modify the rules to fit the new problem, especially when they do not know what to do (Mc Devitt and Ormrod 2010:375 and Schunk (2004:414). The approaches that the teachers use when teaching mathematics also do not address all the challenges that the children face.

Mastery of addition and subtraction computations is basic to later success in mathematical work, because the understanding of multiplication and division are based on the primary concepts of addition and subtraction. For instance, multiplication repeats addition and division repeats subtraction. These two operations are basic for all further learning in mathematics, and without their accomplishment, the chances of a child acquiring higher order mathematical skills would be limited (Schunk 2004:414).

Lemaire and Siegler (1995:89) assert that there are different types of errors that children make in multiplication. The following example demonstrates how operational errors can occur when multiplication is done with single digits. The following is an example:

$231 \times 2 = 233$

The answer to the above computation is incorrect because the child confused the multiplication sign for the addition sign and added 1 + 2 to get 3 instead of multiplying 2 by 1 to get 2.

Furthermore the child brought down the 3 from the tens and the 2 from the hundreds without performing any operation.
The correct answer is:

$231 \times 2 = 462$.

When performing the function of division, children should know that division is the only operation that starts from left to right. With addition, subtraction and multiplication operations start from right to left. However this is problematic with most children as can be seen from the following example:

$34 \div 2 = 12$

The initial step of knowing that the divisor, 2 goes once into the dividend 3 is correct. However, the child did not subtract the 2 from 3 as expected. The child continued to use the divisor, 2 into the dividend 4 to get 2 hence the erroneous answer of 12.

The correct answer is as follows:

$34 \div 2 = 17$.

According to Dowker (2005:324), it is important to identify early signs that may indicate problems and to amend the situation in good time to prevent future Mathematical difficulties (MD). Dowker indicates that at the lower levels of the Foundation Phase, the problem is associated with arithmetic as the children would not have started mathematics yet.

In many countries various intervention methods have been used to ameliorate the poor Mathematics performance. For instance, most teachers focused on testing the mathematics abilities aptitude of the children (Fuchs 2003:174-177). Researchers such as Woodward and Brown (2006:151) focused on low income and ethnic diverse children with mathematics difficulties. They found that attention is once more focused on children and not teachers.

It is important to develop teacher skill because with successful training, children can gradually develop counting skills when solving mathematics problems. It is important therefore to establish what support has been given to South African teachers in the Foundation Phase because behind the success or failure of every child there is a teacher. This is the rationale for proposing a programme for assisting teachers to help children who experience difficulties with mathematics.

In this chapter a brief explanation about how the researcher became aware of the problem will be explained. This background will provide more clarity to the problem and will outline the researcher's perspective on addressing teaching problems in mathematics. The discussion will be followed by the exploration of the problem where the mathematics problem will be further conceptualised. The aim of the study will be preceded by the research questions and followed by an explanation of the methodology that will be used to conduct the research. An indication of the delimitation of the study will be followed by the definition of concepts and ultimately an outline of chapters in the study. The concluding paragraph will sum up the chapter and indicate what will be discussed in the next chapter.

1.2 CONCEPTUALISATION OF THE PROBLEM

The acquisition of numeracy skills in the Foundation Phase is viewed as fundamental to successful learning in later phases especially in Grade 12. Mathematics literacy is also important in work environments after school. Being numerate and functionally literate can open doors to good employment and could lead to economic independence, good parenting and good citizenship.

Mathematics literacy is needed in the development of entrepreneurial skills. For example, builders need to calculate the number of bricks they would need to build a wall and business administration learners use mathematics knowledge to calculate stock in the business (Coffey, 2011:30). It is important therefore to promote mathematics skills as early as possible.

In this regard, Alexander (2011:44) refers to two recommendations that will be made to develop mathematical skills in the early years. The first recommendations suggested that, policymakers, childcare experts and parents could intervene and reduce the risk of mathematics illiteracy. The rationale behind this recommendation is that children from low and middle income groups should receive preschool or early childhood education programmes in order to have a good start in education. It is argued that most of the basic problems begin in early childhood before the second birthday, but the consequences stretch into adulthood resulting in social, economic and educational inequality within the nation and between South Africa and other nations. Poor nutrition, maternal and family stress and poverty are cited as being responsible for affecting brain development from the prenatal period or earlier (Alexander 2011:44).

Although this study is focused on Grade 3 children, it is acknowledged that the problem could have manifested in the earlier stages and it could complicate with time. Evidence coordinated by the Global Child Development Group with support from the United Nations Child's Fund (UNICEF 2006:11), indicated that the results pertaining to South Africa will be similar to those internationally. Children from poor backgrounds will be found to be particularly challenged because risks that occurred in the past could have a cumulative negative effect on the children's mathematics ability.

The report is alleged to be full of high impact, cost effective solutions. But the two most well investigated solutions are said to be early education centred programmes such as group sessions or home visits. The research is very clear regarding the significance of educating mothers and the importance of the need to support parenting at home. This kind of backup includes good quality preschool tuition, conditional cash transfer schemes such as child grants and educational media. These are some of the elements suggested to tackle the risks that affect mathematics and all the learning of children from disadvantaged environments (UNICEF 2006:16).

In the past five years, South Africa is alleged to have made great progress in this regard, according to UNICEF's representative in South Africa, Aida Girma. (Alexander 2011:44). She charges that the number of children enrolled in early childhood development centres has increased from 16 to 43 percent. The research makes it clear that if investments are made continually, the results thereof would be substantial (Alexander 2011:44).

It is vital for South Africa to continue with this trend in rural areas as well as informal settlements in urban areas where communities live in poverty and to help give children a better start to education and a possible remedy to difficulties in mathematics. This is what this thesis argues given that the schools that participated in the UNICEF research will be found to be in similar conditions and circumstances as the schools in this research resemble to a great extent.

Pendlington (2006:3) opines that self esteem is based on two ideas that we acquire by experience as we learn about ourselves and the environment surrounding us. It constitutes ideas about our competence and the values of our communities. The argument in this study is that if we perceive ourselves to be worse and unable to reach the values set by our societies, then we have low self- esteem. In the teaching of mathematics, low achievers do not receive praise like successful children do. Thus they develop the idea that they cannot do mathematics and begin to label themselves as "stupid" and "bad at mathematics". This becomes a vicious circle in life (Pedington 2006:3).

Failure to be numerate or successful in mathematics can thus lead to the development of low self- esteem in children and if not identified and remedied at an early stage, a child would go through life with a lack of self- worth. Such a child would also not be able to do basic things in life like counting money and she or he would lack skills and become unemployable, leading to further problems in the future. This argument is supported by Schminke, Maertens and Arnold (1978:338) who assert that such children meet little success in school and develop a lack of self- esteem, negative attitudes and recurring poor performance, which becomes a vicious circle.

Since language is an important factor in the learning of mathematics it is important for children to posses this skill too. The understanding of both the spoken and written words is made difficult by the complicated and ever changing interactions among phonological processing, syntax structure and semantic variation inherent in the words used to convey meaning" (Morin and Franks 2010:111).

The researcher agrees that it is important for teachers to have knowledge of the various ways in which language is used because of the important role language plays in early learning experiences. Teachers need to understand the differences between what is said and what is meant in order to use language effectively in teaching. In other words, the use of language should be kept very simple. The problem lies in the fact that many children, especially those from poor backgrounds, like those discussed in this study, come to school with little knowledge of the language of learning. Consequently those, children experience learning disabilities (LDs) or specific language impairments (SLIs) which often lead difficulty in performing mathematical tasks (Morin and Franks 2010:111).

Children coming to school for the first time and coming from disadvantaged communities, also a lack preschool education. Thus they have serious language problems and this negatively affects their learning of mathematics. To make the situation worse some come into contact with the language of teaching for first time at school. If this problem is not attended to earlier, such children would experience learning difficulties throughout their lives.

Pal (2009:8) maintains that disadvantaged children (who come from poor environments and economic backgrounds) are more likely to perform poorly at school because of their "different home environments and the practices of school mathematics that do not align with knowledge, skills and dispositions that these (children) may bring to schools". Pal (2009:8) further alleges that children, who stem from disadvantaged groups such as those from poor urban settlements, are more at risk to finding learning mathematics being a complex process because of their varied socio-cultural experiences and lack of "out-of-school" educational support. Therefore, lack of pre- school experience and language training places these children in an untenable situation in their education right from the beginning.

The question that arises in this study is:

Which approach do teachers use when teaching mathematics computation?

Subsiding questions that could assist in answering the research questions include:

- How do they solve the problems?

- How did teachers identify children who experience mathematics difficulties?
- Which aspects of mathematics were most problematic?
- What else do they do to help children understand mathematics computations?

1.3 AWARENESS OF THE PROBLEM

The researcher became aware of the problem during her years of teaching Grade 3 at one of the primary schools in Mamelodi Township. There was a clear indication that children did not posses knowledge about mathematical operations of addition, subtraction, multiplication and division. Teachers experienced difficulty in trying to help children to gain insight. The School Based Support Team (SBST) responsible for giving assistance to teachers approached the researcher for help since the researcher had acquired a Diploma in Special Educational Needs and specialised in supporting children who experienced difficulty in the learning of mathematics.

The researcher applied the remediation principle of starting from the known to the unknown and this approach yielded positive results to a minimum extent. The content of teaching started from the previous grades and gradually progressed to the Grade 3. At the end of the intervention minimal success was achieved. When operational mathematics problems persist even if additional support is given, it becomes imperative to undertake research that will lead to a solution of the problems.

1.4 STATEMENT OF THE PROBLEM

Mathematics underperformance has become a concern in South Africa. This is evidenced by the report of the former Minister of Education Naledi Pandor. She stated that only 35% of children in South Africa could read, write and count The Star (November 2008:6).

- According to the Global Competitiveness Survey of the World Economic Forum out of 131 surveyed countries, South Africa was ranked 128 for the quality of its mathematics and science education (Pottinger 2008:81). Between 1998 and

2005, education in South Africa improved quantitatively but not qualitatively in comparison with other developing countries (Pottinger 2008:134). As from 1998, the number of children in South African schools has increased but not the output as indicated by the Grade 12 results. If children experience challenges in mathematics in the Foundation Phase, they might experience serious problems in Grade 12 later.

- The trends in the International Mathematics and Science study in 2003 showed that South Africa was at the bottom of the pile of 46 participating countries. It was even lower than Ghana, Saudi Arabia and Botswana to mention but a few (Pottinger 2008:138). According to Reddy (2003:17), South African children achieved significantly poorer results in mathematics than all other participating countries, including Morocco and Tunisia, and will be on average older than all other children.

- The analysis in the Star (29 June 2011:6) highlighted that all South African children in the nine provinces, estimated at 5 million, wrote a common paper in mathematics and only 17% managed to score above 50% (Appendix: A for the results).

1.5 THE AIM OF THE STUDY

The aim of this research is to identify approaches teachers use when teaching mathematics computation.

1.5.1 Secondary aims

- To establish how teachers resolve children's challenges in mathematics computations.
- To establish how teachers identify children who experience difficulties in mathematics.
- To establish which aspects were more problematic.
- To establish what else teachers do to help children understand mathematics computations.

1.6 RESEARCH METHODOLOGY

The investigation in this study was conducted by means of qualitative research. The design, method, data collection and analysis are briefly outlined below.

1.7 RESEARCH DESIGN

The case study was chosen as a research design for this study. Creswell (2010:75) and McMillan and Schumacher (2010:20) state that a case study describes the procedures for conducting the study, including when from whom, and under what conditions the data will be obtained. In other words, the research design indicates the general plan: how the research is set up, what happens to the subject, and what methods of data collection are used.

1.8. METHODS OF RESEARCH

The investigation in this study was conducted by means of the qualitative method of research. According to Henning (2004:3), a qualitative approach emphasises participant observation and in depth interviews, makes it possible to obtain first hand information.

Furthermore, as Creswell (1998) emphasises that the reasons for using the qualitative research method allows participants to explain and to give their views. In the case of this research the method will assist in identifying the source of the problem and how teachers have grappled with it.

To the researcher also, such an approach assists in gaining an understanding of children who experience difficulties to learning. The research questions in the study describe what is needed to determine why teachers have difficulties in mathematics teaching. The qualitative method allows flexibility throughout the research process. In this method, the researcher does not follow the standardised rules but decides what to do next as the problems arise.
The methodology for this study was discussed in further detail in Chapter 4.

1.9 RESEARCH TECHNIQUES

Research techniques such as observations, interviews and document analysis will be used to collect data in answering the research questions.

1.9.1 Observations

The advantage of the observations in this research is that it will present an opportunity to gain insight into the problem. The researcher gains insight into the participant's views, develops relationship with them, and allows the researcher to hear, see and begin to experience reality as participants do. The researcher will also learn from own experience and own reflections, which form part of the emerging analysis. Lewins, and Silver (2007:10-11) outlined the advantages of observation.

1.9.2 Interviews

The interviews were used to access more information on approaches teachers use when teaching mathematics. The mode of inquiry will be interactive so as to inquiry constitutes as in depth study using face to face techniques to collect data from people in their natural setting (McMillan and Schumacher, 2010:360).

1.9.3 Document analysis

Documents and records are a useful and valuable source of evidence and will provide background information on the topic (Henning, Van Rensberg and Smit, 2004:99; McMillan and Schumacher, 2010:360).

1.10 SIGNIFICANCE OF THE STUDY

Most research on the teaching of mathematics is undertaken at high school level and not in the Foundation Phase. This research will contribute on the scant information of teaching information about teaching mathematics in this phase. The research could lead to the provision of practical skills for assisting teachers to teach mathematics with success. Mallows and McNeill (2005:5) assert that, in order for teachers to address needs more effectively, they need to upgrade their skills and subject knowledge. Consequently, teachers of mathematics need to consider methods of teaching that would engage the children and enable them to acquire language and number skills so that they understand what is being taught in class (Mallows and McNeill, 2005:5).

Kaufmann, Handl and Thony (2003:565) argue that faulty or the absence of conceptual knowledge might hamper the successful acquisition of calculation skills. Learning by rote procedural skills, without achieving insight is also a problem in mathematics learning. This study will provide information that will help most teachers understand how to approach and address mathematics problems in their classes. Mallows and McNeill 2005:5) and Kaufmann, Handl and Thony (2003:565).

If learning difficulties are identified at the Foundation Phase level, children will stand a good chance of performing well in subsequent years and if they leave school earlier due to other reasons, they will be mathematically functional citizens. The ultimate aim of this study is to produce a programme that will guide teachers on how to teach children who experience problems of calculation. Problems will be better understood because they would have been observed in their learning environment.

Early intervention programmes partly prevent the development of negative attitudes and mathematics anxiety (Dowker 2004: iii). Some intervention programmes are aimed at preventing educational difficulties from increasing, particularly among children from low socio - economic groups (Dowker 2004: iii). In addition, there are individualised components based interventions projects that consider the strengths and weaknesses in “specific components of arithmetic”, for example, the way mathematical rules and strategies are used, including the misapplication of rules. The individualised projects are totally individual, in which some include small group work (Dowker 2004: iv).

The policy, National Curriculum Statement, (NCS 2005: 8) emphasised that the purpose of assessment is to monitor the progress of children. In addition, good assessment indicates whether children are performing to their full potential and making progress towards the level of achievement required for progression.

1.11 DELIMITATION

The study was confined to the schools in Mamelodi (Tshwane South District**).** It focused only on grade 3 classes and teachers. This study focused only on Grade 3 mathematics.

1.12 DEFINITIONS OF CONCEPTS

The following concepts, usually referred to in this study, are simplified and explained:

1.12.1 Barriers/Difficulties

The South African Consultative Paper no.1 (1999:3) assumes that difficulties are “those factors which led to the inability of the system to accommodate diversity, which led to learning breakdown or which prevent children from accessing educational provision”.

1.12.2 Mathematics

According to Coffey, (2011:3), mathematics refers to the kind of lower-level mathematical skills one may need to use daily, for instance, calculating costs and change in transactions, basic percentages, averages or company weights. Gough (2001:32) alleges that “Mathematics is the use of primary school Mathematics classes, and outside of school, possibly including using it in everyday situations at home, during recreation, and in common non-technical non specialist work-place circumstances”.

Fletcher (2006:29) claims that mathematics is a broad domain which includes among others algebra, geometry, arithmetic, calculus and trigonometry. On the other hand, Geary, Carmen and Hoard (2000:238) define arithmetic as adding and subtracting single digit numbers. Askew, Rhodes, Brown, William and Johnson (1997: 10) regard mathematics as an ability to process, communicate and interpret numerical information in a variety of contexts. In this study Mathematics difficulties will be referred to as difficulties that disable the child from solving mathematics difficulties.

1.12.3 Children

The South African NCSNET and NCESS (1997: vii) argue that the term “children” refers to all children, ranging from early childhood education through to adult education. The terms “pupils” or “students” at school and higher education levels are therefore replaced by the term “children”.

1.12.4 Learning barrier

A child has a learning barrier when he experiences “significantly greater difficulty in learning than the majority of children of his age and having an impairment that prevents or hinders him from making use of educational facilities of a kind generally provided in school, within the area of the education authority concerned, for children of his age” (Stakes and Hornby 2000:11).

1.12.5 Foundation phase

This refers to grade R to 3, and includes children from six to nine years of age. The Foundation Phase is a four year phase, starting with grade R (reception year) to grade 3. The most important subjects in this phase are Life Skills, Mathematics and Literacy. This study will focus on the learning and teaching of mathematics in this phase.

1.13 CHAPTER OUTLINE

The research problem is studied, described and explained in the following chapters:

Chapter 1: Introduction and background of the study

The introduction and background of the research that furnishes the theoretical basis of the research informs the reader about the background of the problem, an awareness, exploration and statement of the problem, the research questions, the aim of the research and the research methodology. It also indicates the research approach to this study.

Chapter 2: Literature review

This chapter constitutes the literature review that will strengthen the theoretical basis of the study the issue of the different approaches teachers use when teaching mathematics computations, how the teachers solve the problems, how the teachers identifies children who experience mathematical computations difficulties and. Mathematics curricular in South Africa.

Chapter 3: Different mathematics intervention programmes

This chapter covers the different mathematics intervention programmes used in various countries.

Chapter 4: **Research design and methodology**

This chapter discusses the research design and methodology that was used to carry out the research presented. The research design was used together

Chapter 5: Data analysis and interpretation

Chapter five will cover data analysis and interpretation. It will be the most comprehensive of the entire study and will also contain a built – in literature analysis to support the study's thesis. It covered the analysis of the five interviews questions conducted in the gathering of data for this study namely, Which approach do teachers use when teaching mathematics computation?, How do teachers solve children's challenges in mathematics computations? How did teachers identify children who experience mathematics difficulties? Which aspects of mathematics were most problematic? What else do they do to help children understand mathematics computations?

Chapter 6: Conclusions, Recommendations and Limitations of the study

The main findings of this study which emanates from the literature study and empirical data were summarised and recommendations of further research flowing from these findings were made in this chapter. Finally, limitations of the study were discussed.

1.14 CONCLUSION

This chapter set the introduction and background, conceptualisation of the problem, awareness of the problem, statement of the problem and the aim of the study. The study further explores the research methodology, methods of research, research techniques, observations, interviews, document analysis and significance of the study. Finally the study indicated the delimitation, definitions of concepts, chapter outline and chapter summary. In the next chapter, the theoretical framework within which the research will be conducted will be discussed. The literature review will be in the next chapter and will strengthen the basis of the study.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

"All children should be taught Mathematics because it is a very important and necessary life skill that cannot be done without (Burger (Editor) 2009:11)".

One way of addressing problems of teaching mathematics in the Foundation Phase is to review literature on similar problems. In chapter 1, the aim of this study was to establish the approaches teachers use when teaching computations in mathematics, to establish other difficulties teachers experience when teaching mathematics computations, to establish which aspect of mathematics that is most problematic and also to establish how teachers resolve the problem with the aim of developing a support programme for Foundation Phase teachers.

The purpose of this chapter is to discuss what other researchers say about theories in the teaching of mathematics in foundation phase, the constructivist approach, the importance of constructivist theory in the study and the influence of constructivism in foundation phase learning. The chapter also investigates the identification of mathematics difficulties in children.

The chapter discusses mathematics: as a universal problem, various misconceptions about mathematics teaching, language issues in the teaching of mathematics, teacher challenges in the teaching of mathematics, teacher development for addressing mathematics problems, teachers' mathematics knowledge, mathematics teaching approaches, the mathematics skills approach, the mathematics conceptual approach, the mathematics problem solving approach, the mathematics investigative approach, mathematics: the enjoyable way, child related factors in the teaching and learning of mathematics. The chapter further highlights the child's conceptual knowledge, child led family, the acquisition of early mathematics, children' early mathematics – England, children' early mathematics – people's Republic of China, children' early mathematics in France. The chapter concludes with grade 3 mathematics curricular in South Africa, the revised national curriculum statement (RNCS, national curriculum statement (NCS), curriculum and assessment policy statement (CAPS), specific aims for foundation phase mathematics and the chapter summary.

2.2 THEORIES IN THE OF TEACHING MATHEMATICS IN FOUNDATION PHASE

The intention of this section is to provide an overview of theories of learning suggested by theories in relation to the learning of mathematics. Theories help teachers to conceptualise learning communication, promote interpersonal relationships between teachers and children, help teachers to implement professional ethics and exert an impact on how teachers regard themselves.

According to Illeris (2004) and Ormrod (1995), learning is generally explained as a process that involves the emotional, cognitive and environmental influences and experiences for gaining, enhancing, or making changes in a person’s values, skills, knowledge, and world views. A learning theory is an endeavour to explain how animals and human beings learn, thereby helping to understand the inherently complex process of learning.

Learning theories have two main values, according to Hill (2002). On the one hand, they provide us with vocabulary and a conceptual framework to interpret the examples of learning that we observe. On the other hand, they suggest where to look for solutions to practical problems. Theories direct attention to the variables that are important in finding solutions, but do not themselves give the answers.

Learning theories fall into three main categories, namely behaviourism, cognitive theories and constructivism. Behaviourism concentrates only on the objectively observable aspects of the learning process, while cognitive theories go beyond that to explain brain based learning, and constructivism regards learning as a process in which the child builds new ideas and concepts actively (Vaill, 1996:42).

2.2.1 THEORETICAL FRAMEWORK

According to Henning, van Rensberg and Smit (2005:25) a theoretical framework is a lens on which the researcher positions his or her study. It helps with the formulation of the assumptions about the study and how it connects with the world. It is like a lens through which a researcher views the world and orients his or her study. It reflects the stance adopted by the researcher and thus frames the work, anchoring and facilitating dialogue between the literature and research.

This research is framed within constructivism theory because the aim is to understand chow teachers teach children to actively construct new ideas and derives meaning from them. This also implies that the child should be able to explain what he has learnt or to be able to practically apply the knowledge gained. For instance, the child should be able to use the knowledge gained in a lesson on addition to count the number of marbles he has. The theories that influence the way mathematics should be taught are discussed below.

A constructive theory places the child in a much more active role in the learning. Learning is not “swallowed whole” but it is modified and transformed based on the child’s cognitive structures, social interaction, previous learning, and environment. Interaction with, and manipulation of, mathematical programmes is seen as critical to the development of mathematical knowledge, which is in the state of development and modification (Kutz, 1991:10).

Donald, Lazarus and Lolwana, (2010:81) contend that constructivism is a view of knowledge as being actively constructed (by individuals, groups and societies), not simply transferred. The scholars further state that it constitutes the interest and the will to achieve, or to take on anything. Constructivism sees human beings “as active agents in their own learning”. The idea is that knowledge is not passively received but actively constructed. Through engaging in experiences, activities, and discussions which challenge the children to make meaning of their social and physical environment, children are actively engaged in building a progressively more complex understanding of their world. (Donald et al., 2010:80 and Schunk, 2004:286).

For Moodley, Njisane and Presmeg (1992:26) argue that within constructivism “We see what we understand rather than understand what we see. Man’s drawings of reality and interpretations of situations reflect the internal organisation of his network of ideas.” Thus the scholar’s advice on following objectives when discussing constructivism:

- to discuss different kinds of learning
- to show the way we learn is also determined by the kind of knowledge we know
- to indicate alternatives to the usual one way communication from teacher to child
- to show that meaningful learning takes place if children are given an opportunity to :
    - (a) use manipulatives in the acquisition of new ideas,
    - (b) read and write freely about what they are learning or have learnt,
    - (c) speak to the teacher about new ideas,
    - (d) construct their own knowledge through acting out, writing or describing their understanding,
    - (e) show that it is in the nature of thinking that misconceptions arise,
    - (f) show the new role of teaching is that of facilitating the child’s construction of his knowledge,
    - (g) indicate a new avenue of evaluating learning through interviews and the use of physical media.

The above discussions are pertinent for this study and do concur with how teaching and learning of mathematics are envisions for the South African children as embraced in the curriculum. As a result, the researcher in this study agrees with Moodley et al. (1992:36) about the following:

- Constructivism emphasises the active role of the child in constructing knowledge. The fact that the mind constructs knowledge means that our understanding will be limited by our perceptions. It is no wonder that children have misconceptions in mathematics, which are highly resistant to teaching. In order to replace misconceptions we need to construct a new knowledge that is commensurate with our experience.

- Constructivism encourages dialogue between the child and the teacher with a view to providing an opportunity for the child to construct his knowledge. Emphasis is placed on the importance of a two-directional flow of information between the teacher and children. Through this dialogue, real communication may take place.
- The role of the teacher is to listen to the children and accept what they say and try to understand what they are doing in an atmosphere of emotional and psychological safety. Teaching also has to nurture and promote the formation of more effective and adequate constructions.
- A different approach to teaching have to be blended with the constructive ones, as it is only then that the teacher can appreciate children's difficulties and the manner in which they interact with a given field of knowledge. As has already been noted, constructivism demands that teachers shift from "telling" children to negotiating meaning with children.

Van de Walle (2006:4) states that constructivism suggests that we cannot teach children by telling. Rather, we must help them to construct their own ideas by using what they already know. However, children are not left alone hoping that they will luckily discover new numerical ideas. On the contrary, the teacher's conduct when teaching the class plays an enormous role in what is learned and how well it is understood. Van de Walle (2006:4) adds the following three factors that influence learning:

- **Learner's reflective thinking**

Constructive theory, encouraged children's reflective thinking. For a new idea to be interconnected in a rich web of interrelated ideas children must be mentally engaged. They must find the relevant ideas they possess and bring them to bear on the development of the new idea. For example, children can share and explain how they arrive at the answer.

- **Social interaction with other children in the classroom**

Reflective thought and learning are enhanced when the child is engaged with others working on the same ideas. An environment is needed in which children share ideas and results, compare and evaluate strategies, challenge results, determine the validity of answers, and negotiate ideas on which all can agree. Vygotsky (1978) focused on social interaction as the key component in the development of knowledge. For example, children learn more easily when they learn from their peers and when they are not afraid to ask questions.

- **Use of programmes or tools for learning (manipulatives, symbolism, computer tools, drawings, and even oral language).**

Hiebert and his colleagues (1997) argue that the concept of this programme should be expanded to include oral language, written symbols for mathematics, and any other tools that can help children think about mathematics. For example, the automatic constant feature of a calculator can assist children in the development of skip counting and pattern recognition.

- **Constructivism and understanding of cognitive development in children**

One of the scholars within the constructivism theory is Vygotsky (1978). Vygotsky has helped us to understand that the development of cognition in the young, and the social construction of knowledge itself are related processes. Both involve the construction and transmission of values, information, and ways of understanding through processes of social interaction (Donald et al., 2010:81). Vygotsky (1978) stresses the role of the mediator in the developmental construction of knowledge. His concept of the zone of proximal development (ZPD) incorporates the notion of active agency on the part of the child. He helps us to understand that knowledge in general is not passively received (Donald et al., 2010:80). Thus children provide feedback orally or through written work.

It is necessary only to show how the constructivist tenets can be used by Foundation Phase teachers and those that will demonstrate that children understand effectively.

During this stage, the child's thoughts are related exclusively to concrete and actual things, but they cannot reason abstractly (Slavin, 2009:34). Slavin (2009:37) points out that the child at this stage can form concepts, see relationships, and solve problems, but only as long as they involve objects and situations that are familiar.

2.2.2 The influence of constructivism in foundation phase learning

Van de Walle (2007:28) alleges that the theory of constructivism suggests that teaching does not imply transferring information to children. Furthermore, he explains that learning is also not a process of passive imbibing of information from books or teachers. He alleges that children construct meaning themselves when the teaching and learning process is based on an interactive classroom situation in which children are actively engaged in learning (Van de Walle, 2007:39).

In active learning, the children handle concrete objects to better understand and gain knowledge. The children will also use their own words to explain the information gained from their engagement with the milieu. In this manner children are afforded an opportunity to develop the acquired knowledge and understanding through active learning. By discussing their actions and how they solve the problems, their numerical knowledge is enhanced (DoE, 2003:65).

Van de Walle (2007:6) charges that in contrast to the traditional classroom, constructivism advocates interaction in the classroom where children are actively engaged in the process of constructing numerical knowledge and understanding. This is in line with outcomes based education (OBE) aims and constructivism methods.
The outcomes-based and constructivism methods form the basis of the numerical curriculum (DoE, 2003:1).

The approaches of the proponents of both OBE and constructivism to learning stress that children should be viewed as the central point in the learning process. Children should take the initiative in constructing their own understanding of numerical concepts that will allow them to handle numerical activities with full confidence (DoE, 2003:8).

Such children will be able to use numerical tools to solve problems. Van de Walle (2007:13) also claims that the layout of a reformed numerical environment designed with concrete objects will encourages children to engage in practical activities.

(Vaill, 1996:42) also suggest that the constructivist learning environment should be enhanced by interactive displays of resources that will encourage active learning. By collecting concrete objects, children will be able to count and explain how many objects they possess. Thus children will develop the concept of quantity. For example, by comparing their objects (collected), they will be able to tell who has more or less objects (DoE, 2002:8). Van de Walle refers to this process of handling objects by children as engaging in the process of "doing" mathematics.

According to Van de Walle (2007:30), the classroom environment that is well matched to the theory of constructivism should be characterised by children having their own ideas, realisation and sharing with others, respect for the ideas of others, realisation that mistakes are an opportunity for growth as they are uncovered and explained, and coming to understand that mathematics makes sense.

Van de Walle (2007:14) argues that in the constructivism mathematics class, teachers encourage children to "work in groups, in pairs or individually" to share numerical ideas. As they reason and explain, they understand numerical concepts and improve performance in mathematics.

Whitin and Whitin (2006:200) and Marr (2000:57) argue that teachers who believe that language is an important learning tool that helps children to communicate numerically and construct their own understanding of numerical concepts, use group work and pair investigation in the classroom. They further allege that the report back sessions provide children with the chance to discuss their tasks and their involvement in them. These feedback sessions also give children the opportunity for practical involvement and thus a chance to gain confidence.

According to the Professional Standards for Teaching Mathematics, as alleged by Van de Walle (2007:5), teachers must make a shift from a teacher centred to child centred approach in the teaching of mathematics.

They further claim that child centred classes refer to classroom practices and activities that focus on the involvement of children. The principles of constructivism classrooms Van de Walle (2007:14) claim that the practice of active participation in learning activities is an effective way to enable Foundation Phase children to understand numerical concepts.

This is consistent with how South African teachers are expected to teach. Their roles include facilitation, mediation and support of learning. As facilitators they should always view learners as active participants in the learning process. Should learners experience barriers in this process, teachers are expected to mediate through learning support processes.
The above discussion is relevant for the teaching and learning of mathematics within the foundation phase.

2.3 IDENTIFICATION OF MATHEMATICS DIFFICULTIES IN CHILDREN

Croark, Mehaffie and Greenberg (2007:3) and Joiner (1978:4) have clearly documented that the early identification of children who experience difficulties to learning is of critical importance in enabling such youngsters not only to make greater progress but to become participating members of society. It is important to identify children who experience difficulties to learning as early as possible so that services can minimise or eliminate learning difficulties. On the other hand, it is important to avoid placing harmful labels on young children that lead to lower expectations for achievement. If children who experience difficulties to learning can be identified during early childhood development, they stand a better chance of success since the problem can be addressed.

Steele (2004:75) further supports the notion that early identification of learning mathematics difficulties provides a foundation for later learning and academic success experiences for children at risk. He also claims that if children who experienced difficulties to learning are identified in the early childhood years, it is much more likely that they will have the opportunity to develop to their true potential. Early identification also prevents secondary difficulties from occurring and children who are identified early will have a greater chance of not developing secondary difficulties, such as frustration and anxiety.

Early intervention implies some socio-economic benefits in that prevention or early treatment of developmental problems in young children may reduce more serious, burdensome difficulties with which society may need to cope later, including the accompanying costs.

If children who experience difficulties to learning are not identified early, the learning difficulties continue, which could lead to children dropping out of school, exhibiting behavioural problems and developing greater academic deficiencies.
In addition, early identification of learning difficulties will improve educational opportunities and outcomes for all children with complex needs or particular types or patterns of difficulty in learning in the ordinary school system. Even though every day teachers are faced with children who fail or drop out of school, this does not mean that these children are not capable of doing anything.

Possibly these children might not be able to see well, or may have hearing problems, or handwriting difficulties. For example, children with handwriting difficulties may experience difficulty in keeping up with copying, especially when viewing the material from a distance (such as when they are copying from the chalkboard). They may also experience difficulty in spatial organisation when writing or copying. The child's writing of words or numbers on a page may go upward or downward, or may be cramped too close together or spread too far apart. The child's letters or numbers may appear distorted or rotated (Guerin, 2006:45 and Pierangelo, 1994:74).

2.4 MATHEMATICS: A UNIVERSAL PROBLEM

The problem of poor mathematics performance is not only experienced in South Africa, it is universal (Reddy, 2003:17). In an attempt to address this problem in Australia, Van Kraayenoord and Elkins (1998:370-371) and Brown, Askew, Baker, Denvir and Millet (1998:375) identified certain factors that contribute to poor mathematics performance, namely: teaching method (whole class teaching); failure to use knowledge associated with mathematics; language; lack of flexibility; beliefs; and quality of educator–child interaction. Galton and Simon (Eds) (1980), Good, Grouws and Ebermeier (1983) and Brophy and Good (1986) also noted that poor performance in mathematics has always been associated with whole class teaching.

The view of this researcher is in agreement with the above-mentioned authors. That when teaching the whole class at the same time, children do not learn in the same way. Children who learn fast may benefit, whereas children who do not catch on quickly will be disadvantaged. Ebermeier (1983), and Brophy and Good (1986) argue that in individual cases, particularly poor performance in mathematics has also been associated with whole class teaching. For example, when the teacher uses the whole class teaching method he/she may not be able to interact with all the children at the same time. In such cases, problems experienced by some children are not promptly detected and remedied.

2.4.1 Various misconceptions about mathematics teaching

Schunk (2004:412) asserts that the content area of mathematics is a fertile area of cognitive and constructive research. Schunk (2004:412) adds that topics that have been explored include how children construct mathematical knowledge, how experts and novices differ and which methods are most effective. Schunk (2004:414) also agrees that children and adults often construct procedures to solve numerical/mathematical problems; however, the errors are not random but rather, systematic mistakes. Systematic mistakes reflect the constructivist assumptions that children form procedures based on their interpretation of experiences.

For example, a common mistake in subtraction is to subtract the smaller number from the bigger number in each column, regardless of direction, as follows:

65 - 29 = 44   571 – 298 = 327

Systematic mistakes develop when the children encounter new problems and incorrectly generalise productions, especially when they do not know what to do. They modify the rules to fit the new problem Schunk, 2004:414). Brown and Burton (1978) also leave a gap on how teachers teach mathematics. This is a teacher challenge in teaching mathematics and is precisely what the researcher in this study wishes to investigate.

2.4.2 Language issues in the teaching of mathematics

According to Naude, Pretorius and Vandeyar (2002:293–294), many Grade 1 children enter South African schools having various academic and learning difficulties that might occur as a result of limited language proficiency. A child with limited language proficiency may continue to learn and understand at a slower rate. This explains why Grade 3 children who receive tuition through a language other than their own find it difficult to understand numerical concepts for they also struggle to master the medium of instruction itself because language and thought are interwoven. Limited language proficiency leads to learning difficulties. A child has to be competent in expressive and receptive languages in order to understand and carry out academic tasks including mathematics (Naude et al., 2002:294). Children should also be able to commit what they learn to memory and be able to reproduce it when needed. It goes without saying that lack of language proficiency would be an impediment for children at Foundation Phase. Thus, teachers need to be patient in teaching concepts such as minus, divide, etcetera.

Mercer, 2006:508 argues that the tendency of mathematics educators and policy makers to emphasise the distinction between the subject language of mathematics and more informal talk can hinder the process of inducting children into mathematics practices.

(Mercer, 2006:507) argue that group activities offer valuable opportunities for children to construct solutions for themselves through talk which would not be found in whole class teaching. This method encourages children to participate actively in finding solutions to problems while at the same time using language to communicate. In so doing, children are able to understand better and view mathematics exercises as everyday problems rather than something only related to the school environment and a special language — mathematics jargon.

Vygotsky (1978) stresses the significance of language as a psychological and cultural tool (Mercer, 2006:508). He further argues that the social involvement in problem-solving activities constituted an important factor for individual development (Mercer, 2006:508). He charges that intermental (social) activity, mediated through language, can promote intramental (individual) intellectual development. By using language and examples with which the child can associate and those that stem from his immediate environment, will engender better understanding and enable the child to relate the process in his own words. The children' capacity will also be stimulated.

There are two ways of interaction through which the spoken language can be related to the learning of mathematics in schools. The first is teacher-led interaction with children –the teacher guides the children in their development and understanding, which can be important in the children's induction into discourses, associated with the particular knowledge domains. This is the concept of dialogue teaching propounded by Alexander

(2000). “It concerns more subtle aspects of interaction such as the extent to which teachers elicit children’s own ideas about the work they are engaged in, make clear to them to discuss errors and misunderstandings and engage them in extended sequences of dialogue about such matters” (Mercer, 2006:509). “Dialogic” strategies, according to Mercer (2006:510), achieved better learning outcomes.

Alexander (2004:32) suggests that dialogic teaching is a method that employs the power of talk to encourage and expand the children’s thoughts and advance their learning and understanding. It involves both the teacher and the children, and relates to teaching across the curriculum. It is an approach that is grounded in the principles of collectively, reciprocity, cognition and observation. Dialogical teaching, therefore, requires children to be actively engaged in doing as well as talking (discussing/explaining) what the lesson is about. This approach as such, is good in the teaching of mathematics where children have to handle concrete objects and explain what they see and in tandem also learn the concepts. Dialogic teaching is characterised by certain features of classroom interaction, such as:

- questions are structured so as to provoke thoughtful answers.
- answers provoke further questions and are seen as the building blocks of dialogue rather than its terminal point.
- individual teacher–child and child–child exchanges are chained into coherent lines of enquiry rather than left stranded and disconnected. In this manner, the children experience the learning process as cooperative activity.

The second context of interaction in which spoken language can be related to the learning of mathematics in schools is that of peer group interaction. By working in pairs or groups, children become involved in interactions that are more “symmetrical” than those of teacher–pupil discourse and have different kinds of opportunities for developing reasoned arguments and describing events (Mercer, 2006:510). The child does not only learn mathematics, but also social interaction.

Teachers can help children to gain relevant knowledge of numerical procedures, terms, concepts and operations. They can also help children to learn how to use language to work effectively and to jointly enquire, reason, consider information, share and negotiate ideas and to make joint decisions. This kind of guidance is not usually offered (Mercer, 2006:510).

According to Vaidya (2008:717), some children suffer from dyscalculia. This is characterised by a poor understanding of the number concept and the number system characteristic of their age group. Such children experience difficulties counting, learning abstract concepts of time, direction learning, and recalling facts, sequence of past and future events, and giving and receiving change. They also fail to use rules and procedures to build on known facts. For instance, they may know that 3+5= 8, but would fail to deduce that 5+3=8. Such children are generally said to have difficulties to mathematics learning. Without identification and remediation, these children would not be able to be numerically functional.

Mathematics is a “second language” and should be taught as such. It constitutes formal learning of concepts that have hitherto not been frequently used and known to many of the children. Thus they would also seem to be learning a different language to the one they use at home. The conceptual aspects of mathematics learning are connected to the language. It is exclusively bound to the symbolic representation of ideas. Most of the difficulties seen in mathematics, result from underdevelopment of the language of mathematics (Sharma, 1989).

Teaching of the linguistic elements of mathematics language is sorely neglected. The syntax, terminology, and the translation from English to mathematics language, and from mathematics language to English must be directly and deliberately taught. Consequently, mathematics language can pose challenges for children. For a teacher to get through to her children, she should have an understanding of the “mathematics language”. An added problem is that certain mathematics terms such as “hypotenuse” are not found in everyday conversations

2.4.3 Teacher challenges in the teaching of mathematics

South Africa, like other African countries, suffers from a common crisis in teacher supply. The problem lies not only in numbers but in specific categories of teachers entering the profession (Welch, 2006:326). She further argued that of newly qualified teachers, 80% are white, of which 66% are white women (Welch, 2006:326). Given the demography of the country and the need for mother tongue instruction at the Foundation Phase level, undoubtedly this implies that black Foundation Phase schools and rural schools are bound to suffer a lack of teachers or would be staffed with under-qualified teachers.

Since most of the teachers in teacher training stem from the white community, there will be a shortage of black teachers, especially in black rural schools. Black township schools will also be affected by a shortage of teachers since white teachers are afraid of teaching in the townships. Those who are prepared to go to the townships do not know the African languages, which are the languages of instruction in the Foundation Phase, and therefore cannot be of assistance in that regard. This then, exacerbates the already dire situation and increases difficulties to learning and teaching. It becomes even more catastrophic with regard to the teaching and learning of mathematics. Mathematics teaching poses a challenge to teachers as they consider the principles mentioned below.

Carruthers and Worthington (2006:74) argue that many studies of young children's early writing development suggest some ways in which teachers support the growth of understanding. Ginsburg (1977:119) lists three principles of written symbolism in mathematics:

- Children's understanding of written symbolism generally lags behind their informal mathematics, for example, the child heard the number 5 but does not know how it is written.
- Children interpret written symbolism in terms of what they already know.

- Good teaching attempts to foster connections between the child's informal knowledge and the abstract and arbitrary system of symbolism. Hiebert (1985:501) adds that supporting children early writing development is problematic for some teachers and it appears that introducing the abstract symbolism of mathematics is more so. It is important that the teaching of mathematics is environment based. It is difficult for children to talk about and test out abstract relationships using words alone (Van de Walle, 2004:30).

Teachers have to use objects from the child's own environment when teaching concepts in mathematics. It would be easy for children to understand the concept "two" if they can first associate it with objects with which the child is familiar, for example, that Lethabo has 16 counters and Mpho 27 counters, and that Lethabo and Mpho's counters amount to 43 (added together). Therefore, the numeral/concept two is not arbitrarily symbolic or imaginary to the child but can be associated with tangible objects like counters. The concepts "add" also becomes clear in the process.

It is important that the teaching of mathematics is environment based. For example, children would understand much better if taught mathematics by using objects from their own environment, for example, bottle tops for counting, or shoes and ice cream sticks. Willis (1998) supports the view that mathematics is more likely to improve if taught in the context in which it occurs. For example, the teacher has 23 sweets of which she gives Maselaelo 7 sweets – how many sweets are left? Indeed, teaching children mathematics using numerical concepts and the application thereof, using problems derived from their own milieu, would make it far easier for them to understand and to relate the subject to their environment.

This would motivate children to want to find solutions to problems, as this would be viewed as solving their environmental problems. Numerical concepts would also become easy to follow. For example:

$23 - 7 = 16$

Children would be able to see and understand how they arrived at the answer.
Language also plays a vital role. Children should also develop the ability to use the language listen, speak, question, explain and discuss. It is important that the language used in the teaching of mathematics should be understandable and be pitched at the level of the child. The child would then not only understand mathematics but enjoy it as well. In this way, mathematics difficulties would be eradicated or reduced at an early age in the children's life.

2.5 TEACHER DEVELOPMENT FOR ADDRESSING MATHEMATICS PROBLEMS

Middleton and Goepfert (2002:17) state that the methods that are used to educate teachers need to be revisited. For instance, in a traditional mathematics class, the teacher first starts with correcting the previous homework, followed by the introduction of new concepts, primarily with the teacher as lecturer, and the children in the listening role, perhaps taking notes. At the end of the lesson, a few examples are practised, and then in the final 15 to 20 minutes, the children continue practising a set of problems from the text book on their own. This way of learning does not motivate the children. Middleton and Goepfert (2002:17), Swars (2004:139) and Crawford and Witte (1999:34) support this notion by arguing that active learning in a motivating context is the foundation on which constructivist teachers build their teaching strategies and classroom environment.

For example:

- In these classrooms, children are more likely to participate in hands-on activities than to listen to the teacher.
- They rather discuss with other children their solution strategies than ask the teacher to tell them the right answer.

- They rather work cooperatively in small groups as they shape and reformulate their conceptions than silently practise mathematics rules.
- Desks are not lined up, but children are arranged in groups as this encourages active learning and child interaction.
- Teachers believe that their skills and abilities are effective.

2.5.1 Teachers' mathematics knowledge

Teachers must know the subject matter in order to teach it effectively and therefore it is important they possess mathematics knowledge. Cooney (1999:163) asserts that formerly, our conceptions of teacher knowledge consisted primarily of understanding what teachers knew about mathematics. Mathematical knowledge alone does not translate into better teaching. Cooney (1999:253) asserts that teachers need knowledge of at least three kinds in order to have a chance to be effective in choosing worthwhile tasks, orchestrating discourse, creating an environment for learning and analysing their teaching and children's learning: knowledge of mathematics, knowledge of children and knowledge of the pedagogy of mathematics.

The teacher should know how to use language effectively in order to transfer knowledge. Failure to do so only exacerbates the children's problems of mathematics. Margolinas, Coulange and Bessot (2005:206) argue that a teacher's knowledge is a very significant topic for mathematics education.

Shulman (1986) concurs and further identifies content knowledge, pedagogical knowledge and pedagogical content knowledge as components of the professional knowledge of teachers. This implies that the teacher should not only possess academic knowledge, but should also be able to impart it in an understandable manner. It is vital that the vehicle of the teacher's thoughts and knowledge should be clear and vivid to the child. Steinbring (1998:159) therefore asserts that "a new kind of professional knowledge for mathematics teachers is needed, a kind of a mixture between mathematics content knowledge and pedagogical knowledge".

Askew et al. (1997:21) assume that practice in the classroom, in lessons, is the major factor influencing learning outcomes. They also allege that teachers' beliefs and knowledge and practices in the classroom like lesson planning will inform and influence the lessons. A teacher might believe that children learn best through direct instruction. But if the teacher's knowledge of the subject is incorrect or limited, what the children are going to learn will be affected by the teacher's lack of knowledge (Askew et al., 1997:23). That is why it is important that the teachers should have a good knowledge of what they are going to teach.

The teacher should also have a good knowledge of the child's prior knowledge in order not to teach children what they already know or something that is too difficult for them to grasp (Askew et al., 1997:23). Lastly, the teacher has to use suitable teaching methods in order to render his or her knowledge of mathematics accessible to children (Askew et al., 1997:23). The teacher might be a mathematics genius, but if she possesses no sound teaching methods, she will not be able to reach the children, and thus no effective learning would take place.

Even and Tirosh (1995:164) also argue that a "teacher who pays attention to where the children are conceptually, can challenge and extend children's thinking and modify or develop appropriate activities for children". If the teacher and her children understand concepts she will have better control and direction of classroom activities.

Appropriate mathematics activities can be developed to the level of understanding of the children. It is essential to understand the children and their feedback rather than the content alone, for content can only be understood and meaningfully understood if it is well presented.

Kaufmann, Handl and Thony (2003:565), Gersten, Clarke, and Mazzocco (2007) and Kennedy (2000:95) argue that faulty conceptual knowledge might hamper the successful acquisition of calculation skills. Therefore, for the children to understand mathematics with fewer chances of developing difficulties, they should possess a clear understanding of the concepts.

Without conceptual knowledge, the child might lack further understanding of underlying mathematics problems. Resnick (1989:162) says that knowledge is necessary to allow the flexible and adaptive application of numerical and arithmetic knowledge, and like all knowledge it is not directly absorbed, but is constructed by each individual. As such, children should be active participants in the learning process.

Baroody (2003:6) asserts that the transfer of learning might not take place until numerical and arithmetic knowledge (counting, fact and procedural) becomes meaningful. According to Perry (2000:182), the higher mathematics achievement levels of Asian children, relative to their American peers is partly derived from the fact that Asian mathematics classroom lessons incorporate more explicit teaching of conceptual knowledge than American ones.

Perry (2000:182) points out that meaningful explanation promotes problem-solving competence, in other words, good instruction should make a difference in children developing understanding of mathematics concepts. This then, makes it imperative for the mathematics teacher not only to know the concepts, but also how to impart them to the children in a language they can understand.

Copley and Nunes (1999) found that informal handling of mathematics procedures and concepts yields better learning effects than formal school mathematics because informal learning is meaningful (as it is linked to everyday activities), whereas formal learning is rather abstract (as it occurs from any context) and sometimes even requires the children to suppress their informal numerical knowledge. It is thus important that children are encouraged to work together and find solutions to problems while discussing informally. Learning becomes fun and children are encouraged to participate.

PouIson (2001:41) argues that in an effort to enhance the primary teachers' knowledge of the subject matter, and their professional expertise, subject-specific pedagogy is the assumption that teachers who know more teach better. The more knowledge a teacher possesses the better his teaching becomes. Thus Shulman (1986), according to Poulson, alleges that research on teaching, studies on teachers' knowledge and thinking are regarded as important aspects of educational research.

PouIson (2001:42) termed this type of study "pedagogical content knowledge" and claimed that it is a distinctive part of the teacher's knowledge base. Indeed, subject-specific pedagogy could be very effective in the teaching of a subject like mathematics. This type of teacher training would result in the production of better subject specific teachers which would thus better the children's understanding of the specific subject. This is what South Africa should look at in an effort to reduce the number of children experiencing difficulties to mathematics.

2.6 MATHEMATICS TEACHING APPROACHES

Baroody (2003:17) identified the following four qualitatively different approaches to teaching mathematics, namely:

2.6.1 The Mathematics Skills approach

The skills approach focuses on memorisation of basic skills (Baroody, 2003:17). This approach is based on the assumption that numerical knowledge is simply a collection of useful information (facts, rules, formulas and procedures). In the skills approach, a teacher simply tells children that, for instance, to add addends you start adding from the units, tens hundreds and so on. Children then complete numerous computations with the procedure until it is memorised by rote.

As practice is performed without context (a reason) at a largely symbolic (abstract) level, the skills approach is not purposeful (in the sense that instruction builds on children’s interests and creates a genuine need to learn and practice mathematics), nor is it typically meaningful. As children are seldom engaged in any real numerical thinking, the skills approach is almost never inquiry based, as it involves a repetitive practice.

Even though the foregoing discussion asserts that the skills approach focuses on memorisation, it is important that Foundation Phase teachers encourage the children to learn the multiplication tables in order for them to apply the knowledge when solving mathematics tasks. Schoenfeld (2004:280-281) and Geary (1990) argues that in mathematics, an exclusive focus on basics leaves children without the understanding that enables them to use mathematics effectively. A focus on “process” without attention to skills deprives children of the tools they need for fluid, competent performance.

2.6.2 The Mathematics Conceptual approach

Baroody (2003:17) argues that the focus of the conceptual approach is on the meaningful memorisation of skills. This approach is based on the assumption that mathematics constitutes a network of skills and concepts. Children are viewed as capable of understanding mathematics if told or showed why procedures work. The aim of this approach is for teachers to help children to acquire needed facts, rules, formulas, and procedures in a meaningful way (i.e., with comprehension). The teacher guides children towards understanding and mastery of skills.

In the conceptual approach, symbolic procedures, such as addition of addends are illustrated by actual teacher demonstration. Children may even be encouraged to imitate an illustrated programme themselves with manipulatives. Thus, although instruction and practice is often without context, an effort is made to promote meaningful learning.

From the discussion above, it is important that Foundation Phase teachers should guide children towards understanding and mastery of skills. Teachers should provide them with tasks/activities that will help them to acquire those skills. Children would then be able to solve problems themselves.

2.6.3 The Mathematics Problem solving approach

The problem solving approach focuses on the development of numerical thinking (reasoning and problem solving). This approach is based on the assumption that mathematics is, at heart, a way of thinking, a process of inquiry, or a search for patterns in order to solve problems. Children are viewed on the one hand, as using intuitive thinking and possessing incomplete knowledge and, on the other hand, as naturally curious creatures that can and must actively construct their own understanding of mathematics. The aim of mathematics instruction is to immerse numerical novices in mathematics inquiry (solving what are to them real and challenging problems) so that children can develop more mature ways of thinking and incidentally discover and construct more complete mathematics knowledge. The teacher as a wise partner in this enquiry pushes the process along but does not entirely, or even largely, set the agenda or control the enquiry. The learning content such as the formal procedure for addition in word sums, is secondary to developing children's thinking processes (Baroody 2003:17).

In the light of the discussion above, it is clear that learning using this approach will encourage children to construct their own understanding of Mathematics and children will be able to investigate and to solve real and challenging problems that they may come across.

2.6.4 The Mathematics Investigative approach

According to Baroody (2003:17), the investigative approach focuses on meaningful memorisation of skills and development of numerical thinking. Like the conceptual approach, mathematics is viewed as a network of skills and concepts. Also, like the problem-solving approach, it is viewed as a process of inquiry. Children's active construction of understanding is mediated, guided, and prompted by the teacher – most often through planned activities. In the investigative approach, the teacher mentors children guiding their meaningful construction of procedures and concepts and the development of numerical thinking.

The teacher uses indirect means to help children to construct knowledge. For example, a teacher might guide children to reinvent a procedure such as the algorithm for addition of word sums. The teacher might then encourage children to invent their own procedures for solving the problem. That may well involve using manipulatives or drawings. Children can then be encouraged to represent the problem and their informally determined solution symbolically and look for shortcuts to their concrete procedures. The investigative approach involves purposeful, meaningful and inquiry based instruction. The teacher encourages self invention of problem solutions by building on children's informal knowledge. The children would begin to enjoy what they do and develop a love thereof.

2.6.5 Mathematics: the enjoyable way

De Corte (2004:280) and Geary (2005) claims that “Mathematics is no longer mainly conceived as a collection of abstract concepts and procedural skills to be mastered, but primarily as a set of human sense making and problem solving activities based on numerical modelling of reality”. Indeed children should learn by understanding and not by rote. In order to understand mathematics, the teaching of concepts through everyday language and the use of the immediate environment is critical and essential.

The old method of making children learn by rote, passively and with repetition is no longer encouraged in the reformed curriculum. Teachers who still follow this approach are themselves a barrier to teaching mathematics, which further compounds children’s problems. Such educators should be retrained in order to help them to help and support the children they teach.

Fagnant (2005:355) and Geary (2004) alleges that in mathematics, different from other sciences, objects don’t have a tangible existence. In other words, mathematics can only be presented symbolically. However, in mathematics classes, teachers use counters to develop children’s’ skills of adding and subtracting. It is precisely this symbolic representation that needs clear and simple language together with examples from the children’s immediate milieu to understand mathematics.

The role of the teacher in this regard is of vital importance. Attention should not, therefore, be focused on the symbols and their meaning, but rather on the activity of the symbolising and meaning making (Cobb, Yackel and McClain: 2000). Therefore, the teacher who lacks language or skills to impart knowledge will be a barrier to children. The situation becomes even direr where the medium of instruction is a second language. This is a major impediment for South African children and therefore strategies should be devised to improve mathematics teaching.

2.7 CHILD RELATED FACTORS IN THE TEACHING AND LEARNING OF MATHEMATICS

The conceptual and procedural knowledge are discussed in the next paragraph.

2.7.1 Child's conceptual knowledge

According to Donlan (1998:77), conceptual knowledge is the understanding of the principles that govern the domain and the interrelation between pieces of knowledge in a domain (understanding or principled knowledge) (although this knowledge does not need to be explicit). Donlan (1998:77) defines procedural knowledge as action sequences for solving problems. It is important that the children are taught these principles in a way that they understand them, rather than by rote.

Donlan (1998:75) says that conceptual knowledge and procedural knowledge are much of what children learn in their course of development and without question, they develop in tandem rather than independently. In contrast, school-age children are described as having impoverished conceptual understanding that leads to their generating flawed and illogical procedures for solving multidigit subtraction problems, decimal fractions and other mathematical tasks. Thus it is important for children to be taught concepts so that they understand mathematics more easily.

Piaget essentially sees the child as actively adapting to his environment "from the inside out", and Vygotsky sees the child as active but essentially mediated "from outside in"(Donald et al., 2002:84). This implies that conceptual knowledge should be taught from the known to the unknown. For example, the teacher should begin with what the children know and proceed to what they do not know.

2.7.2 Child led family

The family, especially parents, plays an important role in the education of their child. Among others, they assist the child with their schoolwork. Education is recognised worldwide as a principal means for families and children to advance socially. Therefore, the economic and social effects of HIV and AIDS in Sub-Saharan Africa threaten the educational aspirations of children in this region (Oleke, Blystad, Fylkesnes and Tumwine, (2007:361).

The result is that many children in this region become orphans and have to fend for themselves. The above has a negative impact on the education of orphans. They cannot function well in school when hungry while heavy domestic labour reduces their study time and energy. Being orphaned leads to emotional depreciation, and social anomalies such as labeling and sexual abuse that lead to poor academic output from such children. Therefore, such children would not only experience severe numerical difficulties, but educational difficulties in general. Failure to help and support such children would lead to a perpetuation of the situation and even to the deterioration of already dire circumstances.

2.8 THE ACQUISITION OF EARLY MATHEMATICS

Children's early mathematics is explained in the next section.

2.8.1 Children' early mathematics–England

There are no differences in early mathematics between children in Europe, according to the performance measured once with the Early Mathematics Test (Aunio, Aubrey, Godfrey and Liu 2008:205-206). The test aims to tap several aspects of young children's numerical and non-numerical knowledge of mathematics (Aunio et al. 2008:207). The test is given individually and takes approximately 30 minutes for a child to complete Aunio et al. (2008:207). Children had to answer verbally and point at the correct answer. In certain instances, they were also given material to solve the questions themselves (Aunio et al. 2008:207). In this manner (using material), children are able to concretise their knowledge. They are able to put their theoretical knowledge into practice. This helps them to associate numerical information with concrete objects and to enjoy solving problems themselves. That is, they learn by doing. This could be applied in South African schools in order to help children to develop a liking for the subject in that children would be engaged in problem solving and not mastering concepts by rote learning. Learning would be meaningful to the children.

English children performed lower than the Finish and Chinese ones (Aunio et al 2008:207). Older children performed better than the younger ones in all groups (English, Finish, and Chinese). Finish and English children performed the same in the counting scale (Aunio et al 2008:214). Chinese children performed better. Informal mathematics tends to be very culturally dependent (Aunio et al 2008:215). In England and Finland, the number word sequence is non-systematic, thus linking the acquisition of counting skills with rote learning and rendering it prone to errors (Aunio et al 2008:215).

2.8.2 Children' early mathematics – People's Republic of China

Chinese children constantly outperform their Western peers in abstract and object counting, concrete and mental addition and subtraction, and in the use of sophisticated strategies in mathematics problem solving. Chinese children performed the best of the three groups (Aunio et al 2008:208). The success of children in China can be related to the manner in which the educators, parents and society as a whole appreciate mathematics knowledge. The children are expected to practise and learn mathematics from pre-school level (Aunio et al 2008:214). Given the problems experienced by South African schools in teaching, it would be worthwhile for the South African government to adopt such practices (teaching mathematics from pre-school level) in order to minimise problems when the children start with formal work at school. This would imply that the pre-school education should be made compulsory so that all children start from the same premise and difficulties can be reduced. The one child policy of China helps the children to receive support from parents and grandparents (Aunio et al 2008:215). The Chinese language facilitates children's understanding of numbers and counting (Aunio et al 2008:215).

2.8.3 Children's early mathematics in France

In **France,** classical curriculum children received a traditional education based on a "top-down" approach (an approach that is still applied within the French-speaking community of Belgium). French schools also followed the same method as the above. Children are immediately presented with conventional symbols with an explanation of what they represent and how they should be used. According to Fagnant: (2005:356), "Manipulative materials and visual programmes are used to make the abstract mathematics to be taught more concrete and accessible for the children".

Gravemeijer (2002:8) maintains that the role of teachers is to explore what symbols mean and how they are able to be used by linking them to referents. Materials such as blocks or counters are used to illustrate the formal adding and subtracting operations. If used in South Africa, this strategy could help children to understand concepts better by linking them to concrete objects. Difficulties to learning could be reduced in this manner.

2.9 GRADE 3: MATHEMATICS CURRICULAR IN SOUTH AFRICA

With the dawn of democracy in 1994, the new government wanted a new national curriculum to be introduced to play a multitude of roles. Among others, the roles were: to promote the new constitution, rebuild a divided nation, offer equal education opportunities for all and inspire a constituency that had been oppressed by the very nature of the previous education dispensations and policies.

2.9.1 Curriculum 2005

In response to the above criteria, the hastily developed new Curriculum 2005, an outcomes-based curriculum for the General Education and Training (GET) band (from Grade 0 to Grade 9) was introduced and approved as a policy on 29 September1997. The curriculum was rich in ideology and new terminology different from that of the past. Teachers became known as “facilitators” and “educators”, pupils and students changed to “children”, yearly teaching plans became “learning programmes”, traditional instruction was substituted with notions of facilitation, learning by discovering and group work.

The new curriculum was marketed as a positive new beginning and a move away from the Christian National Education to a new rights-based education and child centeredness. Despite questioning by sceptics about the quality, standards, depth of content and scope, the new curriculum was implemented in 1998. The new curriculum emphasised the general, and disregarded the specific.

The inherent flaws in Curriculum 2005 became obvious by early 2000. Children were unable to read, write and count (at their expected level), and lacked general knowledge. The curriculum concentrated on attitudes, competencies and dispositions and failed to give adequate specifications necessary for learning by concentrating on skills and background knowledge. Curriculum 2005 also failed to adequately provide coherent, systematic content knowledge to satisfy the specific aims of the curriculum. Teachers did not know what to teach and academics and the media called for the review of the curriculum (DoE Final report, 2009:12).

The Minister of Education set up a Review Committee to look at the criticisms and make recommendations. The Curriculum Review Committee’s report (in June 2000) recommended that the design of the curriculum be simplified, assessment requirements needed to be clarified, content had to be brought into the curriculum and be specified. Curriculum overload needed to be addressed including the reduction in the number of subjects in the Intermediate Phase, textbooks and reading had to be introduced, and a plan needed to be put in place in order to address teacher training for the successful implementation of the new curriculum (DoE Final report, 2009:9). The Curriculum 2005 was followed by the Revised National Curriculum Statement (RNCS).

2.9.2 The Revised National Curriculum Statement (RNCS)

The RNCS was a fundamental but essential departure from Curriculum 2005. It was aimed at simplifying and clarifying Curriculum 2005. It was an attempt to redirect the curriculum agenda from a local, basically skills-based and context-dependent body of knowledge to one that is more appropriate for a national curriculum in the twenty-first century and to compete favourably with other regional and international curricula.
The RNCS was completed in 2002 for implementation as from 2004.

However, a number of shortcomings related to its implementation provided an important context for its review. Firstly, there was no clear and detailed implementation plan for the RNCS. There was no clear message and national communication plan regarding the benefits of the new curriculum. Its importance was never emphasised and it was said not to be a new curriculum on its own. Thus teachers and district, provincial and the national Department of Education (DoE) officials blended the RNCS into the Curriculum 2005, which brought about confusion (DoE Final report, 2009:13).

Secondly, the RNCS was not sufficiently detailed and no assessment policy was put in place by the specialists who wrote the curriculum. The teachers were initially told to continue using the old assessment policy of the Curriculum 2005. This resulted in further confusion (DoE Final report, 2009:13).

Thirdly, the problem with the RNCS was that curriculum supporting documents such as the Learning Programme Guidelines were developed within the DoE by different people from those who had developed the RNCS. As a result, some people did not fully understand the purposes and aims of the revision while some retained the allegiances to Curriculum 2005. These also led to contradictions across documentation (DoE Final report, 2009:13).

The fourth problem is that teacher training was superficial and did not clarify the points of departure and newness of the RNCS. The RNCS also failed to address the cry for specific training in subject/ subject content (DoE Final report, 2009:13).

Lastly, the language policy specified in the RNCS was not communicated and never implemented. The language policy states that it is preferable to teach children in their home language in the Foundation Phase; however, they should also receive a solid foundation in the Language of Learning and Teaching (LoLT), which in most cases, is English, as a subject from Grade One. Nevertheless, many schools across the country continued to begin teaching English only in Grade 3, based on the Curriculum 2005 provincial policies, thus leaving children unready for change to LoLT in Grade 4 (DoE Final report, 2009:13).

After realising that the teachers were not able to implement the Outcomes Based Education (OBE), RNC and the NCS, the Minister of Education developed a five-year plan strategy (Foundation for Learning Campaign). In the next paragraph, a summary of the National Curriculum Statement is discussed.

2.9.3 National Curriculum Statement (NCS)

The NCS was introduced in 2002. Its implementation led to a number of challenges and problems. Many stakeholders, among them, teachers, parents, and academics commented on the new curriculum. Among others, they criticised it for teacher overload, confusion and stress, as well as child underperformance in assessments (DoE Final Report, 2009:5).

In response to this in July 2009, Ms A. Motshega, Minister of Basic Education, appointed a panel to investigate the criticism levelled against the implementation of the NCS. The panel identified key areas for investigation based on the complaints and challenges. These were: curriculum policy and guideline documents, the transition between grades and phases, assessment (especially continuous assessment), learning and teaching support materials, and teacher support and training (DoE Final Report, 2009:5-6).

The method used to collect comments, data and evidence included interviews and hearings with teachers across the country, document reviews, and written and electronic submissions from the public (DoE Final Report, 2009:6).

The panel concluded that there is not a clear, widely circulated plan for the implementation and support of the NCS. Many parents and teachers complained that they had no vision of the "bigger picture" in terms of what the curriculum set out to do and achieve, specifically with regard to the country's children. In tandem with poor child performance in local and international tests, the implementation of the NCS has led to some distrust in the education system.

Based on the above criticisms, the panel recommended that the Minister should devise a clear, simple, coherent Five Year Plan to improve teaching and learning across the schooling system which should be adhered to. The plan must be clearly and widely communicated to the country. Its central themes should be to offer support to teachers and improve the performance of children. Mechanisms to monitor the implementation of the plan, by means of regular external monitoring to assess whether it has the desired effect on the teacher and child performance, has to be built into the plan (DoE Final Report, 2009:7). This had to be implemented by October 2009.

Secondly, the panel complained that a series of policies, guidelines and interpretations of policies and guidelines at all levels of the education system existed, from the national education department to the district level and subject advisors. Compounding the problem is that some DoE and Provincial District Education (PDE) officials as well as teachers have not shifted from the C2005 to the NCS. This exacerbated the widespread confusion about the status of the curriculum and [highlighted the need for an] assessment policy document for every subject and subject that would provide support for all teachers and help to address all the complexities and confusion created by curriculum and assessment policy vagueness, lack of specification, misinterpretation and document proliferation (DoE Final Report, 2009:7-8). This was to be implemented as from January 2011.

Thirdly, the commission criticised the NCS for being totally dependent on the subject advisors and district staff intermediaries who function between the administration of the curriculum policy and its implementation in the classroom by the teachers. Yet, the teacher's role demands unnecessary administrative tasks and many of the officials lack the knowledge and skills to offer teachers the support they require to improve child performance. The officials are also blamed by teachers for failure to develop tools to help interpret the policies and guidelines and thus they contribute to confusion and proliferation of documents and paperwork (DoE Final Report, 2009:8). The Foundation for Learning Campaign is discussed in the following paragraph.

Figure2.1: Grade 3 Mathematics Curricular in South Africa

2.9.4 Curriculum and Assessment Policy Statement (CAPS)

(a) According to the DoE (CAPS, 2011:3), the general aims for Mathematics–Foundation Phase in the final draft of the Curriculum and Assessment Policy Statement (CAPS) are the following: The National Curriculum Statement Grades R–12 (NCS) will ensure that all children acquire and apply knowledge and skills in ways that are meaningful to their own lives. Therefore it is important that examples for children should stem from their own environment.

(b) The NCS Grades R–12 serves, among others, the purpose of equipping children, irrespective of their socio-economic background, race, gender, physical ability or intellectual ability, with knowledge, skills and values necessary for self-fulfilment, and meaningful participation in the society as citizens of a free country.

(c) The National Curriculum Statement Grades R–12 is based on the following principle – progression, content and context of each grade shown from simple to complex. It is for this reason that when teaching Foundation Phase, teachers should begin with what the children know (prior knowledge) and proceed to new content.

(d) The NCS Grades R–12 aims to produce children that are able to identify and solve problems and make decisions using critical and creative thinking. Teachers must encourage children to come up with their own solutions to the problems.

(e) Inclusivity should become a central part of the organisation, planning and teaching at each school. Teachers should be able to deal with children who understand as well as those who experience difficulties to mathematics.

2.9.4.1 Specific aims for foundation phase mathematics

DoE CAPS (2011:6) claims that the specific aims for teaching and learning mathematics aims to develop the following in the child:

- a critical awareness of how mathematics relationships are used in social, environmental, cultural and economic relations;
- confidence and competence to deal with any mathematical situation without being hindered by a fear of mathematics;
- an appreciation for the beauty of mathematics;
- a spirit of curiosity and a love for mathematics;
- recognition that mathematics is a creative part of human activity;
- deep conceptual understanding in order to make sense of mathematics, and

- acquisition of specific knowledge and skills necessary for:
  - o the application of mathematics to physical, social and mathematical problems,
  - o the study of related subject matter (e.g., other subjects), and
  - o further study in mathematics.

In South Africa, curriculums are framed within policies. The following table displays the Grade 3 curriculum post 1994.

Table 2.1 Grade 3 Curriculums

Curriculum 2005: 1997	**RNCS: May 2002**	**NCS: October 2002**	**CAPS: 2011**
Number operations and relationships	Number operations and relationships	Number operations and relationships	Number operations and relationships
Patterns, Functions and Algebra	Patterns, Functions and Algebra	Patterns, Functions and Algebra	Patterns, Functions and Algebra
Space and shape (Geometry)	Space and shape (Geometry)	Space and shape (Geometry)	Space and shape (Geometry)
Measurement	Measurement	Measurement	Measurement
Data handling	Data handling	Data handling	Data handling

I did this structure to demonstrate the content of mathematics curriculum in SA so that the reader can see that since 2005 mathematics curriculum has not changed. The four curriculums, OBE, RNCS, NCS and CAPS 2012 did not differ in content. The difference was only in the implementation and emphasis.

For instance, OBE emphasised ideology and new terminology. It was children centred. It resulted in children being unable to read, write and count.

The RNCS was intended to simplify and clarify Curriculum 2005. There was no clear and detailed implementation for the RNCS. The teachers, district, provincial and national (DoE) officials thought it was part of Curriculum 2005 and never emphasised its importance as a curriculum on its own. This resulted in confusion.
Following on the failures in the implementation and child underperformance of the Curriculum 2005 and RNCS the DoE realised that something needed to be done to remedy the situation. Confusion with RNCS was related to the language policy since teachers continued to use English in Foundation Phase even though this curriculum emphasised the use of the home language as the LoLT. The NCS was introduced in an endeavour to simplify the understanding of the curriculum. However, it was criticised for teacher overload, confusion and underperformance.

The Grade 3 curricular is common to all the three curriculums, that is, OBE, RNC and NCS. A new policy, (CAPS) was to be implemented later in 2011. In order for CAPS to function effectively, the shortcomings experienced in the implementation of the former three policies should be avoided. These include, among others, the following:

- Children should be able to read, write and count.
- There should be a clear and detailed implementation plan.
- Teacher training should be comprehensive.

2.10 CHAPTER SUMMARY

The main aim of this chapter was to review relevant literature on which approach teachers use when they teach computations in mathematics? The first part of the literature covered the introduction, theories in the teaching mathematics in Foundation Phase, the constructivist approach, the importance of constructivist theory in the study and the influence of constructivism in foundation phase learning.

The second part of the literature review identification of mathematics difficulties in children, mathematics: a universal problem, various misconceptions about mathematics teaching, language issues in the teaching of mathematics and the teacher challenges in the teaching of mathematics.

The third part of the literature reported the teacher development for addressing mathematics problems, teachers' mathematics knowledge, mathematical teaching approaches, the mathematics skills approach, the mathematics conceptual approach, the mathematics problem solving approach, the mathematics investigative approach and mathematics: the enjoyable way.

The last section reviewed literature on child related factors in the teaching and learning of mathematics, child's conceptual knowledge, child led family, the acquisition of early mathematics, children' early mathematics – England, children's early mathematics – people's Republic of China, children' early mathematics in France, Grade 3 mathematics curricular in S.A, Curriculum 2005, RNCS, NCS, CAPS and conclusion.
The literature mentioned in this chapter was used in the preparation of a research design, which will be discussed in chapter 4.

CHAPTER 3

INTERVENTION STRATEGIES FOR SUPPORTING CHILDREN WHO EXPERIENCE MATHEMATICS PROBLEMS

3.1 INTRODUCTION

The previous chapter examined the literature and explained the theoretical perspective that could bear significance to this study. This chapter describes the various intervention programmes used in different countries to address mathematics difficulties experienced by children. The purpose of discussing intervention strategies is to gain insight into possible ways of assisting children who experience mathematics problems. Engaging in discourse on effective strategies will not deepen understanding about the programmes but will provide ideas that can be used to propose an intervention programme for teachers at the research schools.

Papatheodorou (2006:91) and Peterson (1987:5) allege that when a young child is found to have a difficulty or to be “at risk” of developmental difficulties, intervention should be initiated as early as possible. The early years in the learning of mathematics are regarded as a critical period, when children are most susceptible and responsive to learning experiences.

In addition, during the early years the initial patterns of learning and behaviour that set the pace for and influences the nature of all subsequent development, is established. Intelligence and other human capacities are not fixed at birth but rather, are shaped to some extent by environmental influences and through learning. When restricting conditions and other factors that render a child at risk for developing mathematics problems and learning are present in the early years, there are chances that the problems could become more severe, in the early years (Papatheodorou, 2006:91).

Early intervention programmes can make a significant difference in the developmental status of young children and can do so more rapidly than later remedial efforts after a child has entered elementary school. Parents need special assistance in establishing constructive patterns of parenting young children who are at risk and in providing adequate care, stimulation, and training for their children during the critical early years when basic developmental skills should be acquired.

3.2. PRINCIPLES OF EFFECTIVE PRACTICE IN MATHEMATICS TEACHING

According to Fuchs, Fuchs, Powell, Seethaler, Cirino and Fletcher (2008:79), approximately 5% to 9% of school children may be identified with mathematics difficulties (MD). This in spite of /the fact that poor mathematics skills are associated with life-long difficulties in the workplace and school (Fuchs et al., 2008:79). Some research illustrates how prevention activities at crèche or Grade 1 level can drastically improve mathematics performance. Fuchs and colleagues (2005) for example, identified 169 children in 141 classes as being “at risk” for mathematics difficulties based on their low initial performance. These children were subsequently randomly assigned either to a control group or to receive tutoring in small groups thrice per week for 16 weeks (Fuchs et al., 2008:80).

Results indicated that mathematics development across first grade was significant and much superior for the tutored group than for the control group on mathematical calculation, concepts, applications and story problems.

Furthermore, the incidence of children with a disability in mathematics was greatly reduced by the end of Grade 1; this reduction remained in the spring of Grade 2, one year after the end of tutoring (Fuchs et al., 2008:80).

The above illustrates that if mathematical problems can be identified at crèche or entry to school and intervention such as tutoring applied, the chances are that by the time children reach Grade 3 most of their mathematics problems will have been overcome.

This strengthens the notion that intensive remedial intervention is important. It also indicates the relevance and importance of pre-school education, which is unfortunately not a common phenomenon among children in the schools on which the researcher focused. It is important that the DoE should look into encouraging pre-school education or making it compulsory, especially in informal settlement areas.

3.3 AN EARLY INTERVENTION STRATEGY IN LITERATURE AND MATHEMATICS PROGRAMME

In 1997, the Scottish Office of Education [Intervention] Department (SOEID) decided to implement an early intervention strategy in literature and mathematics as part of a national programme to raise standards in the early stages of primary education in Scotland. This strategy targeted P1 to P3 stages and children from five to seven years old (Stobie, 2004:157). It is a prevention programme.
The programme involved in-service training and staff development on literacy and mathematics for P1 teachers. It emphasised the teaching of phonological awareness through concentrating on the first phoneme in a word and the remainder of the words, a book-rich environment and parent involvement. It also concentrated on a staff tutor to work with the schools involved in the programme and to lend support to teachers in improving approaches to literacy and mathematics. The programme also had to have qualified nursery nurses who had to work collaboratively in P1 classes in the schools. A lending and evaluation collection of resources for mathematics and literacy for schools is also involved in early intervention. Finally, there is provision of more resources for book corners for P1, P2 and P3 levels (Stobie, 2004:158).

The one dimension of this programme concerns populations who are about to undergo life transitions like entering school and who lack positive early learning experiences. These populations also lack positive early learning experiences and find school to be a challenging process in which they may meet failure (Stobie, 2004:158).

It is these kinds of children, on which the study concentrated. They stem from a “retarded” milieu, are poverty stricken and, most if not, all of them did not attend nursery school and thus they come to school with no prior experience of formal learning. Hence, school is viewed by these children as a place where they are likely to fail and consequently they enter school without any motivation. These children also lack experience (prior knowledge is retarded) in that they come from a poor environment, where for example, parents are illiterate, there are no books, televisions, and newspapers to stimulate them.

The aim of the programme was to identify aspects of programme delivery in the selected schools that had to do with good practice in connection with mathematics and literacy. Case-study methodology was used to examine the following variables:

- the use of staffing – including nursery nurses
- approaches to curriculum – including environment and parent engagement
- introduction of phonic sounds – recording children, and
- Parents' perspectives (Stobie, 2004:159).

The analysis included samples of documentation (school policies on early intervention, school development plans, etc.), class observation of interactions between children and teachers (nurse included), interviews with principals, class teachers, nursery nurses, class assistants, parents to children, and children and a questionnaire regarding literacy administered to the children involved (Stobie, 2004:159).

This analysis strategy is similar to the one used in this study even though the SOEID programme goes a little further than the one used in this study by involving the principals and nurses.

The findings reflected the importance of the increased staffing by nurses. The nurses and classroom assistants were considered as an important part of the programme. Their function was to strengthen teaching and to foster the children's interest in literacy and mathematics activities. They also successfully planned and recorded and assisted in identifying children at risk of failure.

Observation revealed that children in the first two years of study, where additional staffing was routinely used to create smaller teaching groups, were very responsive and engaged in their learning. Interviews with class teachers and principals showed that staff development opportunities were highly valued and that there was a continued need for ongoing staff development with regard to mathematics and literacy, especially classroom management and organisation together with planning and target setting. In-service training was regarded as very important, especially for new staff (Stobie, 2004:160).

In other words, this programme highlighted the fact that all staff members should work together in order to ensure the success of the programme. This is lacking in the schools in this study, where grade teachers seem to be on their own and intervention is only done at certain times for specific identified children, instead of there being an ongoing preventative strategy. The main disadvantage of this strategy was found to be a lack of staff to sustain the programme.

The teachers agreed that there was an increase in the levels of achievement as a result of an increase in the pace of children learning mathematics. This could also be attributed to staff development in the theoretical background of the strategy. This improvement was better recognised where there was a high degree of record-keeping and target setting (Stobie, 2004:161).

In the schools that participated in this research, the above mentioned were found to be lacking. It is vital that attention should be paid to these aspects of the strategy. Without proper record-keeping and target setting, progress will be slow. In some schools, children who experience difficulties are identified each year by class teachers instead of them being identified once and a record kept of their development through the various stages and targets set for them to achieve. In the schools in this research, the identification of children and the remedial work involved occurs on an ad hoc basis and does not lead to a permanent solution.

The focus group interviews and questionnaires indicated that parent involvement in classrooms and home support to children was uneven in the phases (grades). The study revealed that Grade 3 children received little help with reading and mathematics at home. The Grade 3 children also used the book corners in the classrooms (Stobie, 2004:161). Despite this, parental involvement was evident in participating schools.

Home-school diaries were used and interviews with parents confirmed that these workshops helped parents to help their children at home.

However, some parents were not clear how to assist the children with numbers. Parental support seemed to decrease in Grade 3 compared to earlier grades (Stobie, 2004:162). Although parent involvement was low, it was better than that at the schools under investigation. This indicates that parents need to be encouraged to play a more active role in their children's education, especially at the lower grades, to render the child's transition to formal education easier.

The provision and use of resources, human and material, is important for the success of the programme. Initial and continued training for staff is needed for the success of the programme. Assessment needs to be built into the programme as well. The result of assessments, especially national assessments, should be fed back to the schools (Stobie, 2004:166). Doing this would ensure success.

This programme relies on all the role players pulling their weight in order to achieve success. The role of the teacher and the other staff is critical, for it is at this level of the programme that identification and remedial work is conducted. If properly carried out, the programme can go a long way in helping children. This kind of intervention, if adopted in South Africa, could contribute greatly to helping to remedy the mathematics problems encountered in South Africa. The programme was also applied among children from a poor economic background as prevailed in the schools where the researcher conducted this research.

3.4 OXFORD MATHEMATICAL RECOVERY SCHEME

Various studies have proved that significant numbers of people experience problems with mathematics. The Esmee Fairbian Charitable Trust is currently conducting a Mathematics Recovery scheme on a pilot basis with six and seven year old children in six First Schools in Oxford (Dowker, 2001:6).

The children involved have been identified by their teachers as experiencing problems with mathematics. The children are assessed on eight components of early mathematics. The children receive weekly individual intervention of half-an-hour a week on specific components in which they have problems. The remediation is carried out by classroom teachers recommended by Ann Dowker. The teachers are released from classroom teaching by the authorities for the intervention. Every child remains in the intervention programme for 30 weeks or until teachers are satisfied that the child no longer needs remediation. Periodically, new children are introduced to the project (Dowker, 2001:6).

The components that form the focus of the project include basic counting, use of written mathematical symbolism, place value, word problems, translation between concrete, verbal and numerical formats, derived fact strategies for calculations, estimation (mathematical) and memory for number facts (Dowker, 2001:6).

With regard to counting, children are made aware that the result of counting a set of items will not change even if you count them in a different order, but adding and subtracting items will change the number. They are taught addition by one, that is, children count a set of counters and are asked how many there will be if one or more counters are added, up to twenty. The same is done where children count items and are asked how many will remain if one is taken away. This is repeated down to zero. The children are also given practice in observing and predicting the results of these repeated additions and subtractions using counters as a form of intervention and asked questions like, “what is the number before six?” or “what is the number after six” (Dowker, 2001:7).

With regard to writing quantities as numerals, children are made to read aloud a set of single and two digit numbers. A similar set of numbers is then dictated for children to write. As a form of intervention, the children are made to practise reading and writing numbers. Those who experience problems in writing and reading two digit numbers are given a practice task in sorting objects into groups of ten and recording them, for example, 20, 30, 40, etcetera. This is carried out where there are extra units (Dowker, 2001:7).

Concerning place value, the children are asked to add tens to units (30+2=32) and the ability to combine the two into one operation (20+31=53). The children may also be made to print to the larger number in pairs of two digit numbers that differ with regard to the units, for example, 24 versus 27, or 37 versus 31. As intervention, children are shown how to add tens to units and tens to tens in various different forms (written, number line, picture, etc.) (Dowker, 2001:7).

Children who experience problems with solving word number problems are given addition and subtraction word problems which are discussed with them. The children are urged to use counters to represent the operations in the word problems and to write the sums numerically as a form of intervention (Dowker, 2001:8).

To address the problem regarding translation between concrete, verbal and numerical formats, children are given tasks of translating in all possible directions between written sums, operations with counters and word problems format for addition and subtraction. For instance, translating from verbal to numerical, children can be presented with a word problem such as, “Lethabo had seven bananas, and she ate three and is left with four”. They are asked to write down the sum that goes with the story. Children are shown the same problems in different forms (Dowker, 2001:8).

One difficulty to mathematics that children experience is with regard to the lack of ability to derive and predict unknown numerical facts from known facts. Children are given the addition and subtraction Principles Test developed by Dowker (1995, 1998). In this particular test, children are provided with an answer to a problem and then asked to solve another problem that could be resolved quickly by using an appropriate mathematical principle; for example, they may be shown the sum, 33+44=77, and then asked to do the following sums, 33+45 or 23+44. The children are asked whether the “top sum” helps them to do the “bottom sum” and why. If children fail to solve these problems, the strategies are demonstrated again to them using single digit addition and subtraction problems, with the help of objects and a number line (Dowker, 2001:8).

Some children do not have the ability to estimate an approximate answer to a mathematical problem. They also cannot evaluate the reasonableness of a mathematical estimate. To assess and remediate this, children are given a task developed by Dowker (1996). They are presented with a number of problems with different levels of complexity and with estimates already made for the problem by imaginary characters. For example, Sello and Mathapelo estimate on a five point scale ranging from “very good” to “very silly” and children are asked to suggest “good guesses” from these problems themselves. Addition and subtraction problems varying in degree of difficulty from those that a child may readily calculate mentally, to those just beyond the child’s capacity to calculate, and to those difficult to solve. They are urged to provide reasons for their answers (Dowker, 2001:8-9).

The ability to memorise number facts is a problem for some children. This is an important factor to be able to understand mathematics. In the study, this skill is assessed through the Russell and Ginsburg (1981) Number Fact Test (Dowker, 2001:9). In the intervention, children are given some elementary addition and subtraction facts such as, 3+3=6, 5+5=10. The same sums are given repeatedly in the sessions. Children also play “number games” that reinforce knowledge of number facts (Dowker, 2001:9).

The evaluation of the project is performed by giving the children in the project as well as their classmates and children from other schools the following Standardised Mathematics Tests: British Abilities scales Basic Number Skills Gubfert (1995 revision) together with the WISC arithmetic subtest. The first places greater emphasis on computation abilities and the second on arithmetic reasoning. The tests are carried out at intervals of six months (Dowker, 2001:9).

The project and its evaluation are still at an early stage. Nevertheless, the results have thus far been encouraging. “The mean standard score on the BAS Basic Number Skills Subtest were 93.52 (standard deviation 12.98) initially, and 97.94 (standard deviation 2.41) after six months. Wilcoxon tests showed both improvements to be highly significant. The re-testing and evaluation is intended to be carried out over a period of three years to assess if the gains made in the study are preserved over a longer term (Dowker, 2001:9).

The children involved in this particular project in the six First Schools in Oxford are of the same age and grades as those in this research. They were identified by their teachers as experiencing difficulties to mathematics similar to those identified in the researcher's study. These identified children, in the Oxford project are then given the forms of remediation described above, whereas those identified in the researcher's study are left for the teachers, parents and district officials of the DoE to help them. The intervention in South African schools also takes a very short time and there is no standardised remediation. Although the Oxford project is relatively new, the various forms of its remediation are very much better than the one offered in our schools. It also emphasises specific skills development in components similar to those that children in the schools the researcher visited and which also experience problems in this regard. Hence, following the remediation used in the Oxford project would be very viable in the South African situation, as the project is already showing signs of very good effectiveness given the initial findings.

3.5 INTERVENTION PROGRAMME FOCUSING ON BASIC NUMERICAL KNOWLEDGE AND CONCEPTUAL KNOWLEDGE

According to Copley (1999), informal handling of mathematical procedures and concepts result in better learning effects than formal school mathematical teaching. They allege that this might be because informal learning is linked to everyday activities and so it is meaningful, while formal learning is rather abstract, it happens in isolation, not in a particular context, and at times even requires the children to suppress their informal numerical knowledge (Kaufmann, Handl and Thony, 2003:565). This suggests that children find it easier to learn mathematical concepts informally than formally.
The aim of the study was to measure the effect of a mathematics intervention programme specifically designed to tap arithmetic and numerical problem areas of children with mathematical learning disabilities (MLD) (Kaufmann, Handl and Thony, 2003:565). The results indicate that many poor calculators and children with MLD have poor or faulty conceptual knowledge.

With regard to intervention, preliminary results of a longitudinal study by Dowker (2000) indicated that children with dyscalculia benefit from mathematics interventions that include problem areas such as counting, use of place value, translation between concrete, verbal and numerical formats and so on (Kaufmann, Handl and Thony, 2003:565). This implies the integration of concrete and abstract counting skills, in other words, the use of formal and informal learning activities.

The experimental groups consisted of six children with developmental dyscalculia. The diagnosis was confirmed by a school psychologist. All participants were recruited from an experimental class for children with isolated learning disabilities. A group of eighteen children without learning disabilities and with average intellectual abilities served as a control group. All children were in third grade and right handed. The mean age of the experimental group was 9.6 years (SD=0.4) and that of the control group was 9.4 years (SD=0.4) (Kaufmann, Handl and Thony, 2003:565-566).

All the participants were subjected to a comprehensive test of number processing and calculation skills. The calculation battery was assigned to test all components of basic numerical, procedural and conceptual knowledge. The battery quantified performance differences between control and experimental group participants before and after intervention. It also evaluated the efficiency of the intervention programme by means of reassessing the children at the conclusion of the intervention (Kaufmann, Handl and Thony, 2003:566).

The intervention programme was conducted among the second and third grades, three times a week for about six weeks. Each session lasted twenty-five minutes. The intervention schedule consisted of semi-hierarchically organised modules aimed at establishing basic conceptual and numerical knowledge by guiding the children's understanding from the concrete to the abstract meanings of numerals. The learning material was also, where possible, offered in a game like fashion. Every module incorporated explicit teaching of conceptual knowledge by making the children familiar with the inversion of problems of the calculations they have to work on by either making up stories related to their calculation and estimating an appropriate result or by having them reconstruct calculations using concrete objects (Kaufmann, Handl and Thony, 2003:566).

The data analysis looked at basic numerical knowledge like counting sequences, thermometer, dot enumeration, number bisection and number comparison; arithmetic fact knowledge, like basic number facts; procedural knowledge such as solving complicated written calculations; and conceptual knowledge like arithmetic principles. Non-parametric statistical procedures were used because of non-normal data distribution. The control group outperformed the experimental group on all components of number processing and arithmetic. At the conclusion of the intervention programme, these performance differences among groups were still significant even though slightly attenuated with respect to numerical fact retrieval, conceptual knowledge and procedural knowledge. Only tasks that tapped basic numerical knowledge stopped showing group differences at Time 2 for mean percentages of correct responses.

With regard to basic reaction time (RT) effects, only the control group showed subitising in dot enumeration and distance effects in number comparisons in both Time 1 and Time 2. The experimental group however showed subitising abilities only at Time 2 and displayed prolonged latencies in enumerating small dot arrays at Time 1. Surprisingly, the experimental group demonstrated a preserved distance effect at Time 1, but just partial at Time 2 (Kaufmann, Handl and Thony, 2003:567).

With regard to more detailed analysis of the results, both groups demonstrated significant changes with regard to arithmetical fact knowledge and procedural knowledge. For performance knowledge, the score increase was higher for the control group, and only approached significance for the experimental group (Kaufmann, Handl and Thony, 2003: 567-568). Finally, when calculating a composite score that included all numerical tasks, the intervention effects were found to be significant in the experimental group. Performance changes over time in the control group were not significant (Kaufmann, Handl and Thony, 2003:568). Teachers and parents in the experimental group demonstrated an obvious learning transfer with regard to their attitude towards mathematics and their level of achievement (Kaufmann, Handl and Thony, 2003:569).

The above results demonstrate the importance of basic numerical knowledge and conceptual knowledge for children to successfully acquire and apply calculation skills (Dowker, 2000).

3.6 AN EARLY CHILDHOOD INTERVENTION PROGRAMME AND THE LONG–TERM OUTCOMES FOR CHILDREN

Reynolds, Mann, Miedel and Smokowski (1997) identified a number of assumptions believed to guide early childhood intervention programmes. They firstly assume that the underlying conditions of poverty affect the child’s development and are related to problems including school underachievement and delinquency. Secondly, they assume that educational and social enrichment can address some of these disadvantages. Thirdly, they claim that the child will experience early childhood education intervention (Martin, 2010:259-260).

There is scholarly evidence that in the United States, the early childhood intervention programme Head Start was successful in the early years. This programme aimed to improve the life chances of children through pre-school education. This programme was copied by the Bernard Van Leer Foundation of Holland and the Department of Education. The project was based in an area where most males were unemployed, part time work among females was common, and there was a very low level of parent education (Martin, 2010:260). (The conditions described there are almost similar to the ones prevailing where this study was conducted).

The project was conducted at Rutland Street Junior Primary School and Preschool. It was specifically established for children of three to five years old to improve their cognitive skills in preparation for their entrance to school. The project was influenced by Piaget's principles of development with specific stress on school readiness (Martin, 2010:260).

The first evaluation of the programme established that the children made good progress while attending the pre-school centre, but the progress faded at primary school. This is in line with findings of other similar studies (Martin, 2010:260).

The research methods used for evaluation involved "a quasi-experimental design with two groups, the experimental group (programme participants) and the control group (judged equivalent to the experimental group but who did not participate in the pre-school programme). At the end of the pre-school period, the evaluation found great improvement in the children's performance on tests of scholastic ability, knowledge of numerical concepts and vocabulary, among others (Martin, 2010:261). Nonetheless, after three years, subsequent tests found that the level of scholastic achievement had deteriorated and participants fell under the achievements of the standard population, but above that of the control group. The findings were similar to those for the Head Start programme in the United States.

In a follow up study, the work experience and aspects of attitudes, leisure activities and social deviance, and the educational careers of the control group and the experimental group were measured and compared at the age of sixteen for the experimental group. The latter group reported that a high number of them received encouragement from their homes to go to the next level. Importantly, 9.6% of the experimental group progressed to the Senior Cycle compared with none of the control group. More significantly, the study found that a “lack of success at primary level was an important predictor of early school leaving” and that the experimental group (30.5%) was three times more likely than the control group (11.8%) to take the Intermediate Certificate Level (15 to 16 years).

3.7 MATHEMATICS RECOVERY PROGRAMME (MRP)

According to Carr (2004:8), Professor Leslie Steffe and his colleagues at the University of Georgia undertook what they termed the “Mathematics Recovery Programme” (MRP) in an attempt towards early identification and intervention of children who develop a negative attitude towards mathematics. Their research indicates that vast differences in mathematical knowledge already exist among children when they initially enter school.

They also allege that strong negative attitudes to mathematics can develop as the children proceed with their studies. The MRP was directed towards early identification and intervention in this connection, and to provide children with a programme for individualised teaching. Children are assessed by means of an “Interview Schedule”. The assessment is done orally, seeking to identify among others, counting and place value. Once identified, children with negative attitudes are then given one to one teaching by the class teacher in order to address the child’s problems from a constructivist perspective. This is carried out for 10 to 15 weeks for 30 minutes daily, up to four or five times a week. Carr (2004:8-9) described how low-attaining children were identified and raised to a level where they could return and function successfully in the mainstream class at an early stage, and subsequently be provided with intensive, individualised remediation.

The MRP kind of intervention could also be very useful and effective in addressing difficulties to mathematics if adopted by South African schools. This is because the children’s problems would be addressed individually and confidentially.

Children would also be encouraged to reflect on their own mathematics thoughts and respond to the teacher without fear of being laughed at by their peers.

It goes without saying that children who emerge successfully from this programme will have an increased self-esteem and motivation. Identification and intervention are necessary, as well as the need for good language usage and encouragement by teachers. The programme also illustrates the value of self-esteem in education, especially at this level of the children's careers (Carr 2004:9).

The MRP also emphasises group teaching. Children are assigned to groups according to ability and performance in the subject. As they progress, the children are moved to better performing groups. Those children who experience mathematics difficulties would gain more confidence and improve if the tasks are aimed at their level of understanding. This helps to remedy difficulties that children have and promote learning. Children also become hungry to be included in better performing groups.

Children can also be placed in a mixed ability group. The use of group work as a means of instruction in this programme also encourages children to work together, participate and help each other. Here again, the good and effective use of language is vital. The teacher demonstrates and the children practice. Child led interaction also takes place.

Kyriacou and Goulding (2004:58) argue that for children to make early progress in mathematics and develop self confidence is a key challenge facing teachers of mathematics. They further charge that any approach that can improve children's early progress can help to provide a solid basis for future success (Kyriacou and Goulding, 2004:58). This is the reason why it is essential to identify and intervene as early as possible where children experience difficulties to learning. It is only by correcting the difficulties that children can develop self-esteem and as such, motivation to learn. Undoubtedly, if children are confident in solving mathematics problems their performance will be good.

3.7.1 Findings of the programme (MRP)

All the children seemed satisfied with their placement and understood the significance of ability as criteria for the groupings. They were also happy that they were being regrouped in an endeavour to help them. Most understood that they could change groups. Few in the weak ability group seemed not to be aware of this. Most children and parents from the sixth class were happy to exchange teachers for instruction during the year, but those in the fifth class were not happy with this arrangement. The general attitude towards the subject improved since the regrouping.

However, children from the middle and weaker groups appeared more sensitive to comments made about placements. It was also perceived that by the time children reach the sixth class, and had been in the system for a year, they generally accepted the process as the norm and the parents expressed their desire to have the regrouping continue (Carr 2004:10-11). The main focus of the system falls on the development of confidence towards the subject and the increase in positive self-esteem (Carr 2004:11).

3.8 STRATEGIES TO IMPROVE MATHEMATICS

Strategies in improving Mathematics from developed and developing countries are discussed in this section. In the next paragraph, the Australia – National Inquiry into the teaching of Literacy is explained.

3.8.1 Australia - National inquiry into the teaching of literacy

In Australia, to resolve mathematics problems, a mathematics recovery strategy for Grades 3 to 9 was developed. It was used in parts of Australia and adopted in several countries (Wright, Martland and Stafford, 2000). Achievement tests are conducted in Grades 3, 5, 7 and 9 (Elkins, 2007:396). In this manner, the Australian Education, Science and Training Department is able to monitor mathematics instruction and development of children. Among other things, fluency in reading, spelling and arithmetic are emphasised in Australia.

The mere fact that the mathematics recovery programme is being used beyond Australia's borders, for example in the United Kingdom and United States of America indicates that it is somehow successful and maybe South Africa should look at that or something similar in order to raise the education bar. The use of the achievement tests in Grades 3, 5, 7 and 9 constantly helps in checking problems related to mathematics teaching. South Africa does not have such a recovery programme and thus children go through a number of levels without any intervention in this regard. (The only external examination is in Grade 12 and by then it is very late to offer remediation).

3.8.2 England – National Numeracy Strategy (NNS)

Faced with the same problem as South Africa, in **England** the National Numeracy Strategy (NNS) was introduced in 1998 to reform mathematics teaching in all primary schools with the aim of improving and raising the standards. South Africa still needs to come up with a programme to do this.

Myhill (2006:19) claims that whole class interactive teaching was considered as a method of teaching in this strategy. Smith, Hardman, Wall and Mroz (2004:395-396) suggested that interactive forms of whole class teaching can play an important role in raising literacy and mathematics norms by promoting high quality dialogue, discussion and inclusion, to improve learning performance and understanding. The advantage here is that the teaching is interactive. The National Literacy Strategy (NLS) Framework is said to be discursive, characterised by high quality oral work, and the NNS Framework charges that high quality direct teaching is oral, interactive and lively. In the latter framework, children play an active part answering, discussing, explaining and demonstrating their methods (Smith et al., 2004:396 and Dowker 2003). The two methods, (National Literacy Strategy and National Numeracy Strategy) do not comprise the traditional lecturing and listening approach in which children are passive, but rather, they constitute an active two-way process.

Children are expected to participate orally as well as to practice. South Africa should perhaps also look at adopting these strategies so as to improve mathematics teaching. To do this effectively, the teacher should be able to use language effectively and efficiently and thus the teacher–child interaction is enhanced.

Although Brown et al. (1998:370-371) dispute the effectiveness of these approaches, a two-way process is encouraged. Teachers capitalise on children’s prior knowledge and how they can help children to become independent. Reynolds and Farrell (1996) argue that whole class teaching combined with direct instruction was the driver for high educational achievement in those Asian countries which adopted the NNS framework as standard practice.

It is important for South Africa to use both class and individual teaching so that one (the teacher) sees how the class does and at the same time corrects and supports individuals. Galton, Hargreaves, Comber, Wall and Pell (1999) assert that in spite of successive studies over several decades, which had repeatedly demonstrated the strong tendency of teachers to dominate classroom scenarios, the problem of domination by teachers still persists.

South African teachers should endeavour to give children more chance to practice rather than monopolising the lesson. Alexander (2004:17) critiqued the Reynolds and Farrell research on the grounds that it draws inappropriate correlation between the pedagogic practices of whole class teaching as the commonest teaching approach world-wide, because it is strongly associated with low as well as high standards.

Mathematics educators agree that if learning becomes simply a process of mimicking and memorising, children's interest is likely to diminish. The educators' intention in England was to involve children in constructing personal understandings consistent with accepted mathematics ideas. This also helps children to be active participants in constructing personal understanding with acceptable mathematics ideas. It is also to prepare children for a technological society in which the emphasis has changed from routine, process orientated calculating to the application of calculation in a wide range of contexts and situations through the development of more strategic thinking (Anghileri, 2006:364).

Following the final report of a government appointed mathematics task force (DfEE, 1998) the National Mathematics Strategy (DfEE, 1999a) was introduced as a nationwide initiative to improve mathematics attainment in all primary schools in England. In furthering the implementation of the National Strategy, a National Mathematics Framework for Teaching Mathematics from reception year to 6 years (DfEE, 1999a) that outlines programmes of study and sets expectations for each year group was distributed to all schools and was generally welcomed by teachers.

The above is something which South Africa should consider implementing. South Africa also needs such a strategy in order to be able to monitor the performances of children continuously from their reception year. This would minimise the problems of drop outs in later years.

3.9 INTERVENTION STRATEGY AT SCHOOL LEVEL IN THE SOUTH AFRICAN CONTEXT IN THE CLASSROOM

As the one person who spends long hours with the children during the day, the teacher knows the children better than the parents do. In the case where a child experiences mathematics difficulties, the teacher would use strategies like individual assistance, and modifying the curriculum so that the child can be accommodated. If there is no improvement from the child, then the child is referred to the School Base Support Team (SBST).

Once the child is identified as experiencing difficulties (such as mathematics) the child's profile document will serve primarily as a tool for educators to plan intervention and support on a day-to-day basis as part of the teaching and learning process. The uncovering of difficulties to learning must be based on sound observation, interviews and consultations, previous records, reflection, formative actions and should be grounded in the curriculum (The South African National Strategy on Screening, Identification, Assessment and Support (DoE SIAS), 2008:81). Once the educator has exhausted all strategies and support interventions he or she will consult with the institutional level support teams (ILSTs).

The South African White paper 6 (2000:33) asserts that the ILSTs should be involved centrally in identifying at risk children and addressing difficulties to learning. "Early identification of difficulties to learning will focus on children in the Foundation Phase (Grades R to 3) who may require support, for example through tailoring of the curriculum, assessment and instruction."

The South African National Strategy on Screening, Identification, Assessment and Support (DoE SIAS 2008:78) argues that if there are no ILSTs at a school, the District-based Support Teams (DBST) must assist to set them up.

3.10 SOUTH AFRICA – THE FOUNDATION FOR LEARNING CAMPAIGN (FFLC)

In a comment in the *Star* (November 2008:6) Naledi Pandor, the former **South African** Minister of Education, argued that only 35% of children in South Africa can read, write and count. It is for this reason that the minister introduced the programme called Foundation for Learning Campaign (FFLC) from 2008 to 2011, with the aim of improving mathematics and literacy in South African schools. It was also intended to increase the average children's performance to not less than 50% in all foundation phase grades in the country. The Foundation for Learning Campaign Programme was published in the South African Government Gazette of 14 March 2008. It was to culminate in the national evaluation at the end of 2011 to assess literacy/mathematics levels of Grades 3 to 6 children in order to determine the overall impact of the campaign. The South African Government Gazette (2008:4) reports that the four year campaign's goals were to:

- Improve the reading, writing and mathematics abilities of all South African children.
- Provide energy as well as direction and inspiration across all levels of the education system and also to ensure that by 2011 all children are able to demonstrate age appropriate levels of literacy and mathematics.
- Provide teachers with clear directives on the Department of Education's expectations of schools and teachers to achieve the expected levels of performance.
- Ensure that support is provided towards the achievement of the campaign's objectives.

Ensure that ultimately children across the system acquire and sustain a solid foundation for learning.

All primary schools will be expected to increase average child performance in literacy language and mathematics to not less than 50%, indicating an improvement of 15% to 20% during the four years of the campaign.

I have read all the different programmes by various scholars mentioned in chapter 3. The programme that I propose will be based on Dowker's (2001) ideas as she cites similar child problems to the once I encountered during the data collection in (5.2).

I see Dowker's (2001) programme as the best as it address issues that are mentioned in 5.2.However, it does not really address South Africa problems completely. Hence I will modify/adapt the programme in order to suite my study and after for specifically SA problems on my findings among grade 3 children. The proposed programme will be discussed in detail in chapter 6.

3.3 CONCLUSION

This study outlined the introduction, the different intervention programmes used in different countries and South Africa in addressing mathematics difficulties experienced by children, principles of effective practice in mathematics teaching, Oxford mathematical recovery scheme, intervention programme focusing on basic numerical knowledge and conceptual knowledge, an early childhood intervention programme and the long–term outcomes for children, an early childhood intervention programme and the long–term outcomes for children.

This study also outlined mathematics recovery programme (MRP), findings of the programme (MRP) strategies to improve mathematics**,** Australia - National inquiry into the teaching of literacy and England – National Numeracy Strategy (NNS).

Lastly the study highlighted the intervention strategy at school level in the South African context in the classroom, and the Foundation for Learning Campaign (FFLC).

CHAPTER 4

RESEARCH DESIGN AND METHODOLOGY

4.1 INTRODUCTION

The literature review in the foregoing chapter served to illuminate the different perspectives on aspects that pose challenges in the teaching of mathematics in the FP. It provided further detail that would assist in answering the research question namely, which approaches teachers use when teaching mathematics computation in Grade 3 and realising the aim of the research which is to establish the approaches teachers use when teaching mathematics.

This chapter outlines the research methodology, study design and sampling procedures. The chapter further explains data collecting techniques which include observation, interviews and document analysis. The rationale for using the methods is explained. The chapter further highlights how ethical requirements were observed.

4.2 RESEARCH METHODOLOGY

A pilot study was carried out at one school prior to the actual fieldwork in this research. The school resembles the ones used in the research in terms of area where they are situated, child problems and teacher challenges in teaching mathematics. The purpose of the pilot study was to test the research instrument and gain more insight into the mathematics teaching problem.

The aim of conducting a pilot study was also to test if participants would be able to answer the interview questions as expected and to allow the researcher to re - phrase them where necessary and also note if the participants needed further clarification. The outcome of the pilot study indicated those questions that were not clear enough and these were paraphrased to enable the current participants to answer them appropriately. The qualitative method was selected as appropriate for this research for reasons explained below.

4.2.1 The qualitative method

McMillan and Schumacher (2010:320) describe qualitative research as an analysis of people's individual and collective social actions, beliefs, thoughts and perceptions and are primarily concerned with understanding the social phenomena from the participant's perspective in addition to this definition. Creswell (2010:56) charges that the aim of qualitative research studies is to engage in research that probes for a deeper understanding of a phenomenon rather than to search for causal relationships. Qualitative research sets out to penetrate the human understanding and the construction thereof.

The qualitative approach was used in this study to explore the views of Grade 3 teachers regarding challenges they faced when teaching Mathematics. The approach was followed because it is an approach that allows researchers to gain insight into the inner experience of participants, to determine how meanings are formed through culture, and to discover rather than test variables (White 2005:81 and Corbin and Strauss 2008:12).
As a researcher using the qualitative method, it is important to describe the context in which this study was conducted. According Terre Blanche (2001:271), in any qualitative study, the context was accepted in a naturalistic manner where a researcher was physically present. In the case of this research the contention is that it will be best for understanding children's problems and teacher challenges in the teaching of mathematics. It would be best to visit the schools and observe teacher child interactions. Thus, this context is viewed as influencing both the participants and the data that was collected.

Merriam (2009:13) concurs with this view and adds that events could be understood adequately if they are seen within a context. Thus any context is unique and is characterised by a unique time, geographic setting, social and historical settings and that these aspects impact on both the researcher and the participants.

Babbie (2003:272) also states that the qualitative researcher has a preference in understanding events, actions, and processes in their context and adds that other writers refer to this as the contextualist or holistic research strategy of qualitative research. Thus, the qualitative researcher aims to describe and understand events within the concrete, natural context in which they occur. Therefore, it is only when one understands events against the background of the whole context and how this context confers the meaning to the events concerned, that one could truly claim to “understand” the events.

Since this research was about establishing how mathematics computations were taught, it became important to consider a study design that would best yield the desired answers. (Creswell 2010:78).

4.2.2 Study Design

Mouton (2006:55) defines design as a plan of how one intends conducting the research. According to his explanation, a research design focuses on the end product, formulates a research problem as a point of departure, and focuses on the logic of the research. Thus a research design ensures that there is a structure for the way in which data will be collected and analysed as well as the procedure to be followed.

David and Sutton (2004:133) and McMillan and Schumacher (2010:345) argue that the purpose of the research design is to provide a framework for the collection and analysis of data and to improve the validity of the study by examining the research problem.
The present study was designed as a case study investigating which approach teachers used when they taught computations in mathematics. The rationale for the choice of the design would allow the researcher to focus closely on the issue at hand. The design would also make it possible to establish which aspects of mathematics teaching are problematic. Yin (2009:18) argues that a case study is used in order to understand a real-life phenomenon in depth; however, such understanding encompassed important

contextual conditions, because they are highly pertinent to the phenomenon of the study. Contextual issues in this study would be the learning environment, especially those classroom variables that are related to mathematics teaching. The case study was preferred because Baker (1999:321), McMillan and Schumacher (2010:344) and Creswell (2010:75) indicate, it could afford the researcher a better understanding of the problem.

Another important fact is that a case study has to do with a limited number of units of analysis (often only one) such as an individual, a group or institution, which are studied intensively, (Welman and Kruger 2001:105 and Creswell (2010:75). In this study, the units of study constitute the Grade 3 classes in the Foundation Phase of schools in Mamelodi Township in Tshwane South district.
The schools and teachers were selected according to the sampling procedure outlined below.

4.3 SAMPLING

Creswell (2010:79) explains sampling as the process used to select a portion of the population for a study. Sampling implies selecting a section of a population for investigation in which we are interested. A sample is studied in an effort to understand the population from which it was drawn. As such, we are interested in describing the sample not primarily as an end in itself, but rather as a means of helping us to explain some facet of the population (de Vos 2000:199 and Bryman (2012:416). McMillan and Schumacher (2010:129) describe sampling as the group of participants from whom the data are collected is referred to as the sample.

The sample can be selected from a larger group of persons, identified as the population from whom data are collected even though the subjects are not selected from the population.

Sampling decisions are made for the purpose of obtaining the richest possible source of information in order to answer the research questions. Qualitative research usually involves smaller sample sizes than those required for quantitative research studies. Sampling in qualitative research is flexible and often continues until new themes no longer emerge from the data collection process – termed data saturation (Creswell (2010:82).

4.3.1 Types of sampling

There are two types of sampling namely a probability sample and non - probability sample. Probability sample is a sample selected by using a random selection whereby every member of the population has a chance of being selected. Probability sample can be divided into: simple random sample, systematic sample, stratified random sample, and multi stage cluster sample.

The first is the most basic form of probability sample with everyone in the population standing an equal probability of being included in the sample. The second type implies selecting participants (units) directly from the sampling frame without using a table of random numbers. The third type is where you want your sample to be representative of all various elements, inclusive type implies dividing the population into clusters and then using probability sampling method to select a sample from among those selected in the clusters (Bryman 2012:416).

Qualitative research can also be based on non-probability. A non – probability sample implies a selection of a sample not using a random method of selection and some members of the population are more likely to be selected than others. A non – probability sample covers all other kinds of sampling not conducted according to probability sampling. It includes convenience sampling, snowball sampling, qouta sampling and purposive sampling. Convenience sampling is simply available to the researcher by virtue of its accessibility. Snowball sampling may be experienced when the researcher meets or makes contact with a group of people relative to the topic under research and then uses them to make contact with others. (For example make initial contact with Mamelodi Sundowns players and then through them make contact with Orlando Pirates' players). Qouta sampling is used mostly in commercial research and very rare in academic social research. Qouta sampling aims to produce a sample that reflects a population in terms of proportions of people different categories for example gender, age – groups or ethnicity, Bryman (2012:416).

Purposive sampling was chosen for this study, because it would be the most representative way of looking at the targeted population. For the researcher, this was appropriate because it would allow for the selection of specific schools. The researcher also considered certain specific characteristics when selecting this sample. Among others, children who are in Grade 3, whose ages are between nine and ten, and Grade 3 teachers in disadvantaged areas. The rationale for the choice of this sampling procedure is elaborated below.

4.3.2 Purposeful sampling

Purposive sampling means that participants are selected because of some defining characteristics that make them the holders of the data needed for the study. Sampling decisions are made for the purpose of obtaining the richest possible source of information in order to answer the research questions. Purposive sampling decisions are not only restricted to the selection of participants but also involve settings, incidents, events and activities to be included for the data collection.

According to White (2005:120 and, McMillan and Schumacher (2010:138), in purposeful sampling, the researcher identifies "information–rich" participants as they are possibly knowledgeable about the phenomenon under investigation. Purposive sampling also defines a type of sampling that allows one to choose a case because it illustrates certain features in which one is interested.

Purposive sampling is based entirely on the judgment of the researcher in that a sample is composed of elements that contain the most characteristics that are representative or typical attributes of the population (de Vos, 2004:207). For the purpose of this study, the targeted population was Grade 3 children and teachers in primary schools in Mamelodi.

The sample comprised five schools purposely selected in Mamelodi Township in the Tshwane South district of the Gauteng Department of Education. These were schools known to experience problems in the teaching of mathematics. One teacher was selected per school since all the schools had one Grade 3 class. The focus was on the Grade 3 teachers' teaching activities and children responses to the teaching. The teachers were studied not only for what they taught but also whether they offered learning support to children experiencing problems.

4.4 DATA COLLECTING TECHNIQUES

In qualitative data collection, the researcher is the main collection device (Creswell, 2010:78). The researcher is a tool and therefore without him or her no research can take place. The researcher has to be immersed in the study and to be the instrument. In order to carry out this research inquiry, the researcher identified and selected data sources for the purpose of this research (White 2005:186). The researcher collected data at the local setting of the school site over a period, in line with (Creswell, 2010:78) (section 3.18).

4.4.1 Observations

In qualitative research, the techniques that are normally employed are observation, individual interviews and document analysis. Since this research follows the qualitative approach, the researcher used all three techniques. The process of data collection was followed in three phases.

Creswell (2010:83) explains observation as a systematic process of recording the behavioural patterns of participants, objects and occurrence without necessarily communicating with them. Observation is an everyday activity whereby we use our senses (seeing, hearing, touching, smelling, tasting) but also our intuition to gather bits of data. McMillan and Schumacher (2010:208) allege that observation is used to describe the data that are collected, regardless of the technique employed in the study.

Observational research methods also refer, however, to a more specific method of collecting information that is very different from interviews or questionnaires. The observational method relies on a researcher’s seeing and hearing things and recording these observations, rather than relying on subjects’ self report responses to questions or statements. De Vos (2002:278) describes observation as a typical approach to data, which implies that data cannot really be reduced to figures. In the observation of participation the emphasis is thus both on one’s own and on the participation of others. Denzin and Lincoln (2000:673) add that researchers observe both human activities and physical setting in which such activities take place.

Observation is used to describe the data that are collected, regardless of the technique used in the study. Classroom observations were the most important tools of the said qualitative research as the researcher witnessed all the processes of teaching in a natural setting (McMillan and Schumacher 2010:208).
According to Creswell (2010:83), there are four kinds of observation that are used in qualitative research.

The first is complete observer. This researcher is a non participant observer who looks at a situation from a distance. It is the least obtrusive type of observation. The second is an observer as a participant. This observer gets involved in the situation. The observer does not get involved or influence the dynamics of the setting. The third type is the participant as observer. This is characteristic of action research projects in which the observer becomes part of research process.

The researcher works with the participants in the situation under observation and may intervene in the activity and even attempt to change it. The last type is termed a complete participant. The observer is totally immersed in the situation such that those involved do not even notice that they are being observed. This may sometimes raise grave ethical concerns when those being observed were not asked for consent.

In this study the researcher acted as a non – participant observer during data collection. The researcher assumed the role of non - participant observer when investigating different schools and held informal one- to- one observation with individual teachers. The researcher sat at the back of the classroom taking field notes describing the classroom activities using an observation guide (Appendix: B). The researcher wanted to explore the approaches teachers use during the teaching of mathematics computation. The researcher observed the following:

- **Classroom organization**

  Mercer (2006:507) charges that children construct solutions for mathematics through talk. Therefore it is important to organize children in groups in order to encourage child participation (2.4.2). Alexander (2000) also concurs with Mercer by arguing that dialogic teaching encourages children's active participation (section 2.4.2).

- **Classroom Resources**

  Carruthers and Worthington (2006:74) and Willis (1998) allege that children would understand learning content better if they use objects derived from their own environment in their learning (2.4.3). Crawford and Witte (1993:34) claim that the use of resources encourages active learning by children. This makes the children active participants in their own learning (2.6.5). Fagnant (2005:355) also supports these assertions by claiming that using counters develops children's skills of addition and subtraction (2.6.5).

- **Teacher Activity**

According to Even and Tirosh (1995:164) if a teacher and her children understand concepts, she will have a better control and direction of classroom activities (2.5.1). De Corte (2004:280) supports Even and Tirosh's allegation and adds that children should learn by understanding and not by rote. Therefore the children's understanding of concepts will help to facilitate learning (2.6.5).

- **Teacher child interaction**

Van de Walle (2007:30) states that teacher - child interaction in which children are actively engaged in the process of constructing numerical knowledge and understanding is effective in the learning situation. The children learn by doing and thus help to find the solutions to problems themselves (2.2.1). Schunk (2004:412) also argues that children construct mathematical knowledge as advised by teachers. Teachers therefore do not give children solutions to problems but guide the children to find these solutions. Success gained this way would lead to more interest to participate in learning.

- **Child to child interaction**

Van de Walle (2006) argues that child interaction enhances social interaction as children can share how they arrived at the answers (section 2.2.1). Vithal et.al. (1992) suggest that dialogue between children and teachers is good for the learning process. This helps the introvert to open up and participate in the learning process too (2.2.2).

Lewins and Silver (2007:10-11) outlined the advantages of observation. The advantages include the fact that the observer is actively engaged in activities at the research site, where there is first hand involvement and immersion in a natural and social setting.

The researcher gains insight into the views of the participants more readily, develops a relationship with them, and hears, sees and begins to experience reality as the participants do. The researcher does not stand aside as an outsider.

Observations give comprehensive perspective on the problem under investigation. The researcher also learns from her own experience and reflections, which form part of the emerging analysis. Data are gathered directly and are never of a retrospective nature. Informal observation data was supported by semi structured interviews during her experience within the context and by the verification of factual data through the interrogation of documents where necessary.

4.4.1.1 Observation guide

1. The classroom environment was observed to determine if it contributed to mathematics teaching problems. The following were observed:

- Classroom resources
- Classroom organisation

2. Teaching activities are important variables that influence successful teaching and learning. These will include:

- Teacher - child interaction
- Child participation
- Child - to - child interaction

3. Methods used to teach mathematics computations are regarded as the major determinants of successful learning. The methods used were observed for their effectiveness on children’s successful learning.

4.4.2 Interviews

An interview is a two – way conversation in which the interviewer asks the participants questions to collect data and to learn about the ideas, beliefs, views, opinions and behaviours of the participants (Creswell 2010:87) and Marshal, and Rossman, (1995).. In qualitative research there are three types of interviews, an open ended interview, semi structured and structured interviews.

- **Open ended interviews**

  This is a type of interview in which the intention of the researcher is to explore with the participants ideas, views, beliefs and attitude about events or things. Open ended interviews normally take a long period and consist of a series of interviews.

- **Structured interview**

  In this type of interview, questions are detailed and compiled in advance like in survey research. It is mostly used in multiple case studies or larger sample groups. This is done in order to ensure consistency.

- **Semi structured interview**

  The semi structured kind of interview is commonly used in research projects with an intention to corroborate data found in other resources. It often takes long and requires the participant to answer a series of prearranged questions. A semi structured interview guide is drawn to define the line of questioning. As suggested by Bless *et al*. (2007:119) and Lincon, and Guba. (2006), semi structured interviews clarify concepts and problems and allow the formulation of possible answers and solutions. In addition, semi structured interviews allow new aspects of the problem to emerge by elaborating in detail the explanation given by the participant.

The researcher opted for semi structured interview as it could help her to explain in detail which approach teachers use when they teach computations in mathematics. The researcher's intention was also to find clarity on mathematical aspects that were most problematic.

In this study, interviews took place in Grade 3 classes at the school site. The interviews were held during school time and lasted approximately twenty to thirty minutes. I conducted interviews during working hours as I had received permission to conduct research at the schools from the National and Provincial Department of education Appendix.

The researcher conducted individual face - to - face interviews with the teachers. The interviews were semi structured in nature.

During the process the researcher tape recorded the interviews held with Grade 3 teachers and thereafter transcribed them verbatim. The researcher listened to the tapes several times, perused the transcriptions a number of times too, in order to find meaning and context. The researcher also looked at the participants' reaction collectively to each question. Inductive analysis means that categories and patterns emerge from the data rather than being imposed on data prior to data collection.

The researcher used probes in order for participants to provide further information as advised by Leedy, and Ormond, (2005) and Creswell (2010:81) (4.2.1). The researcher kept a diary where she recorded her own reflections during the interviews. She stored the transcribed data in a safe place. An interview guide was employed in accordance with the principles outlined by Hollway and Jefferson (2001) and Creswell (2010:87) (Appendix C). After observing the lessons, the researcher asked the participants for permission to audio tape the discussions as it was not possible for her to capture all the discussions otherwise.

Firstly, when the researcher asked about the approach the teachers used for teaching mathematics computations, the idea was to establish their knowledge of appropriate approaches for teaching mathematics. Secondly, the question regarding whether the teachers' experienced difficulties was asked to determine the exact nature of the mathematics problems. The ultimate purpose of all interview questions was to get to the source of poor mathematics performance so as to recommend a way of dealing with them.

During the interview, the researcher took field notes regarding interview interactions (verbal and non-verbal communication) between the researcher and the participant. After the completion of the interviews, the researcher asked all participants if they had any questions they would like to ask in case the researcher left something out. The researcher thanked all the participants for their time, their contribution, and for agreeing to take part in this research.

An interview guide was used during the interview and the interviews were conducted in English. In the next section, the researcher outlines the data captured from the individual interviews. All the participants responded to each question. The researcher used the interview technique as it enhances the study.

While flexibility and adaptability are great advantages of personal interviews, they are costly and time consuming (Welman and Kruger 2001).

Personal interviews could also not be conducted anonymously and researchers must thus take care not to say anything that could be construed as a desired response, but must rather use open ended questions. Some advantages of personal interviewing identified by Welman and Kruger (2001) include control over responses and response rate of the participants. They emphasise the control of the researcher in the interview situation through personal interaction whereby they may gain the confidence in interviewing evasive respondents, record their answers, and follow up on incomplete or vague responses and so obtain rich data. The researcher's physical presence may reduce elusive responses during a direct encounter and participants may be more willing to talk about their experiences in an interview.

White (2005:143) outlines the following advantages of interviews:

- *Flexibility,* when the participant indicates that she has not understood the question, the researcher could repeat and probe for more specific answers.
- *Response rate:* Participants, who are unable to read and write, could still answer questions in an interview.
- *Control over the environment:* The researcher could standardise the interview environment and hold it in a quiet and private place.
- *Non-verbal behaviour:* the presence of a researcher could observe non- verbal behaviour and assess the validity of the interviewee's response.
- *Question orde*r: the researcher could ensure that participants answer questions in order.
- *Spontaneity*: immediate answers may be more informative than answers about which a participant has had time to think.
- *Respondent alone could answer*: the researcher obtains immediate answers as the participant is not able to cheat.
- *Completeness* the researcher is able to make sure that all questions are answered.

4.4.2.1 Interview guide

- Which approaches do teachers use when teaching computations in mathematics?
- How do they resolve the problems?
- How did teachers identify children who experience mathematics problems?
- Which aspects of mathematics were most problematic?
- What else do they do to help children understand mathematics computations?

4.4.3 Document analysis

In the view of McMillan and Schumacher (2010:452), documents are printed or written records of past plans and events. For each school visited, the researcher requested that the principal allow the teachers to provide her with their records in order to determine the extent to which they interact with the policy documents of the DoE and how this influences the skills development plans at the school.

In order to gain further insight into the research, the researcher collected all the relevant official and unofficial documents such as the child's books, the teacher's work schedules, referral forms and the Mathematics curriculum learning programme as evidence to improve the trustworthiness of this study. The researcher also used documents and records of the Grade 3 teachers in order to clarify classroom observations. The purpose for so doing was to establish the understanding of the teachers and other role players with regards to DBE policies and the interpretation thereof. These records were also viewed as being important in this study as they are specific. Documents used in my analysis and referred in the text of this dissertation are listed and included as appendices to the thesis.

- **Child's books**

  The children's books could reveal where the child encountered a barrier, how the child arrived at the answer, and how the teacher could support the child.

- **Teacher's work schedule**

  The teacher's work schedule could indicate the work that the teacher is presently covering, the different tasks that are set for the various children, and the types of media employed.

- **Referral forms**

  Referral forms could provide the same information; however, they could also indicate further support for an individual child, including requests for the placement of a child in an appropriate school such as a special school or further assessment in order to rule out any possible learning difficulties that a child might be experiencing.

- **Time Table**

  The time table could show how many times mathematics is taught a day and per week. It will also indicate at what time of the day is mathematics taught.

- **Mathematics curriculum**

  The Mathematics curriculum could indicate whether the teacher follows the policy as well as whether the teacher is on track with the curriculum.

  Document analysis is suitable for this study because it afforded the researcher an opportunity to view the documents, policies and learning programmes that are used in teaching Mathematics. The researcher could also establish whether the teacher's Mathematics lessons fell in line with the policies.

These documents were analysed and integrated with the evidence obtained through the interviews with teachers. The documents enriched and supported the oral information collected (Appendix: D). The following paragraph outlines why the researcher used observations, interviews and document analysis in collecting data.

As supported by Henning, Van Rensberg and Smit (2004:99) and McMillan and Schumacher (2010:360), documents constitute a useful and valuable source of evidence. In the following section, the interview techniques employed in the study are discussed.

4.5 PHASES OF DATA COLLECTION

PHASE: 1

The study was conducted in three phases. Classroom observations were conducted for five weeks in three phases at all the sampled schools. During this phase the researcher used observation technique with the aim of getting a clear picture of, what approaches teachers used in the teaching of mathematics, how they interacted with the children and also how the children participate during mathematics teaching (4.5). In this position, the major aspect of the observation was listening, while watching was occasionally necessary. The researcher sat at the back of the class taking field notes describing the classroom activities using an observation guide. The researcher observed five mathematics lessons at each school.

PHASE: 2

During the second phase, the researcher conducted five weeks of classroom interviews with five teachers. The researcher interviewed each teacher in the morning whilst the children were still active. The researcher interviewed all the teachers with the aim of confirming what she had seen during the observation. The researcher also wanted to see if the teachers could answer the research questions (1.2) namely:

- Which approaches do teachers use when teaching computations in mathematics?
- Which aspects of mathematics were most problematic?
- How do they resolve the problems?
- How do teachers identify children who experience mathematics problems?
- What else do they do to help children understand mathematics computations?

The researcher requested that the principals of the five sampled schools grant permission to take photographs of all five of the participants

PHASE: 3

In the third phase, the researcher requested documents used during the mathematics teaching with the aim of confirming what she saw during the observation and heard during the interviews. The researcher collected mathematics documents such as children's books, teacher's work schedule, referral forms, time- table and mathematics curriculum from the five teachers over a period of one week (4.5)

4.6 TRUSTWORTHINESS

The researcher employed the following strategies to ensure the trustworthiness of the data used in this study: member checking, triangulation, peer debriefing and a prolonged stay in the field.

- **Member checking**

  After the collection of data, the data were transcribed, arranged into cases, and analysed. The researcher went back to the participants with the cases in order to verify that the researcher had captured them well. The cases that were found to contain inaccuracies or misunderstandings were rectified.

- **Triangulation**

  The instruments of data collection were tested before the data collection processes In order to validate the data collected, one of the methods used was triangulation (figure 4.1). Triangulation is defined as the use of more than one data collection method (White, 2005:89). The researcher employed multiple theoretical perspectives, that is, constructivism and cognitive theory.

- **Peer-debriefing**

  The researcher shared her data with a colleague who is an expert in the field and received feedback which helped her to add further information. As mentioned earlier, the data was presented and critiqued at UNISA (College Research symposium), the local conference UNISA (Teacher Education at a Distance) and an international conference (EASA).

- **Prolonged stay in the field**

  A researcher needs to be in the field long enough to collect credible data. The researcher collected data for fifteen weeks in three phases. Thereafter she carried out member checking for a week. In the next section, the validity of the study is discussed.

4.6.1 Validity of the data

An instrument is valid if it measures what it is supposed to measure (Creswell 2010:216). There are different forms of validity, namely: Face validity, which refers to whether an instrument appears to measure what it is suppose to measure. Content validity, this validity refers to the extent to which the instrument covers the particular construct. It should measure all the components of the construct. Construct validity, is the kind of validity needed for standardization. If for instance one measures intelligence, it must measure all personality factors related to intelligence. Criterion validity, construct indicates the correlation between the instrument and criterion. A high correlation implies a high degree of validity (Creswell 2010:216).

To ensure the validity of the data collected, one of the methods employed was triangulation. According to White (2005:89), triangulation defines more than one source of data collection method in the study of human behaviour. Consequently, unstructured, semi structured interviews, observation, and document analysis were all used in this study. To further validate the process, the researcher made follow up visits and conducted interviews in order to seek clarity on the interview transcripts from the participants. In going about her research, she was at all times considerate of ethical issues such as informed consent, confidentiality, and possible effects on the participants.

The researcher also triangulated the data by using more than one theory, for example, the constructivism and cognitive theory, because these theories validate this argument with regards to aspects that pose a challenge in the teaching of mathematics among Grade 3 children, thus affording this argument as a base. These presentations enhance the validity of the data

4.6.2 Reliability of the data

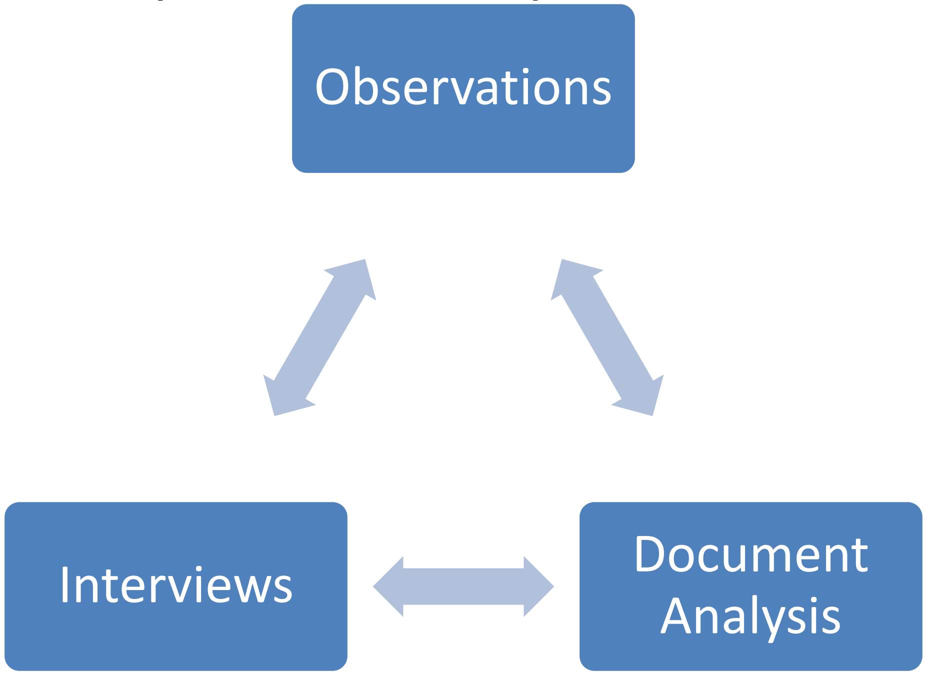
Reliability is when the same instrument is used at different times but always gives the same results. In other words the instrument is repeatable and consistent (Creswell 2010:215). There are four different forms of reliability namely:

Test - retest reliability – the same instrument is administered on the same subject at different times and the results are more or less the same. Equivalent form of reliability is obtained by administering the instrument and then on a second occasion an equivalent instrument is used to measure the same construct. Split – half reliability the items that make up the instrument are divided into two. The two separate “half instruments” are then compared. Internal reliability – is also referred to as internal consistency when a number of items are formulated to measure a construct and there is a great degree of similarly (Creswell 2010:215 - 216).

(Mertler and Charles 2008:130). To ensure reliability the researcher provided her evidence with the following:

The study was also piloted in three schools not participating in the research in order to test the instruments before the process of data collection. The instruments were piloted and revised appropriately. The inclusion of multiple sources of data in a research project is more likely to increase the reliability of the observations (Mertler and Charles (2006:132) Denzin, as cited by Thomas and Nelson 2000:14). Furthermore the data for the present study was presented and critiqued at UNISA (College Research symposium), local conference UNISA (Teacher Education at a Distance) and international conference (EASA) 2011 and 2012.

Figure 4.1 multiple data used in the study



As this study was conducted among teachers in the Foundation Phase, the researcher could not separate the three instruments (observation, interviews and document analysis), especially since these instruments are intertwined (David and Sutton 2004:133; McMillan and Schumacher 2010:33) as indicated in (4.4.1, 4.4.2 and (4.4.3). The researcher used multiple forms of data so as to answer the research questions as supported by David and Sutton (2004:77) in (4.4.1, 4.4.2 and (4.4.3). and also to promote triangulation.

In the next section, the ethical considerations of the study are discussed.

4.7 ETHICAL CONSIDERATIONS

Bless *et al.* (2006:139) explain that the word "ethics" is derived from the Greek word "ethos", meaning one's character. It is related to the term "morality". A moral issue is concerned with whether behaviour is right or wrong, whereas an ethical issue is concerned with whether the behaviour conforms to a set of principles.

Researchers such as Creswell (2010: 41) and Bless *et al*. (2006:139) agree that ethical issues are integral to the research process and therefore need to be carefully considered before the research process is finalised. An essential ethical aspect is the issue of the confidentiality of the results and findings of the study and the protection of the identities of the participants. Creswell (2010: 42) further adds that obtaining letters of consent, obtaining permission to be interviewed, undertaking to destroy audiotapes, and so on should be included in the ethical principles. In this study, the following ethical issues were observed:

Permission: to conduct research in Tshwane South District was approved by the Regional Director, the school governing bodies, the principals and the teachers to carry out the proposed investigation in the selected primary schools. Letters requesting permission and their replies can be found in (Appendix: E). The researcher also submitted the project outline to the heads of institutions where the research was conducted so as to avoid deception and betrayal, and to ensure anonymity, confidentiality and honesty about the purpose of the study and the conditions of the research

- **Gaining entry to Mamelodi schools**

  The researcher phoned the principals of all the sampled schools and scheduled an appointment with each one. Upon arrival, the researcher introduced herself and the purpose of her being there. She handed to the principals a letter (Appendix: F) of requesting the said research to be conducted at their schools with approved permission from the DoE head and the district offices. The researcher further requested the principal to nominate one of the Grade 3 teachers with whom the researcher would work. The principals and the HODs of those phases introduced the teachers to me. The researcher again introduced herself to the HODs who took her to one of the Grade 3 teachers. Once again she introduced herself to the teacher and explained the purpose of the research and the role of the teacher in the study.

She arranged a date on which she could observe the teacher in her class. The researcher thanked her for agreeing to participate in the study and assured her that her name will be kept anonymous and that all the data gathered from her will be confidential. The researcher further explained to her that during her visit the researcher would request her to sign a consent form. The following paragraph describes how the researcher gained entry into the Mamelodi schools.

- **Informed consent:** Above all, the researcher ensured written consent (Appendix: G). Participants were informed about the purpose of the research, the interview and transcription process, and were assured of confidentiality. The researcher informed the participants of what the research was about, and the fact that they had the right to decline participation if they chose to do so. Bless *et al*. (2002:143) assert that the researcher should explain to participants what the study entails and what is required of them in terms of participation. Each participant was asked to sign an informed consent form, which is an indication that they indeed understood what had been explained to them. Voluntary participation is important. The researcher explained the purpose of the research and why she had included them in the sample. She asked interviewees to ask any questions.

- **Confidentiality:** To promote confidentiality, information provided by the participants, particularly personal information, was protected and not made available to anyone other than the researcher. All participants were assured of confidentiality by means of a written notice. Participants were allocated pseudonyms to protect their identities and to ensure confidentiality. The researcher reassured the participants that their real names would be kept anonymous and all data gathered would be kept confidential. The researcher introduced herself in order to gain the trust of the participants.

- **Data anonymity:** The data collected from the participants was kept under secure conditions at all times. The researcher assured all participants that no person, except the researcher and the study leader would be able to access the raw data. The transcribed raw data did not contain the names of participants, the children, or the school names. Alpha notations were used for labelling the data.
- **Anonymity:** Creswell (2010: 143) agrees that participant's data must not be associated with his or her name or any identifier; rather, the researcher may assign a number or alpha symbol to a participant's data to ensure that the data remain anonymous.

- **Discontinuance:** To promote the discontinuance, participants were given every assurance that they were free to discontinue their participation at any time without being required to give an explanation (Creswell, 2010: 143).

- **Appointments**: the researcher distributed the letters personally to the principals of each selected school, followed by visits and appointments to conduct observations, and interviews.

- **Letters to the principals**

  Boundaries for data collection are influenced by the general research methods pertaining to the study (1.8) and the proposed research questions (1.2). The specific parameters for data collection in this study include the choice of the site and the selection of the participants (4.3).

  In this study, the researcher telephoned the head office and the district office in the Gauteng Department of Education requesting permission to conduct research at the schools. The researcher was requested to complete a document of request for conducting research.

After the researcher submitted the document, she was informed by means of email and by post that permission had been granted and that the researcher could conduct the said research in the schools. She personally delivered the letters to the principals in the schools. The following paragraph explains the pilot study that was conducted. The following paragraph details the strategies of trustworthiness.

- **Scientific ethics:** Mouton (2006: 293) refers to unethical behaviour called scientific misconduct, which includes research fraud and plagiarism. Scientific misconduct occurs when a researcher falsifies the data or the methods of data collection. Scientific misconduct also includes significant departures from the generally accepted practices of the scientific community for conducting or reporting research.

  Research institutes and universities have policies and procedures to detect misconduct, to report to the scientific community and to penalise the researcher who engages in it. The researcher is continually under the supervision of his or her promoter and abides by the rules and regulations of the university.

4.8 DATA ANALYSIS

Qualitative data analysis is an ongoing process by which a researcher tries to find out how participants are making meaning of a specific phenomenon. The researcher analyses their feelings, attitudes, values, knowledge, understanding, perception and experiences in an endeavour to approximate their construction of the phenomenon (Creswell: 2010:99 and McMillan and Schumacher 2010:367). Since the purpose of the study is to explore the approaches teachers used when teaching computation in mathematics., the interpretive paradigm allows me to explore and get a deeper understanding of the research participants' perceptions, experiences and opinions in relation the approaches teachers use when teaching computation in mathematics.

Data analysis is mainly interpretive, involving the categorizing of findings. The aim of data analysis is to reduce and synthesise information to make sense out of it and allow inference about the population, while the aim of interpretation is to combine the results of data analysis with the value statements, criteria, and standards in order to produce conclusions, judgments and recommendations as noted by Mertler and Charles (2008:153) and White (2005:104).

Finally, the researcher arranged the cases by each question for all participants (see Appendix: H). In the case of this research, some of the categories that emerged from this study among others, the approaches teachers use when teaching mathematics computation, which aspects of mathematics were most problematic, how did teachers solve the problem, how teachers identify children who experience mathematical problems, and if the Foundation for Learning Campaign helped teachers and children with the teaching and learning of mathematics.

The researcher analysed the data after every interview. This reduces the volume of raw information, sifting significance from trivia, identifying significant patterns and constructing a framework for communication the essence of what the data reveals as in line with (De Vos 2006:333). This made it easier, in that, the researcher sifted through the data and collected that which she deemed relevant for the study.

The researcher read the transcribed data and field notes from beginning to end for a number of times in order to get the initial sense of the data. The reason for reading the whole materials to enter vicariously into the lives of participants, feel what they are experiencing and listen to what they are telling us as in line with (Corbin and Strauss 1998:163).

To ensure confidentiality during the Phase 1 participating schools were coded by means of the letters of the alphabet, from A to E. All the school's letters of alphabet remain confidential, only known to the researcher, the Tshwane South District Office and the Gauteng Department of Education (3.15). Meanwhile teachers, children's documents and phases used in this study, were coded as follows:

School: A = SA Teacher: A = TA Child: A = LA Document: A = DA   Phase: 1= P1
School: B = SB Teacher: B = TB Child: B = LB Document: B = DB   Phase: 2= P2
School: C = SC Teacher: B = TC Child: C = LC Document: C =DC   Phase: 3= P3
School: D = SD Teacher: D = TD Child: D = LD Document: D = DD
School: E = SE Teacher: E = TE Child: E = LE Document: E = DE

Finally, in my analysis I wrote a summary of each individual interview incorporating the themes that had been elicited from the data.

4.9 CONCLUSION

This chapter described the research methodology and referred to the research approach, the design and the data collecting techniques. It also explored how ethical considerations were observed and also briefly how the collected data would be analysed in chapter 5.

CHAPTER 5

DATA REPORT, ANALYSIS AND INTERPRETATION

5.1 INTRODUCTION

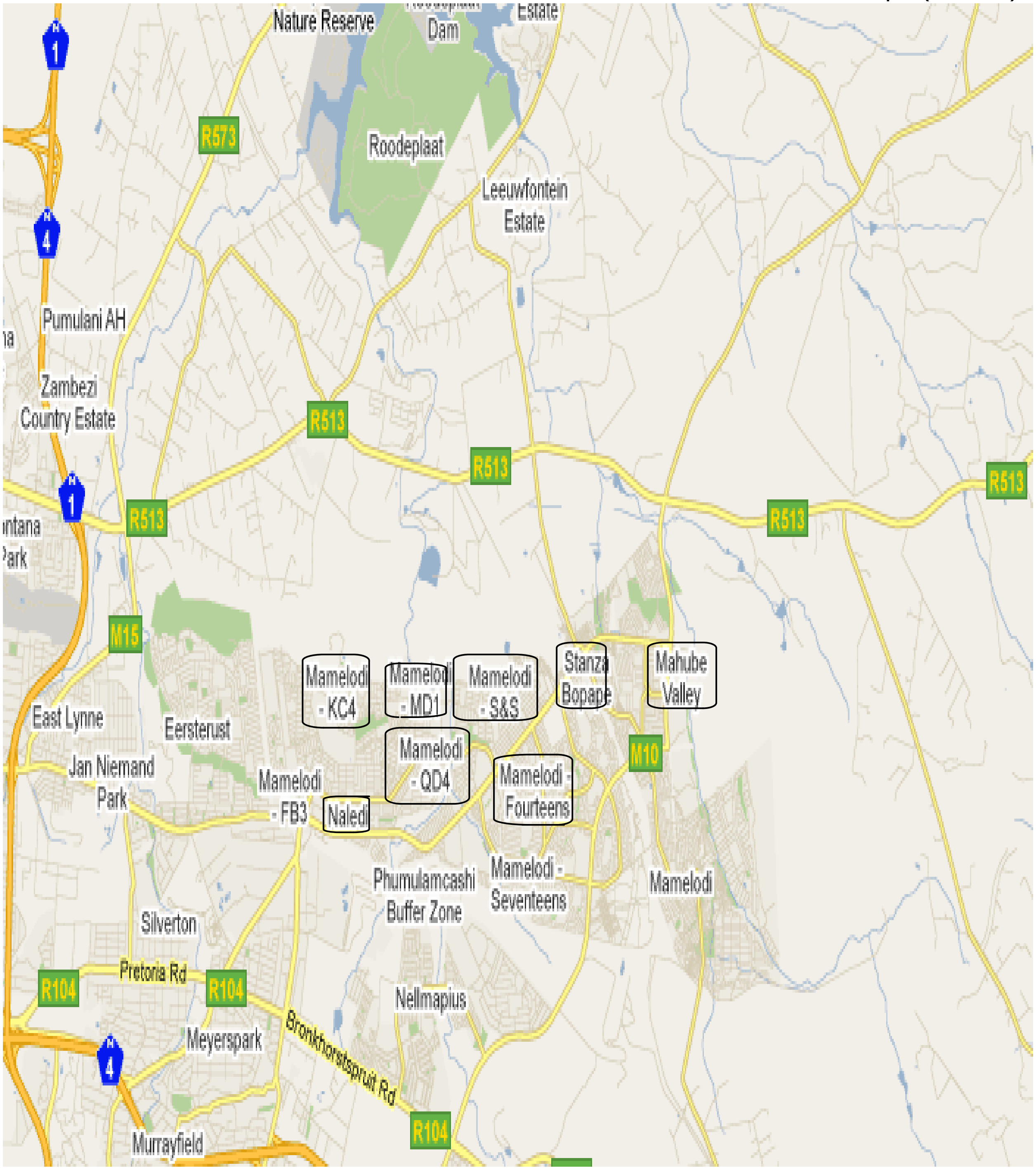
The purpose of this chapter is to report and present an analysis and interpretation of the collected data in this study in order to answer the research question which seeks to establish the approaches that teachers use when teaching computations in mathematics. The analysis and interpretation could also inform the aim of the study. The responses that are presented here are for phases one, two and three of the data collection. The responses were collected from Grade 3 teachers by means of individual interviews. The rationale behind the data collection was to give credence to the realisation that teaching mathematics computations in Grade 3 poses challenges. In addition, such analysis is important to determine exactly those aspects that may be problematic in the teaching of mathematics computations in order to arrive at the results that will lead to a better understanding of the phenomenon being studied (section 4.3). In order to present an informative analysis and interpretation the description of the locale of the research, Mamelodi, is given below.

5.2 DESCRIPTION OF MAMELODI

Mamelodi Township was established in accordance with the Group Areas Act of 1950 passed by the former apartheid government. The township was developed on the farm Vlakfontein 20 kilometres northeast of Pretoria. Mamelodi, which literally means "mother of melodies", has a total area of nearly 25 square kilometres with an official population of close to a million people (Robertson 2010:1) which could mean that the school populations that could be affected by the noted problem, are equally large. Many families live in small council built brick houses, others in informal tin shack settlements, both of these factors being unfavourable home situations for supporting mathematics learning. However, those schools in informal settlements are not captured in the map presented, because they are not formal structures.

Mamelodi is divided into Mamelodi East and West by the Moretele River, the East Township containing the latest established schools and the West schools being the oldest. For this study, investigations were carried out at both Mamelodi East (Mahube, Selborne Side, Stanza Bopape, Fourteens) and Mamelodi West (Naledi, QD5, and MD1 and KC5). This approach was seen as a necessary means to promote the validity and reliability of the study since the dynamics in the different sections of the Township are different but both would be captured.

5.3 THE MAMELODI TOWNSHIP IN GAUTENG PROVINCE ColinsMaps (2010:1)



5.4 REPORT ABOUT THE SCHOOLS AND THE TEACHERS

It should be kept in mind that the schools researched were purposefully selected to represent both sections of the Township. However it emerged accidentally that all the selected schools were non performing schools. The teachers in all the schools reported that their children experience the same problems. This unprecedented finding raises further concerns and there is therefore an urgent need to research how many non functional schools are situated in this Township.

With regard to the revelation about teacher challenges in the teaching of mathematics computations, it is important to know if they are properly prepared to teach mathematics at this level. The following table offers an analysis of teachers' qualifications.

Table 5.1: TEACHERS' QUALIFICATIONS

	Degree	**Diploma**	**Certificate**
TA	B Tech	NPDE ACE	
TB		NPDE ACE	
TC	BA degree		SEC
TD	BA degree	STD, HDE, ACE	
TE		STD	

Table 5.1 shows teacher qualifications

The above teacher's qualifications are a good reflection of what a qualified cohort of teachers should consist of. What comes to my mind is whether the BTech education goes to the same depth in the teaching of mathematics in comparison with a BEd degree at the University. It should however be noted that TA possesses two diplomas, a National Professional Diploma in Education (NPDE) and an Advanced Certificate in

Education (ACE), which were specifically aimed to make her a better teacher and which enhance the BTech degree.

Although teacher B has no Bachelors degree she has attained two university diplomas, the National Professional Diploma in Education (NPDE) and the Advanced Certificate in Education (ACE) which should make her a good teacher.

Another teacher who has gained a degree is TC who possesses a BA degree and a university certificate in teaching. This certificate was intended to improve teaching methodology in teaching.

Of the five teachers the best qualified is TD who has gained a BA degree and three diplomas: a Secondary Teachers Diploma (STD), an Advanced Certificate in Education (ACE) and a Higher Diploma in Education (HDE). However the fact she also experiences challenges in the teaching of mathematics raises questions about teacher preparation at higher institutions of learning. In this regard there is a need for further research to establish how mathematics teachers are taught at institutions of higher learning.

TE has obtained a Secondary Teachers Certificate (STD) which is a college teaching diploma targeted at teaching high school students, but TE has received no training in teaching primary school children. This could be a contributory factor to the teaching mathematics.

In general, there is therefore no reason for questioning teachers' qualifications as a possible source of teaching mathematics computations in the Foundation Phase. However, there is need for a study to determine whether the mathematics knowledge acquired at Technikons and universities is comparable. Another factor that could influence teachers' ability to teach mathematics computations could be teachers' experiences at the Foundation Phase level. In order to explore the possible influence, an analysis of these follows below.

Table 5.2 Teachers' experiences in teaching

	5 – 10	11 – 15	16 – 20	21 – 25	26 – 30	More than 30 years
TA		X				
TB						X
TC						X
TD	X					
TE		X		X		

Table 5.2 shows teacher's teaching experiences

The said experiences range from a minimum of 5 to a maximum of 39 years. TA has spent 13 years in teaching, all in FP. This experience should have caused the teacher to perform well but this is not the case.

TB reports an impressive teaching experience of 37 years. This experience, coupled with the fact that her qualifications were obtained from the university, should make a good teacher; however she has reported experiencing problems like the other teachers.

Another notably lengthy teaching experience is that of TC who has taught for 39 years, 26 of which were spent teaching in the intermediate phase. The fact that she experiences the same challenges as the rest is a concern.

TD has nine years' experience, five in the FP and four years in high school. The five years' experience should be sufficient to help the teacher in the teaching of mathematics but this does not seem to be the situation. The teaching experience of TE spans a remarkable period of 23 years, five of which were spent in FP and 18 years at high school. Like TD, the five years of experience in FP should have assisted her in teaching mathematics but this does not appear to be the case.

It is therefore necessary to research teacher experience and capability in teaching mathematics. In the following subheading fieldwork conducted through a three phase data collection technique is reported.

5.5 OBSERVATIONS

Classroom observations were carried out with the aim of establishing approaches teachers use when teaching mathematics computations. Such observations are the most important tools of qualitative research, as the researcher sees all the processes of teaching while being physically present in a natural setting. Observation helps to understand why things happen as they do. One is obviously able to witness the forms of mathematics instruction during the lesson. The rationale for conducting the observation in three phases was to establish whether the participants were consistent in what they said in the first phase and throughout, which would also increase the validity and credibility of the data. The findings from the classroom observation are discussed in the following paragraph.

Generally, children at two schools visited were arranged in groups in the classroom, that is, the teachers use cooperative teaching. The strengths of this approach are that:

- Children learn from each other.
- They learn different ways of problem solving and
- They are not afraid to make mistakes.

However, I also observed that the manner in which three teachers arranged their classrooms suggest that children did not work in groups. The teachers were still using the whole class teaching approach as the only method of teaching mathematics. The children were seated as in church style facing forward in one direction. Consequently, such children cannot interact with one another as they are seated in a formal manner. This method may not be suitable for the schools researched because the children stem from diverse families. Those from informal settlements, probably from a more impoverished milieu, may not understand easily. They need a more individualised approach.

During the data collection, I observed that the manner in which some teachers arranged their classrooms suggest that children do not work in groups. The teacher gave the same tasks to all the children and each child did his or her work. In this case, the researcher believes that teachers should encourage children to work together and create flexible learning by allocating different tasks to the children because they do not learn at the same pace. This will enable all children to take part (not only in doing tasks) but also to assist each other. Children at this stage need to feel free so that they do not easily become bored, especially as they have only to listen to the teacher and do not actively participate in the lessons. In support of Donald et al (2.2.1) and Van de Walle (2.2.3), teachers could consider including different approaches when teaching mathematics. If one approach does not work for a particular child, perhaps the next approach would do. Also, it is important to realise that children, particularly at this level (FP), learn better by doing.

5.5.1 Teaching approach

Classroom observation revealed that the teachers were still using the whole class teaching approach as the only method of teaching mathematics. This method may not be suitable for the research schools because the children come from diverse families and environment as mentioned above. The other method that was observed is group work teaching (cooperative learning).

The strength of cooperative learning:

- Children learn from each other.
- They learn different ways of problem solving
- They are not afraid to make mistakes

However, as I have observed the manner in which three teachers arranged their classrooms suggest that children did not work in groups.

For the research schools it could be that the children who sat at the back may not be able to differentiate between the addition sign (+), the multiplication sign (x), the subtraction sign (-) and the division sign (÷). If she was next to them children would have seen the mathematics computations when she wrote them.

5.5.2 Teacher–child interaction

Generally, in all five participant schools, the researcher did not observe much teacher–child interaction. As indicated in the previous section, most teachers used the whole class teaching approach. Children listened to the instructions for the whole class and responded as individuals, not as members of a team. The author posits that the manner in which teachers teach mathematics should be looked at differently. If teachers were to employ different mathematics approaches, the chances are that the identification of children who experience mathematics difficulties would take place earlier, as supported by Goods and Grouws, and Brophy and Goods (2.3). Whole class teaching encourages the development of difficulties because no individual attention takes place and it is also difficult to identify problems using this method.

5.5 3 Child to child interaction

As regards child-to-child interaction**,** the researcher noted that in most schools where the children were arranged in small groups, they were talking and showing their peers how they had arrived at the answers. It was pleasing to see small children showing/explaining to their peers who did not understand the allocated class work tasks by using concrete objects and discussing each step.

5.5.4 Mathematical tasks for children

Another observation made was that three teachers gave children the same tasks to solve irrespective of whether some children lagged behind or not.

5.5.5 Teaching and learning resources

Teaching and learning resources are the most important tools that teachers can use in order for children to learn effectively and for children not to forget easily what they have learned. Generally, all classrooms were well decorated with good, informative and colourful media displayed on the walls. But merely displaying these resources and not using them in actual teaching is of no help at all.

Investigating teachers' challenges with regard to teaching mathematics computations further involved the observation of topics that were taught. The following table summarises mathematics topics observed in each school.

Table 5.3 Mathematics topics observed at different research phases in each School

School	Topic and Phase Phase 1	Topic and Phase Phase 2	Topic and Phase Phase 3
SA	Estimation	Halving	Multiplication
SB	Grouping and estimation	Word sums	Halving
SC	Number line	Multiplication	Word sums
SD	Shopkeepers and buyers	Grouping and estimation	Expanded notation
SE	Multiplication	Fractions	Number names

The above table explains the mathematics topics observed in different research school During Phase 1 conducted at the beginning of the year at the five research schools I observed that each school was dealing with different mathematics topics. In my opinion, all of the topics were not appropriate for that time of the year. Ideally, teachers should recapitulate what was done in the previous grade, in this instance Grade 2. This means that teachers should have started with additions, subtractions, multiplications and division using numbers and not concrete objects because that was done in Grade 1.

This would solidify what children had learned and serve as a foundation for further mathematical computations. The following lessons were observed.

A number line is a line that uses numbers for calculations. Children are taught how to do addition, subtraction, multiplication and division on the line. The teacher began the lesson by drawing a number line on the chalkboard. She explained what it meant to the children and then showed them how numbers are represented thereon. She asked individual children to come forward and demonstrate this on the chalkboard. Once the children had understood this, the teacher showed them how to do addition sums using the number line. This seemed easy for the children to understand as they were able to do this practically, thus reinforcing that children learn better by doing. The challenges that were encountered during the lesson were that some children were not sure where to start counting on the number line: either from zero or from the number one.

This lesson should have been taught after children's memory of additions and subtraction has been mastered. The difficulties that they experienced could have been obviated by first strengthening their ability of addition and subtraction.

Grouping and estimation was the second topic observed during the same phase at the second research school. In the grouping lesson, children put together similar items, for example by colour, size, shape, etcetera. In the lesson the children were divided into three groups of seven each. The teacher gave children pebbles, marbles and orange seeds mixed together. The children were instructed to group each of these objects separately first and then to group each sort into groups of ten. Thereafter the children had to count how many groups of tens they had of each type of object. The teacher then asked who had estimated correctly. My observation was that the children cooperated in carrying out the tasks given and seemed to enjoy working in groups. The challenge I observed during the lesson was that when children were asked to estimate, many of them wanted to calculate the number of objects concerned. This implies that they do not see the reason to give an estimate when they can actually count and get the actual number. This seems to also imply that this aspect is rather too difficult for children or it was not well explained by the teacher. The same argument held above. The children's inability to follow the instruction could have been lessened if the basic computation skills had been revised.

A lesson on estimation was the third topic observed during this phase. Estimation is imagining and guessing what amounts could be. The teacher grouped children in small groups and gave them different concrete objects, for example: bottle tops, pumpkin seeds, pebbles to estimate the amounts or numbers. Each group was given a lot of these concrete objects and asked to estimate how many objects there could be. The objects were many, approximately 500, and doing this activity was overwhelming to many children. Each group had to think and come up with a common number which was then written down on a page. The teacher moved around the groups to ask children to count and see if their estimation matched with the concrete objects that had been counted. Problems that were experienced with estimation included the fact the teacher used big numbers; as a result some children forgot to name the number that followed, for example 121, 122, 123, 124, 125, 126, 127, 128, 129, 12010. This difficulty could have been associated with their uncertainty with counting and their knowledge about the concepts many or less; their responses to the lesson showed that some children were not following the instructions.

Another topic observed was multiplication. The topic was taught at the end of Grade 2 and could have been the starting point for reasons explained above. The teacher introduced the lesson by stating that there are two ways of increasing things, namely by adding to what you already have or by multiplication. She gave the example of twelve multiplied by two. She went on to calculate fourteen multiplied by three using concrete objects. Subsequently the class was divided into groups of six, given different sums per group and concrete objects. She then went from group to group supervising the process. The lesson was very interesting to the children as they enjoyed working cooperatively and assisted each other. The use of concrete objects made it easier for the children to follow the lesson. However the challenge that I observed was that some children were confusing the addition sign (+) and the multiplication sign (x) for example:

2 x 2 = 4.The challenge I observed is that children assumed that all numbers multiplied with that number will produce the same answer as given in the example above for example: 3 x 3 = 6 whereas children were supposed to show that 3 three times (3 + 3+ 3 = 9).

The last lesson that I observed during the first phase was one involving shopkeepers and buyers wherein children learn mathematics through selling and buying using self made notes and coins. They were playing shopping in the classroom where there were four shopkeepers who alternated during the selling; the rest of the class were buyers. The items used in the shops were empty containers of card boxes with prices marked on them; different notes and coins were created from paper. The teacher introduced the lesson by asking the children whether they had been to a shop before and what took place there. She then told them that the person who sells at the shop is called a shopkeeper and that those who buy goods are called buyers. This lesson was taught through role play in class. One child played the role of a shopkeeper and the rest became buyers. This lesson was very successful because the children were directly involved. They participated very eagerly in this lesson. The implication is that children learn much better by active participation and by moving from the known to the unknown. Although the children enjoyed selling and buying I noted that some children experienced a challenge when they bought items whose price was expressed in notes (rands) and coins (cents), for example: the price of a washing is R3, 45 but the buyer pays with a R10, 00 note.

It is because of these facts that the author strongly objects to what was done at all the five schools during Phase 1. A major concern is the fact that the schools were in the same District but there was variation in the teaching. It seems there is little or no support to teachers on how to start teaching mathematics at the beginning of the year. The convention is that the beginning of the year is a period for consolidating what was learned in the previous grade. The common cliché ‘from the known to the unknown’ should have been followed.

School observations were repeated for the second time at all five schools as a way of promoting the reliability of the research results. In terms of topics, the same concerns emerged again. The topics that were taught were the following:

The first topic was halving, sharing a whole into two equal parts. The children were asked what they would do if given sweets by their parents but there were not enough sweets for each of them. The children responded that they would share the sweets, break them or cut them into equal pieces for each. The teacher then explained to the children that sharing, breaking or cutting means making pieces of the whole, which in mathematics is called fractions. She put an apple on the table, asked how it would be divided between two children and requested one child to divide it. The teacher then told them that the apple was in this way made a fraction (part of a whole). It was now two halves, one half is represented as 1/2, which implies one piece out of two pieces. The children were then given other examples. The teacher used the whole class teaching method and it was hence not easy to see if all children had understood.

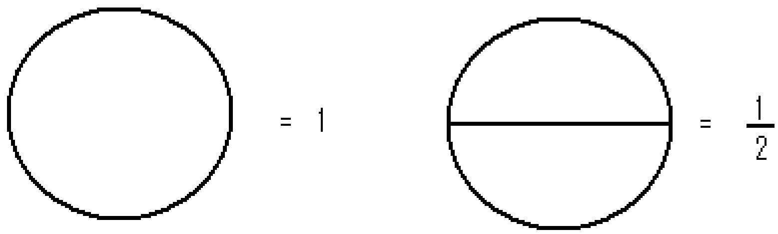
The second lesson observed was grouping and estimation which was being repeated during this phase at one of the schools. It entails sorting objects and visualising how many there might be. The teacher gave children a box full of beads in different colours. She divided the children into six groups and named each after a particular colour for example black. She then asked the children (in their groups) to group the beads of their group in a pile together. When this was completed each group was asked to estimate how many beads they had in their pile. The children then counted the number of beads they had and were asked whether their estimation was correct, less or more, by how much. The lesson was very successful as the children participated with a great deal of enthusiasm. This was an indication that when children work together, it is easy for them to understand what they are learning.

Another lesson observed concerned word sums, which are mathematical problems defined in words dealing with everyday issues that the children encounter. The teacher wrote the sum on the chalkboard. “Kgothatso has 10 marbles. He gives three to his brother. How many will Kgothatso be left with"? The teacher then asked the children to give an answer to this. Some children said 13 (added Kgothatso's 10 to the three) or 10 (implying Kgothatso gave his brother three others, not from his ten). The children were subsequently given 10 marbles, asked to give one of themselves three and then instructed to count what was left out of 10. They seemed to understand how to do this sum only after experiencing it practically. The implication was that they understood better by doing.

Another topic observed was multiplication: the teacher began by explaining the term multiplication to the children. She explained that multiplication is similar to addition. She gave the example of 3 X 3 = 9 as being similar to 3 + 3 + 3 = 9. However, some children then interpreted this (3 X 3) being the same as (3 + 3). This led to further confusion as the children also became confused as to which symbol or operation, X or +, meant multiply or add. The teacher attempted to simplify the children's understanding of multiplication by referring to addition but confused the children. This implies that the children identified as experiencing difficulties in mathematics (multiplication) sometimes do not really have those difficulties but that the teachers' teaching approaches or the instructions given could contribute to these difficulties.

Fractions were the last topic observed during this phase. I observed a halving lesson in which children were asked what they know about fractions. The teacher gave children a clue by giving the example of a mother who possesses one orange and has to share that between two children. How would she do so? Some children answered that each child should get half, others that the orange should be cut in the middle.

The teacher showed the orange to the whole class and explained that she has one orange:



The challenge I observed during this lesson was that children encountered difficulty with mathematical concepts as the books were written in English whereas in the school children are taught using the LoLT of the school; for example the fraction given above in English is called halve whereas in Northern Sotho the term is seripa gare. Children who are not Northern Sotho speakers will not understand or even take part during the teaching and learning. This implies that some children know the concept half in theory although they do not know it practically. Those who knew the concept half theoretically would understand better when it is shown to them practically but those who did not know it would find it difficult to understand both the theory and the practice.

School observations were repeated for the third time at all five schools as a way of promoting the reliability of the research results. In terms of topics, the same concerns emerged again. The topics that were taught were the following:

The first lesson I observed during the third phase was multiplication. I observed a multiplication lesson in which the teacher was teaching children how to multiply. The teacher brought concrete objects and demonstrated how this can be done for example:

24 X 3=

The teacher explained to the children that 24 X 3 means 24 thrice. She further showed children how to solve the problem for example:

24 X 3

(20 X 3) + (4 X 3)

60 + 12

(60 + 10) + 2

72

A lot of children did not understand how the teacher arrived at the answer. Some children confused the multiplication sign with the addition sign, for example 24 X 3= 27 whereas other children were unable to carry over to the tens, for example 24 X 3= 60 (Appendix I). This implied that children understand better when using or seeing concrete objects.

A lesson on word sums was also observed. The teacher introduced the lesson by asking the children how many pens they would be left with if they each possessed nine pens and were asked to give three to their friends. A number of different answers were given. The teacher then grouped the children into pairs, gave them nine marbles and asked them to give their partners three and tell the class how many were left. It seemed easy for the children to execute the task, but when the teacher used the concept of the basic operations (minus), most of the children failed to understand. The impression is that the difficulty in doing word sums lies in the lack of understanding of the concepts. Learners understand only if one asks, “from nine pens give your friend three; how many are you left with?” but once the teacher says “nine minus three”, it becomes something different.

Another lesson observed was expanded notation. Expanding numbers means that one breaks down numbers into smaller parts but when adding those parts together they yield the same answer. The teacher showed the children a musical instrument called the accordion and demonstrated how it is played. They initially saw it as a small instrument but as the teacher played it became longer. Then the teacher told children that even numbers can be expanded. She wrote the number 46 on the chalkboard, and asked one child to read that number out. She asked the children what the number 46 is made of. She explained to the children that 46 has two digits meaning four and a six and the digits are not equal in value. She further explained that the value of the six units is one whereas the value of the single unit is a ten. She asked the children “how many units do we have and how many tens do we have? When expanding the number 46 this is how we write it: 40 + 6 = 46”. The teacher worked through more examples with the children and they were actively involved and understood what was taught. This implies that when the teacher's instructions are clear, children tend to understand.

A lesson on number names was also observed. Number names are the names of different numbers. The number names were displayed on the wall written in Northern Sotho and English. The teacher requested all the children to go outside (to the car park). She asked each child to write down any number that was on the car number plate. Then children were instructed to back to the class. In the classroom they were given the following instructions:

"Add five to the number you have written down and write down the number name for example: 114 + 5 = 119 (number name is hundred and nineteen).

Add three to the new answer and write down the number name for example: 119 +3 = 122 (number name is hundred and twenty two)". It was an interesting lesson, during which some children were able to carry out instructions from the teacher but many others showed that they were unable to write down the number names. The teacher arranged them in groups and repeated the same instructions after which the performances were better. This implies that when children work together they learn from each other and they are not afraid to make mistakes.

Another lesson observed was on halving. The teacher asked the children to tell her what half of two was, to see if they had acquired the concept of halving or not. There was no response from the children. This implied that they had no idea what half meant. The teacher then took an apple and divided it into two equal halves and explained that each part is called a half and that the two halves constitute a whole. She went on to show them that five is half of ten by using pebbles. The teacher then gave them sums to work out, to see whether they understood the lesson. Many got the sums wrong after which the teacher asked them to use objects to solve the problem. Only then were they able to get the sums correct. This implied that the children could not count unless they used concrete objects.

5.6 INTERVIEWS

All interview schedule was drawn up to interview teachers at all five schools. The interview schedule explained in chapter 4 (4.4.2.1) was used for all participants in order to increase the validity and credibility of the findings. In some instance direct teacher responses were written down to capture the problem situation more clearly. The following were the questions and teachers' responses.

5.6.1 Which approaches do teachers use when teaching mathematics computation?

I asked this question in an endeavour to find out what teaching approaches were being used by the teachers in order to establish whether the strategies were appropriate, effective, clear to the children, or if they led to children experiencing problems and hence poor performances. The responses that teachers gave did not refer to any specific approach to mathematics teaching. Teachers also explained that they were obliged to implement other mathematics programmes.

All of them explained that they were using the Foundations for Learning Campaign (FFLC) which is mainly an intervention strategy developed by the Department of Basic Education (DBE) to address mathematics problems in general. However there were other programmes that they were required to implement. For example, the intervention programme was intended for non–functional schools that were part of the Gauteng Province Literacy Mathematics Strategy (GPLMS), and the Annual National Assessment (ANA) which is a compulsory examination for all Grade 3 children at schools in the country. At the time of my collection of data the teachers were also allegedly still undergoing training for CAPS that was to be used in 2012. The District officials of the Department of Education expect to see children's performances improving. From these responses I deduced that the entire grade 3's in the country had to write the ANA, and implement the FFLC and the CAPS. Under performing schools would also sit the GPLMS.

Table 5.6 Teachers' other tasks

Concern	Responses number of teachers			
	FFLC	**ANA**	**GPLMS**	**CAPS**
TA	**X**	**X**		**X**
TB	**X**			
TC	**X**	**X**	**X**	**X**
TD	**X**			**X**
TE	**X**		**X**	

The above table explains the different interesting programmes that grade 3 teachers were expected to participate besides their normal teaching and learning. The FFLC is discussed in chapter 5 (5.7.2).

The implications of these many requirements as regards mathematics teaching are lack of focus and poor performance; contrary to why the FFLC was introduced, it caused many challenges. Teachers explained that:

- The FFLC is prescribed and all teachers are obliged to put children through the programme.
- It has many aspects to teach in a week.
- Although they were given information in files about the programme, they did not know how to implement the programme.
- In addition, teachers were given green books whose activities were supposed to link with the content of the teachers' files. However, this was misunderstood and children did not use the books as workbooks.
- Children found it difficult to understand what teachers demanded of them.
- The assessment procedures are not well spelled out and teachers are not certain what to assess and when to assess. They are further confused by the fact that the assessment has to include both mathematics and literacy.

ANA

The purpose of ANA was to improve basic education outcomes in grade 3, grade 6 and grade 9 and set improvement targets of 60% levels of performance in literacy and numeracy by 2014 (The South African ANA 2012:4). All (grade 3, grade 6 and grade 9) children write the standardised test. After marking, each school in each province is graded. Schools that have obtained a pass rate under 40% are labelled as underperforming.

However my observation was:

- Teachers explained the test question to the children.
- Some children did not understand the teacher's explanation.
- In all the schools that I visited children exceeded the stipulated time of the test.
- The test was exhaustive and this influenced their performance.

GPLMS

The purpose of GPLMS was intended to improve children's literacy performance. Teachers are given tasks to work on with the children, but the DBE officials (coaches) create more problems for the teachers, contrary to their noble intension. The tasks that were given to the teachers consumed a lot of their time that could be used for mathematics tasks.

CAPS training

The DBE reviewed the old RNCS in order to help the teachers workshops are carried out to train teachers in the use of the new curriculum. However this has proven to be another burden that precluded teachers from revising mathematics computation with children. Teachers were expected to leave their children behind in order to attend the CAPS training. The fact that teachers leave their classes during working hours to attend workshops, also contributes to the difficulties experienced by the children. This furthermore may lead to teachers and children delivering poor results at the end.

5.6.2 How do they resolve the problems?

This question was asked in order to determine what the teachers do in an effort to solve the problems they encounter in teaching mathematics and whether they send pupils with problems in learning mathematics to specialists or specialist institutions. The researcher also needed to find out the procedure followed in order to determine whether the teachers/schools followed the same route in so doing or not. The intention was also to establish whether the intervention was able to improve the children's understanding or not.

The response was that children with mathematics learning difficulties were assisted by being given extra activities to do after school and being provided with easier problems to solve or given examples from the previous grade (grade two), which implies actually lowering the standard or indirectly postponing grade 3 work and the problem.

Parents are also called in to the school and asked to help the children at home with their school work, but this request is rarely acceded to as alleged by the teachers. Those with easily identifiable defects like sight and hearing are referred to specialists such as opticians.

Children who still cannot perform as expected are referred to the school's SBST for further assistance. The irony of this is that some of the members of the SBST are not even experienced in teaching mathematics at grade three themselves. If the SBST also fails to remedy the problem, the school then invites a specialist from the district office to intervene and in this way the problem is recognised as being beyond the school to solve.

5.6.3 How do teachers identify children who experience mathematics difficulties?

This question was asked with the aim of finding out what method/s were used by the teachers to identify children who experience problems in learning mathematics and to ascertain whether those methods are effective or not.
The teachers claimed that they identified the latter through their (children's) performances in class tasks and tests. They also asserted that they would also identify poor performing pupils by asking oral questions; those not responding would be deemed to be experiencing problems. Report cards from the previous grade (grade two) teacher were said to indicate children with problems. Some children, it is averred, were identifiable by their failure to participate in group discussions.

Teachers were asked how they identified children who experience mathematics difficulties. This question was intended to determine whether teachers were able to identify such earners and the methods they use in so doing. Effective identification would result in help being given to such children on the one hand, while on the other hand, lack of identification may result in difficulties not being attended to. The teachers responded as follows:

All participants agreed that children are identified through tests and failure to respond/give feedback. A minority indicated that they used observation books from the previous Grade. Very few said that they could identify children through failure to answer questions orally. A minority said they identified children through mental work and different strategies

5.6.4 Which aspects of mathematics were most problematic?

This question was posed in order to establish from teachers whether there were any specific aspects that were most problematic from a teaching point of view or from understanding by pupils. I also wanted to determine if the problems were general or differed from one school to the other, from teacher to teacher or were related to any difficulty in the syllabus. This would establish whether individual teachers' methods were the cause of the problem and needed attention.

The response from teachers did not identify a mathematical aspect per se, because they referred to the Language of Teaching and Learning (LoLT). The teachers pointed to a number of factors in this regard. Learners at these schools came from different ethnic groups and hence spoke different home languages that teachers did not understand. This was further compounded by the presence of children from foreign countries who spoke languages the teachers themselves knew nothing of. Mathematical concepts were also difficult to teach in African languages, for instance; the four basic operations (addition [to a lesser extent], subtraction (where they have to borrow), multiplication (carrying over) and division (remainder). It was difficult for teachers to coin new words. Even then only a section of the class would benefit.

5.6.5 What else do they do to help children understand mathematics computations?

Teachers were also asked to respond as regards what else they do in this respect. Generally, they indicated they only concentrated on the FFLC, arguing that the latter is effective as it saves them time by providing lesson preparations. Most teachers also indicated that the children's prior learning is tested by doing oral work, children are able to count and they enjoy working in groups.

Four of the five teachers indicated that the FFLC improved the children's mathematics performance. Only one of the five teachers indicated that the FFLC did not improve the children's performance much and also that the FFLC has too much content.

Four of the five teachers agreed that FFLC helps them in teaching mathematics. They also concur that it is easy to use and the teachers have learned good methods from the campaign. The FFLC also helps teachers to tackle most of the activities very easily.

Some felt that more training is needed in order to be able to use the programme to the full. Four of the five teachers also indicated that the FFLC provided them with a lot of teaching media and that it also encourages children to be part of the lesson. The following paragraph concerns the analysis of documents used in the study. One of the five teachers, however, alleged that no training or explanation was given to them on how to use the programme.

5.7 DOCUMENT ANALYSIS

The following documents were collected and analysed:

5.7.1 Mathematics Policy

I asked teachers to provide me with the mathematics policy document (NCS). My aim for doing so was to determine if the Department had a policy, what the policy implied and whether the teachers followed it. The response from the teachers was that they use the FFLC which was in its final year of implementation.

One of the five schools of the sampled schools had a copy of the Grade 3 Mathematics Policy because they were implementing the FFLC. Four of the five schools did not possess a copy of the grade 3 mathematics policy. The implication of this finding is that teachers might not have understood some of the requirements because they did not have the policy document that explained it all.

5.7.2 The FFLC document analysis

Teachers were asked if the FFLC improved their mathematics teaching and children's performance. They asserted that it was a useful programme but also exhibited some difficulties in implementation. These problems included that the programme (FFLC) gave many activities to be carried out, which is impossible to do in one week. Many children thus lagged behind and this became a problem in moving forward while other children still remained behind.

The teachers also alleged that the training for the campaign was too short (two weeks) and mentioned that they did not know when to assess as this was not made clear in the FFLC document. Teachers, however, liked the fact that the FFLC saved them time in that they did not have to do any preparation as the document covered that and they only have to tick the work done. The major problem with the FFLC, as the teachers alleged, is the teaching of concepts. Some concepts that they are required to teach are completely new to their children, for instance “pyramid”. Since there is no pyramid in the African languages, the LoLT has no equal term.

Most schools were using the FFLC strategy documents. The researcher requested to see the FFLC documents to establish what the teachers were doing at the time. Generally, teachers and children engaged in the lessons and activities in the FFLC in hands on manner. However, the researcher questioned why the teachers were not on the same level (see section Table 5.2). Generally, all teachers indicated that they enjoy and implement the FFLC. In most schools, children demonstrated their interest during the mathematics lessons.

5.7.3 Children’s books

I requested teachers to provide me with the children’s writing books. My aim was to find how children perform in order to detect their level of competency; I also wanted to see what problems the children were encountering with regard to their work / activities. It was furthermore my intention to observe how the teachers assessed the children. I wanted as such to see whether teachers give the children the credit they deserve and hence motivate them, or whether they are too strict in their marking or give negative remarks that would demotivate the children.

Generally, all participants gave the researcher samples of the children’s work. This helped her to establish where the children encountered problems and what intervention could be undertaken. In most schools, the researcher observed that there are some children who experience serious dyscalculia difficulties. Most of the work of the children indicated understanding. However, a few demonstrated severe mathematics difficulties.

5.7.4 Referral forms

In four schools with a School Base Support Team (SBST), the participants were able to provide the researcher with referral forms; one school did not have this team and thus was unable to share with the researcher how it supports children who experience mathematics difficulties.

The referral forms assisted the researcher to determine how many times the difficulty occurred and what support the teachers provided. The teachers with the SBST in their schools explained how they support the children in the following manner:
The class teacher identifies and records children's difficulties.
The teacher gives the necessary intervention.
If the child still does not show any improvement, the class teacher refers the child to the grade representative who further provides another intervention.
The grade representative also records all the interventions given to the child and if she sees that there is no improvement by the child, the child is then referred to the school SBST coordinator who administers another intervention.
If the child does not show any improvement the SBST coordinator invites the multi disciplinary team.
The multi disciplinary team also attempt an intervention, and if no improvement is shown this team writes a report and recommendation for further referral.
The SBST coordinator completes the 450 form (Intervention support form) to the District Based Support Team (DBST) as well as all the reports from the multi disciplinary team.
The DBST analyses all the recommendations and creates a Learners with Special Educational Needs (LSEN) number after which the child is referred to a special school.
Generally, teachers provided the researcher with referral forms (450). The school that did not have a SBST could not share with the researcher how they support children who experience mathematics difficulties.

5.7.5 Teachers’ work schedules

I requested the teachers to provide me with their work schedules. The rationale for doing this was to establish whether the teachers have work schedules, which resources they use when teaching mathematics and what approaches the teacher is going to use. I wanted to discover whether the work schedule catered for individual children, for groups and not only for the entire class as a unit.

This would also have helped me to establish whether the work schedule included activities for various kinds of children, not only for capable ones. I wished also to look at the assessments envisaged so that I could compare them with how actual assessment was done by teachers. I hoped to discover whether the teachers adhered to the content of the work schedule or deviated there from.

According to the teachers, the work schedule sometimes confuses them by for instance providing too many tasks dealing with different themes: for example, where children are expected to learn halving, multiplication and addition in one week. This becomes a problem for the teachers as to what to concentrate on, and for the children to master all these in a single week.

Generally, all participants possessed well prepared work schedules. In all schools that took part in this research, the researcher realised that teachers were following different themes although they were using the same mathematics document (FFLC). Most teachers give the same tasks to all children irrespective of whether all the children understand or not. The researcher believes that teachers should provide different tasks/activities in their work schedules as children do not learn in the same manner.

5.8 CONCLUSION

Chapter 5 comprised an analysis of the case evidence and discussion of the data, exploring approaches teachers used in teaching mathematics computation among Grade 3 children. The perceived aspects were examined through classroom observation, interviews with teachers and document analysis. The data was analysed and summarised. In chapter 6, the meaning of the findings from the literature study will be interpreted.

CHAPTER 6

CONCLUSIONS, LIMITATIONS, RECOMMENDATIONS AND SUMMARY OF THE STUDY

6.1 INTRODUCTION

In the foregoing chapter the findings of the empirical research were presented and analysed. Plausible factors that could have influenced the outcome of the results were explained and supported by evidence from the literature review in chapter 2.

This chapter draws conclusions from all the evidence captured in the investigation and provides recommendations that could address the research problem. It also reflects on the limitations of the study and sums up the study. A major feature of this chapter is the outline of a teaching strategy aimed at skilling teachers in the effective teaching of mathematics in grade 3.

6.2 SUMMARY OF RESULTS

The research was designed from a constructivist theory perspective. Instruments used to gather data included observation, interviews and document analysis. The research findings showed that most FP mathematics teachers were not qualified to teach in the FP.

A summary of the main findings follows:

- The approaches teachers use when teaching mathematics computations are whole class teaching and group work.
- Teachers' solution to mathematics computations is to refer children to SBST.
- Teachers identify children who experience mathematical difficulties by looking at children's performances during assessment.
- The aspects that were most problematic in the teaching were those concerning mathematics computation.
- Most teachers indicated that they only concentrated on the FFLC; they mentioned that it is a good strategy, but contained aspects that were supposed to

be taught in a week. As a result some children experienced mathematical difficulties.

My interpretation on the findings of the study mentioned in 5.5 is that they could be the result of children not receiving a good foundation of mathematics computations. Therefore the proposed intervention programme will focus on mathematics computation based on the theory of Alexander (2004:32) (2.4.2).

6.3 CONCLUSIONS ON CLASSROOM OBSERVATIONS

It can be concluded on the basis of what was reported, analysed and interpreted about the observed classroom practice that:

- Mathematics teaching was dominated by the teacher and very little interaction with children took place. Teachers were not aware that other children did not understand. The large numbers in some of the classes prohibited the teacher from noting some children’s questioning gaze that could have alerted her to the fact that those children did not understand what she was saying. A poor teacher-child interaction could be regarded as a contributory factor to some of the problems experienced by the children in the same manner as explained by Ebermeier (1983), and Brophy and Good (1986) (2.4).

- What was observed about child to child interaction and the effects of this lack interaction in children’s ability to learn mathematics is similar to what is already referred to in this study as supported by Vygotsky (1978) (2.2.1), Vaill (1996:42) (2.2.3) and Van de Walle (2006:4 (2.2.3).

- Individual attention promotes learning on the part of children. The fact that child-to child interaction yields better understanding among children is a useful way of promoting learning. Therefore it could be concluded that when there is no individual attention the outcome is poor performance as in line with Van de Walle (2006:4) (2.2).

- The availability of resources in the class is meaningless if there is no teacher intervention to plan the resources and to link them with what is taught. The problems of mathematics difficulties in these schools under investigation could be ascribed to teachers' ignorance about the importance of explaining, integrating and highlighting the resources to ensure the children understood as supported by Van de Walle (2006:4) (2.2), DoE (2003:1) (2.2.3).

  Further evidence that offers credence to the claim that the research questions were answered and the aim realised is to be found in the following interview responses.

6.4 CONCLUSIONS ON INTERVIEWS

The manner in which teachers responded to the interview questions leads to the conclusion that:
The approach that the teachers use to teach mathematics could be a contributory factor to children's poor mathematics computation. They used whole class teaching which, is not a sound approach as explained in 2.4.

From experience as a grade 3 mathematics teacher, an approach that yields good performance is group teaching as supported by (Dowker 2004: iv) (1.10), De Corte (2004:280) (section 2.6.5), Middleton and Goepfert (2002:17) (section 2.5), Fagnant (2005:355) (2.6.5), Van de Walle (2007:5) (2.2.2), Mercer, (2006:508) (section 2.4.2). In all instances where teachers used this approach (5.xx; 5.yy; 5.zz) children seemed to understand the lesson better.

- How do teachers solve challenges in mathematics computations?

  The fact that teachers did not explain how they solve children's problems, but instead referred to the language of learning as a problem, emphasises the severity of this issue. It seems to them that language ability is an important contributory factor to successful learning. It might therefore be necessary to consider the influence of language in mathematics teaching.

- With regard to the identification of children who experience mathematics difficulties it became evident that the methods the teachers used could be problematic themselves. For instance teachers who concluded that these children who did not participate during the lesson were encountering mathematics challenges could be wrong because such children could be struggling with the language of teaching and not mathematics per se. Since no standard criteria are given to teachers for the identification of such children it will be prudent to consider the teachers' expertise in mathematics teaching, the child's language and the curriculum content.

- Which aspects of mathematics were most problematic?
  My interpretation implies that there are really grave problems in the teaching of mathematics because the children lack understanding of the basics. The LoLT is a very serious impediment especially where the children's own home languages are unknown to the teacher which thus makes it impossible for her to explain to those children. This results in such children experiencing barriers they can never overcome.

  Additional evidence that shows the importance of language ability in the teaching of mathematics is obvious again in teachers' responses to the questions which inquired about the aspects of mathematics that were problematic for children. Teachers' claims that language of teaching is the root cause of all mathematics problems should therefore be heeded.

- What else do teachers do to help children understand mathematics computations?

Although teachers explained that the intervention they received provided them with better teaching skills there is no certainty that this added significant value to their teaching approach. The problems in the grade 3 programme persisted despite the intervention because the content in the intervention was taught for a day with no follow up the next day to strengthen what the children had learned the previous day. Success in learning mathematics was also limited by the sequencing of mathematics activities in the intervention programme. This means that a sound intervention programme may well be compromised by a lack of repetition to entrench understanding, poor sequencing, overloading and the length of the mathematics problem.

6.5 CONCLUSIONS ABOUT DOCUMENT ANALYSIS

The following documents were collected from the participants: Mathematics Policy, The FFLC strategy, Children' books, Referral forms and the Teachers' work schedules. A study of these documents leads to the conclusions which follow:

- The absence of a mathematics policy document (NCS) that is supposed to guide teachers is a serious omission and leads teachers to struggle with teaching mathematics. This means teachers had no access to knowledge about how to teach certain activities and how to assess them.

- From what the teachers allege, it became clear to me that the approaches used in the FFLC do not aid either the children or the teachers. In fact there were more disadvantages than advantages in applying the FFLC.

With regard to the children's mathematics books, I realised that the teachers were also not fair towards the former as they only gave a mark for the final answer and nothing for the steps leading to the answer. This helped only to demotivate the children rather than encourage them to strive for better understanding. This implies that the teachers are not completely without blame for the children's poor performance.

In some schools the School Base Support Team (SBST) exists only in name. An investigation of the team involved, demonstrated that in most schools the type of intervention given to the children does not improve their performance. For example, in most schools Grade 3 children are given Grade 1 work as an intervention. This is only part of the solution to the problem as the intervention leaves out the Grade 2 work. The child therefore would continue to have this gap (Grade 2 work) unfilled in his or her development and numerical understanding.

My contention is that teachers' work schedule does not facilitate the teaching of mathematics as intended. The activities are not well sequenced and are often confusing to teachers. For this reason they interpreted the same content differently and prepared different activities for their lessons. This confusion in turn filters down to the children as some teachers attempt to do all that appears in the work schedule within the specified period, leading to children acquiring limited information on each aspect and thus also being unable to do tasks or activities effectively.

6.6 LIMITATIONS OF THE STUDY

The approach followed in this study together with the selection of the methodology ensured the validity and reliability of the study. However, the study is not without limitations.

First, the research sample comprising five teachers and five schools is very small for generalizing the outcomes of the results. Secondly, fieldwork was undertaken at a time when teachers were implementing the FFLC intervention from the DBE and were therefore not involved in self-initiated activities. Observed teachers' practices could be therefore have been influenced by this intervention.

6.7 RECOMMENDATIONS

In order to address the problems identified in this study, the following recommendations are made. To address the issue of teaching approaches, it is important that teachers use a variety of teaching methods in order to accommodate all children and also encourage children to use concrete objects.

Children's challenges in mathematics computations could be addressed by selecting SBST members who have a mathematics background and who are trained to do remedial work.

Most SBSTs do not consist of members who are qualified to act in this capacity. In many schools the SBST is made up of the principal and other members of the SMT who do not necessarily possess expertise in supporting children who experience difficulties in mathematics but are included in the SBST by virtue of their seniority in the schools. Assistant teachers involved in the SBSTs should consist only of members qualified in the subject. They should also be knowledgeable about supportive measures that can improve children's abilities.

Identification of children who experience mathematics problems

Teachers are using various methods to identify children who experience mathematics problems, but these are not standardised.

The DBE should train teachers to be able to identify such children, based on agreed strategies which would make identification uniform in all schools, and remediation which should follow a standard pattern too.

Teachers who participated in this study among others claimed that they could identify such children when they fail to do well in response to questions in class. As such they did not look into all the reasons leading to failure to respond positively to questions or activities. These teachers themselves are not trained to identify children who experience difficulties (in mathematics) and as such provide a variety of reasons for children's difficulties. Consequently even children who do not experience difficulties might be wrongfully identified as such.

Once these children are identified, remediation should take place promptly by their being enrolled in the proposed programme. In it, the children are to remain until they have mastered the programme or overcome their barriers before they exit the programme and are replaced by new entrants.

The solution to the LoLT problem is to use English as a medium of instruction. It is difficult to offer mother tongue instruction where there are more than three different languages spoken by children which the teacher sometimes does not even know. For instance, some of the children coming from certain countries north of SA speak French as a first language; none of the teachers know it and would not be able to explain to such children in their own language. Children too would be unable to express themselves. Hence LoLT is a very serious barrier to learning mathematics itself.

It is further recommended that children must be taught to deal with numbers first by using concrete objects. This means

Finally, the FFLC strategy, based on Dowker's programme termed "Numeracy recovery: a pilot scheme for early intervention with young children with numeracy difficulties" is proposed. The rationale for using this programme is that the children whom Dowker mentioned in her programme are similar to the ones I observed during data collection in many respects.

This thesis has demonstrated that children from impoverished socio–economic backgrounds and ethnic minorities are most at risk of educational barriers and failure (Van Tuijl, Leseman and Rispens 2001: 148). If not attended to, the barriers widen over time and eventually lead to lack of self–esteem and finally failure. That is why it is of utmost importance that children who experience mathematical barriers are identified as soon as possible.

Children go from counting concrete objects and concretely dealing with numbers to counting and dealing with numbers abstractly (Van Luit, 2000). Consequently, work with concrete materials should precede any introduction of symbolic abstractions. Van Luit (2000) states that young children, with special educational needs, benefit from early maths instruction and practice at three levels, namely, manipulating concrete objects, using semi concrete presentations of objects, and performing mental acts. These three levels correspond to the three stages of learning identified by Piaget (1952).

In conclusion to the study, the proposed programme will be based on the Dowker (2001) programme. In the next paragraph the proposed programme will be discussed. Continued research is needed to investigate mathematics intervention for struggling children: intervention that consists of the critical features of instructional design, including sufficient time for children to learn early mathematics concepts and operations (Bryant, Bryant, Roberts, Porterfield and Gersten 2011:9).

6.8 The strategy

Aim:
To provide grade 3 mathematics teachers with a strategy that could promote the learning of mathematics computations

Outcomes:

At the end of the strategy the children will be able to:

- Understand and be able to do mathematics computations.
- Understand and know the differences between mathematical operations.
- Enjoy and love the subject mathematics

Focus of strategy content:

Mathematics computations, namely addition, subtraction, multiplication and division.

Duration:

The strategy will run for a period of three months comprising at least one period of at least 30 minutes every day. The rationale for this comes from the fact that FP children cannot concentrate for a long time. Children will be grouped in small groups and complete different mathematics tasks.

Approach:

Cooperative teaching and learning based on constructivist theory

Sequencing of activities related to mathematics computations

Classroom organisation:

Organize children into groups of five or six and set the physical environment to accommodate this organization.

Activities:

Topic	Criteria	Activity
Addition (+)	Addition of two digit numbers without carrying 67 + 21 67 + 21 88 (60 + 20) + 8 80 +8 88	Week:1 Two days
Addition (+)	Addition of two digit numbers with carrying 64 + 18 64 + 18 82 (60 + 10) + 12 (70 + 10) + 2 80 + 2 82	Week:1 Three days

Addition (+)	Addition of three digit numbers without carrying 324 + 131 324 + 131 455 (300 + 100) + (20 +30) + (4 + 1) 400 + 50 + 5 455	Week: 2 Two days
Addition (+)	Addition of three digit numbers with carrying 256 + 175 256 + 175 431 (200 + 100) + (50 + 70) + (6 + 5) 300 + 120 + 11 (300 + 100) + (20 + 10) + 1 400 + 30 + 1 431	Week: 2 Three days
Subtraction (-)	Subtraction of two digit numbers without carrying 65 – 44 65 – 44 21 (60 – 40) + (5 – 4) 20 + 1 21	Week: 3 Two days
Subtraction (-) Subtraction (-)	Subtraction of two digit numbers with carrying 73 - 47 73 – 47 26 (60 - 40)+ (13 – 7) 20 + 6 26 Subtraction of three digit numbers without carrying 345 – 196 345 – 196 159 (200 - 100) + (13 - 9) +(15 – 6) 100 +50 + 9 159	Week: 4

Solve addition and subtraction problems	Children solve addition and subtraction with two digit number problems explaining own solution to problems. 56 + 32 68 + 21 67 - 51 78 – 49	
Solve addition and subtraction problems	Children solve addition and subtraction with three digit number problems explaining own solution to problems. 123 + 142 154 + 157 213 – 112 321 - 134	Week: 5

Multiplication (X)	Multiplication of a two digit number by a one digit number without carrying. 34 X 2 34 X 2 68 (30 X 2) + (4 X 2) 60 + 8 68	Week: 6
Multiplication (X)	Multiplication of a two digit number by a one digit number with carrying 43 X 4 43 X 4 172 (40 X 4) + (3 X 4) 160 + 12 170 + 2 172	Week: 7 Two days

Multiplication (X)	Multiplication of a three digit number by a one digit number without carrying. 132 X 2 132 X 2 264 (100 X 2) +(30 X 2) + (2 X 2) 200 + 60 + 4 264	Week: 7 Three days
Multiplication (X)	Multiplication of a three digit number by a one digit number with carrying. 214 X 3 214 X 3 642 (200 X 3)+ (10X 3) + (4X3) 600 + (30+ 10) + 2 642	Week: 8
Division (÷)	Division of a two digit number by a one digit number without a remainder 12 ÷ 3 **VVV VVV VVV VVV** 4 1 2 3 4	Week: 9
Division (÷)	Division of a two digit number by a one digit number without a remainder 45 ÷ 5 9 **ooooo ooooo ooooo ooooo ooooo ooooo** **1 2 3 4 5 6** **ooooo ooooo ooooo** **7 8 9**	Week: 10
Solve multiplication problems	Children solve multiplication with two digit number problems explaining own solution to problems. Complete the multiplication sentences	Week: 11

<table>
<tr><td></td><td>2 X 3 =
4 X 2 =
6 X 3 =
9 X 4 =
Complete the number pattern
<table><tr><td>3</td><td></td><td>9</td><td></td><td>15</td><td></td><td>21</td><td></td><td>27</td><td></td></tr></table></td><td></td></tr>
</table>

<table>
<tr><td>Solve division problems</td><td>Children solve division with two digit number problems explaining own solution to problems.
15 ÷ 3 =
27 ÷ 3 =
36 ÷ 4 =
Find the correct answer on the right
<table><tr><td>12 ÷ 6</td><td></td><td>3</td></tr><tr><td>28 ÷ 4</td><td></td><td>12</td></tr><tr><td>36 ÷ 4</td><td></td><td>2</td></tr><tr><td>42 ÷ 2</td><td></td><td>7</td></tr><tr><td>21 ÷ 7</td><td></td><td>9</td></tr><tr><td>48 ÷ 4</td><td></td><td>21</td></tr></table></td><td></td></tr>
</table>

Resources:

The teacher should use concrete objects and also encourage children to manipulate them during the mathematics teaching and learning so that children can see how they can arrive at the answer.

Addition:

pebbles, stones, ruler

Subtraction:
pebbles, stones, ruler, bottle tops 100 number chart

Multiplication:
ruler, stones, ruler, bottle tops

Division:
ruler, 100 number chart

Assessment:
I am not going to say much as this is a study on its own. It is important that teachers use multiple activities when assessing children: assessing them on one aspect
will not give a true reflection of their capability.

6.9 THE SIGNIFICACANCE OF THE STUDY

This research is significant as it suggests relevant mathematical approaches that can .be used by grade 3 teachers as children do not learn the same.
It suggests mechanism which can be use by teachers in the Foundation Phase to identify children who experience mathematical barriers/difficulties by for example by developing a uniform format of identifying barriers.
The study also highlights the relevance of language usage in mathematics. It indicates that language can be a barrier in the teaching of mathematics. This is exacerbated by the fact that many children have different home languages to that used by the teacher. Consequently the children and the teacher find it hard to understand each other.
It also highlights salient learning mechanisms that can be used by teachers in facilitating learning by for example allowing children to learn language through play. It encourages teachers to use play as teaching mechanism to enhance language for teaching mathematics.

The study gave teaches a voice to express their views on the teaching of mathematics in grade 3. The teachers were able to express the challenges which they encountered in teaching mathematics like dealing with large numbers in class.

6.10 UNIQUE CONTRIBUTIONS

Although the study focused on the teaching of mathematics in grade 3, it also signifies the importance of language for teaching mathematics.
It identifies the existing gap in the DoE mathematics programmes that are currently in place. For example in the FFLC programme many aspects are taught in one week instead of concentrating on one only.
This study suggests a practical and implementable strategy that indicates progression in teaching specific aspects. It provides a management plan that can be used by district officials, policy mediators when teaching and training teachers.
This study proposes a strategy that can be used by teachers in the teaching of mathematics.
It can be used to help material developers from the universities to incorporate the proposed strategy in their teaching and learning materials.

6.11 SUMMARY OF THE STUDY

The realisation that grade 3 children in the research area did not master mathematics exercises about addition, subtraction, multiplication and division prompted the researcher to investigate the problem. The fact that the problem was prevalent in the research district raised questions about the teaching of mathematics computations. The research questions thus sought to investigate approaches teachers used in this respect.

The aim of the study was therefore to identify these approaches. The study followed a qualitative approach and techniques associated with the research design, namely, observation, interviews and document analysis.

A detailed literature review in chapter 2 included theories about mathematics teaching, approaches and methods of teaching mathematics in the Foundation Phase, as well as difficulties that children experienced in the different aspects of mathematics and research undertaken. In particular, the literature was approached systematically first to include international content, then the content related to the African content followed by national information. Ultimately the focus was placed on the local situation where the researcher identified a gap in literature. The conceptual framework of this study was based on this content. The dearth of literature about local schools in previous disadvantaged areas encouraged this research. The need to contribute meaningfully to the study of mathematics was also felt and this became part of the study.

In order to contribute meaningfully, it was important for the researcher to gain an in-depth knowledge about programmes and strategies that aimed at resolving mathematics problems similar to the one in this research. As a result, chapter 3 of the study focused on discourse around mathematics problems internally and the measures taken to solve them.

A mathematics programme designed by Dowker (2001) was found to be the most relevant for resolving the problems in this study because the nature of the problems she identified was very similar to the ones in this study. Furthermore, it would be feasible to incorporate some of her ideas into the strategy that would be conceived in this research.

Fieldwork was undertaken in three phases, mainly to ensure that all relevant information was collected. All methodological factors were taken into consideration, including ethical demands. Data analysis was based on the categories that emerged from the feedback of interviews and observations. The research report included information on the research area to enable the reader to understand the context of the investigation.

Reference to the limitations of the study was a way of indicating to the reader whether the study could be replicated.

The recommendations made were aimed at possible solutions to the problems identified. The strategy that was conceived by the researcher was an expression of what she regarded as a possible way of addressing the mathematics computation problem. When the strategy was conceived, the aim was to align it with the CAPS because compliance with this curriculum is mandatory.

REFERENCES

Alexander, G. (2011). *The cries South Africa can't ignore*. *Mail and Guardian* Nov 2011, 18 – 24.

Alexander, P. (2004). *Towards dialogic teaching. Rethinking classroom tasks (Cambridge Dialogs).*

Alexander, R.J. (2000) *Policy and Practice in Primary Education: local initiative, national agenda*, London: Routledge.

Anghileri, J. (2006). *A study of the impact of reform on students' written calculation methods after five years' implementation of the National Strategy in England*. *Oxford Review of Education*, 32(3), July 363 – 380.

Aunio, P., Aubrey, C., Godfrey, R., and Liu, Y. (2008). *Children's early numeracy in England, Finland and People's Republic of China.* Journal of Early Years Education, 16 (3), 203 – 221.

Askew, M., Brown, M., Baker, D., Denvir, B., and Millett, A. (1998). *Is the National Numeracy Strategy research-based?* British Journal of Educational Studies, *46*(4), 362–385.

Askew, M, Rhodes, V, Brown, M, William, D and Johnson, D. (1997). *Effective teachers of numeracy*. *Report of a study carried out for the teacher Training Agency.* School of Education, King's College: London.

Babbie, E. (2003). *Adventures in social research*. *Qualitative Research Journal*, Special Issue, 11-23.

Baker, T.L. (1999). *Doing social research* (3rd Ed.). New York, NY: McGraw-Hill.

Baroody, A and Dowker, A. (2003). *The development of arithmetic concepts and skills: constructing adaptive expertise.* USA: Library of Congress Cataloguing- in-Publication Data.

Bless C., Smith, C.H. and Kagee, A. (1995). *Fundamentals of social research methods: An African perspective*. 4th Ed. South Africa: Juta.

Bryant, D. P., Roberts, G., Bryant, B. R., and DiAndreth- Elkins, L. (2011). *Tier 2 for K – 2 early numeracy number sense interventions for kindergarten and first – grade students with mathematics difficulties. In Gersten and B. Newman – Gonchar* (Eds), *RtI mathematics book* (pp 65 – 83). Baltimore, MD: Brookes.

Burger, E.B. (2009). Mathematics for elementary teachers: A contemporary Approach 8th Ed. Depart, J Wicey and Son.Inc., 111River Street. Hoboken.

Brophy, J.E., and Good, T.L., (1986). *Teacher behaviour and student achievement*. In Wittrock, M. (Ed.) *Handbook of research on teaching*, 328-375) New York: Macmillan.

Brown, M., Askew, M., Baker, D., Denvir, H., Millet, A. (1998). Is the *National Numeracy Strategy research based?* British Journal of Educational Studies, 46 (4), 362-385.

Brown, J.S., and Burton, R.R. (1978). *Diagnostic programme for procedural bugs in basic mathematical skills. Cognitive Science*, 4, 379-426.

Bryman, A. (2012). *Social research methods* 4th Ed. New York: Oxford University Press.

Burger, D (Editor) (2009). South African year book. South Africa: Government Communication and Information System.

Carr, J. (2004). *Mathematics in the primary schools: discussion document circulated for the Irish National Teachers Organisation* (INTO) Consultative Conference of Education.

Carruthers, E., and Worthington, M. (2006). *Children's mathematics: Making marks, making meaning.* (2nd Ed.) London: Paul Chapman Publishing.

Cobb, Yackel, and McClain, K. (Eds.) 2000.*Symbolizing and communicating in mathematics classrooms: perspectives on discourse, tools, and instructional design*. Mahwah, N.J.: Lawrence Erlbaum Associates.

Coffey, M. (2011). *Raising to numeracy challenge*. Adults learning June 2011.

Copley, J. (Editor). (1999). *Mathematics in early years*. Reston, VA: National Council of Teachers of Mathematics.

Corbin, J. and Strauss, A. (2008). *Basics to qualitative research* 3rd (Ed) USA: Library of Congress Cataloguing- in- Publication Data.

Cooney, T.C. (1999). *Conceptualizing teachers' way of knowing*. Educational Studies in Mathematics, 38: 163-187.

Crawford and Witte, M. (1999). *Strategies for mathematics teaching in context.* Educational Leadership/, November 1999.

Creswell, J.W. (2010). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks: Sage.

Creswell, J.W. (1998). *Qualitative inquiry and research design: Choosing among five traditions.* Thousand Oaks, CA: Sage.

Croark, C.J, Mehaffie, K.E, McCall, R.B and Greenberg, M.T. (2007). *Evidence-Based Practices and Programs for early childhood*. United Kingdom: Sage.

David, M. and Sutton, C. (2004). *Social Research: The basics*. London: Library of Congress Cataloguing- in- Publication Data.

De Corte, E. (2004). *Mainstreams and perspectives in research on learning (mathematics from instruction.* Centre for Instructional Psychology and Technology, 53 (2), 279-310.

Denzin, N.K. and Lincoln Y.S. (Eds) (2000a). *Handbook of qualitative research* (2nd Ed.).Thousand Oaks, CA: Sage.

Department for Education and Employment (DfEE) (1999) *The National Numeracy Strategy: Framework for Teaching Mathematics from Reception to Year 6* (London, DfEE.

Department of Basic Education, January 4 (2012). *Big decline in numbers of matric maths passes – Equal Education*. Pretoria: Department of Education.

Department of Basic Education, September (2012). *Annual National Assessment: Test Administration Manual.* Pretoria: Department of Education.

Department of Education. (2011) *Curriculum Assessment Policy Statement*. Pretoria: Department of Education.

Department of Education (2009). *Report of the Task Team for the review of the implementation of the National Curriculum Statement. Final Report October* 2009. Pretoria: Department of Education.

Department of Education. (2008). The Government Gazette. Pretoria: Department of Education

Department of Education. *National Strategy on Screening, Identification, Assessment and Support* 14 March 2008. Pretoria: Department of Education

Department of Education. (2007) *Revised National Curriculum Statement*. Pretoria: Department of Education.

Department of Education. (2005a) *National Curriculum Statement.* Grades R-9: Parents' guide .Pretoria: Department of Education.

Department of Education. (2003) *Revised National Curriculum Statement Grades R – 9 (Schools): Teacher's Guide for the Development of Learning Programmes: Foundation Phase.* Pretoria: Department of Education

Department of Education (2002b) *Revised National Curriculum Statement for Mathematics Grades R to 9*. Pretoria: Department of Education.

Department of Education. (2001). *Education White Paper 6, 30 July 2001. Special Needs Education Building and Inclusive Education and Training System*. Pretoria: Department of Education.

Department of Education. (*1999). Consultative Paper No. 1. First Steps. 30 August 1999 Special Education: Building an Inclusive Education and Training System, First Steps.* Pretoria: Department of Education.

Department of Education. (1997). *Curriculum 2005: Specific Outcomes, Assessment Criteria and Range Statements, Discussion document of the Ministerial Committee for Development Work on the NQF.* Pretoria: Department of Education.

Department of Education. (1997). *Quality education for all overcoming barriers to learning and development.28 November 1997. Report of the National Commission on Special Needs in Education and Training (NCSNET). National committee on Education Support Services (NCESS).* Pretoria: Department of Education.

De Vos, A.S. (Editor). Strydom, H., Fouche, C.B. and Delport, C.S. L. (2000). *Research at grass roots*. 2nd Ed. Pretoria: Van Schaik.

Donlan, C. (2007). Mathematics development in children specific language impairments. In D.B. Berch and M.M. Mazzocco (Eds.), why is math so hard for some children? The nature and origins of mathematical learning difficulties and disabilities, 147 – 150. Baltimore: Brookes

Donald, D., Lazarus, S. and Lolwana, (P. 2010). *Educational psychology in social context.* 4th Ed. Cape Town: Oxford University Press.

Donald, D., Lazarus, S. and Lolwana, P. 2002. *Educational psychology in context. 2nd* Ed. Cape Town: Oxford.

Dowker, A.D (2005). *Early identification and intervention for students with mathematics difficulties.* University of Oxford, Vol. 38, No 4 July/August 2005, 324 – 332.

Dowker, A.D. (2004). *Children with difficulties in mathematics: what works?* London: DfES.

Dowker, A.D. (2004). *What works for children with mathematical difficulties?* University of Oxford. ISBN 1 84478261 1.

Dowker, A.D. (2003). *Intervention in numeracy: Individualised approaches. In1. Thompson (Ed.), Enhancing primary mathematics teaching, 127-138.* Maidenhead, UK: Open University Press.

Dowker, A.D. (2001). *Numeracy recovery: a pilot scheme for early intervention with young children with numeracy difficulties*. Vol. 16, No 1, 6 – 10.

Dowker, A., Hannington, J., and Matthew, S. (2000). *Numeracy recovery: A pilot scheme: Early intervention for young children with numeracy difficulties*. [Online] Available: www.tirp.org/pub/acadpub/Dowker2000.pdf.

Ebmeier, H. (1983). *Improving the productivity of testing programs through matrix sampling, Educational Leadership*, 41(3), 63-64.

Elkins, J. (2007). *Learning disabilities: Bringing fields and nations together*. Journal of Learning Disabilities, Vol. 40, 392-399.

Even, R., and Tirosh, D., (1995). *Subject – matter knowledge and knowledge about students as sources of teacher presentations of the subject matter, Educational Studies in Mathematics,* 29, 1 – 20.

Fagnant, A. (2005). *The use of mathematical symbolism in problem solving: An empirical study carried out in grade one in the French community of Belgium.* XX(4), 355-367.

Fletcher, J. M., Lyon, G. R., Fuchs, L. S., and Barnes, M. A., (2006) *Learning disabilities: From identification to intervention.* New York: Guilford.

Fricke, E. Horak, L. Meyer, L and Van Lingen, N. (2008) Lessons from a mathematics and science intervention programme in Tshwane township schools. *South African Journal of Higher Education* Vol. 22 64 – 77.

Fuchs, L.S., Fuchs, D., Powell, S.R, Seethaler, P.M., Cirino, P.T., and Fletcher, J.M. (2008). *Intensive intervention for students with mathematics disabilities: Seven principle of effective practice. Learning Disabilities Quarterly*, 31.

Fuchs, L.S., Compton, D.L, Fuchs, D., Paulsen, K., Bryant, J.D., and Hamlett, C.L. (2005). *The prevention, identification, and cognitive determinants of math difficulty. Journal of Educational Psychology*, 97, 493 – 513.

Galton, M., Hargreaves, L., Comber, C., Wall, D. and Pell, A. (1999). *Inside the classroom: 20 years on*. London: Routledge.

Galton, M. and Simon, B. (eds.) (1980). *Progress and performance in the primary classroom*. London: Routledge.

Geary, D. C., and Hoard, M.K. (2005). *Learning disabilities in arithmetic and Good*, T.L., Grouws, D.A and mathematics: *Theoretical and empirical perspectives*. In J.I.D. Campbell (Ed.).*Handbook of Mathematical cognition*, 253 – 268. New York: Psychology Press.

Geary, D. C. (2004). *Mathematics and learning disabilities*. Journal of Learning Disabilities, 37, 4–15.

Geary, D.C., Hamson, C.O. and Hoard, M.K. (2000). *Numerical and arithmetical cognition: A longitudinal study of process and concept deficits in children with learning disability. Journal of Experimental Child Psychology,* 77**,** 236–263.

Geary, D. C. (1993). *Mathematical disabilities: Cognitive, neuropsychological, and genetic components.* Psychological Bulletin, 114, 345–362.

Geary, D. (1990). *A componential analysis of an early learning deficit in mathematics*. *Journal of Experimental Child Psychology,* 33, 386–404.

Gersten, R., Clarke, B., and Mazzocco, M.M. (2007). Historical and contemporary perspective on mathematical learning disabilities. In D.B. Berch and Mazzocco (Eds.). Why is Math so hard for some children? The nature and origin of mathematical learning disabilities, 7 - 28. Baltimore: Brookkes.

Ginsburg, H. (1977). Children’s Arithmetic: the learning process. New York N Y: D.

Good, T.L., Grouws, D.A., and Ebermeier, H. (1983). *Active mathematics teaching*. New York: Longman.

Graig, A. Mertler, C.M. and Charles, C.M. (2008). *Introduction to educational research*. US A: Library of Congress Cataloguing in Publication Data.

Gravemeijer, K. (2002) *Preamble: From programmes to programming*. In K Gravemeijer, R. Lehrer, B. van Oers, and L, Verchaffe (Eds.), Symbolising programming and tool use in mathematics education, 7-22. Dordrecht. The Netherlands: Kluwer Academic.

Guerin, G. and Male, M.C. (2006). *Addressing learning disabilities and difficulties*. United Kingdom: Library of Congress Cataloguing- in- Publication Data.

Henning, E., Van Rensberg and Smith (2004). *Finding your way in qualitative research*. 2nd Ed. Pretoria: Van Schaik.

Hierbert, J. (1997). *Making sense: teaching and learning mathematics with understanding*. United States: Heinemann.

Hiebert, J. (1985). (Ed.) Conceptual and procedural knowledge: The case of mathematics. Hillsdale, NJ: Erlbaum.

Hill, W.F. (2002) *Learning*: *A survey of psychological interpretation (7th ed)*, Boston, MA: Allyn and Bacon.

Hollway, W. and Jefferson, T. (2001) *Doing qualitative research differently: free association, narrative and interview*. London: SAGE.

Illeris, H. (2004): *Educations of vision. Relational strategies in visual culture, Nordisk Pedagogik, 24(4): 250-267.*

Joiner, L.M. (1978). *Identifying child's with special needs: A practical guide to developmental screening*. Florida: Learning Publications, Inc.

Kaufmann, L., Handl, P., and Thony, B. (2003). *Evaluation of a numeracy intervention Program focusing on basic numerical knowledge and conceptual knowledge. 36 (6), 564-573.*

Kennedy, L.M., and Tipps, L. (2000). *Guiding children's learning of mathematics*, 9th Ed.. United Kingdom: Library of Congress Cataloguing- in- Publication Data.

Kutz, R.E. (1991). *Teaching elementary mathematics*. United States of America: Library of Congress Cataloguing- in- Publication Data.

Kruger, D., and Yorke, C. (2010). *Collaborative co-teaching of numeracy and literacy as a key to inclusion in an independent school.* South African Journal of Education EASA, 30: 293 – 306.

Kyriacou, C., and Goulding, M. McNamara, O. (Ed.). (2004) *Proceedings of the British Society for Research into Learning Mathematics*, 24(2).

Leedy, P.D., and Ormond, J.E. (2005). *Practical Research: Planning and Design, 8th Ed. United States of America:* The Lehigh Press, Inc.

Lemaire, P., and Siegler, R.S. (1995). *Four aspects of strategic change: contributions to children who are learning multiplication.* Journal of Experimental Psychology: General, 124, 83 – 97.

Le Roux, K. (2008). *A Critical Discourse Analysis of a real-world problem in mathematics: Looking for signs of change, Language and Education*, 22(5): 307-326.

Lewins, A., and Silver C. (2007). *Using software in qualitative research: A step-by-step guide*. London: Sage.

Lincoln, N., and Guba, Y. (2006). *The Sage handbook of qualitative research*. Thousand Oaks: Sage Publishers.

Mallows, D. and McNeill, R. (2005) *Special Report Numeracy*. The Magazine of NRDC 1 (2) 01 February.

Margolinas, C., Coulange, L., and Bessot, A. (2005). *What can the teacher learn in the classroom?* Educational Studies in Mathematics 59, 205-234.

Marshal, C., and Rossman, G. B. (1995). *Designing qualitative research*, 2nd Ed.. Thousand Oaks: Sage.

Martin, W., Strother, S. Beglau, M., Bates, L., Reitzes, T., and Culp, M. (2010). *Connecting instructional technology professional development to teacher and student outcomes.* Journal of Research on Technology in Education, 43(1), 53-74.

Marr, B. (2000). *How can they belong if they cannot speak the language? Enhancing students' language use in the adult mathematics classroom.* Literacy and Numeracy Studies, 10 (1 and 2), 55-69.

Martin, S. (2010). *An early childhood intervention programme and the long – term outcomes for students. Child care in practice,* 16 (3), 257 – 274.

McDevitt, T. M., and Ormrod, J.E. (2010). *Child development and education*, 4th Ed.. United States: S4Carlisle Publishing Services.

McMillan, J.H., and Schumacher, S. (2010). *Research in education. (Evidence based inquiry)* 7th Ed.. United States of America: Library of Congress Cataloguing in Publication Data.

McNeil, N. M., and Alibali, M.W. (2005). *Knowledge change as a function of mathematics experience: All contexts are not created equal*. Journal of Cognition and Development, 6 (2), 285 – 306.

Mercer, N. (2006). *Teaching children how to use language to solve maths problems*. 20(6).

Mertler, C.A. and Charles, C.M. 2008. *Introduction to Educational Research.* Boston: Pearson Education.

Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation*. U.S: Library Cataloguing in Publication Data.

Middleton, J. A., and Goepfert, P. (2002). *Inventive strategies for teaching mathematics: Implementing standards for reform.* Washington, DC: American Psychological Association.

Moodley, M., Njisane, R. A., and Presmeg, N. C. (Eds) (1992). Mathematics Education for In-Service and Pre-Service Teachers, Shuter and Shuter, South Africa.

Morin, J.E., and Franks, D.J. (2010). *Why do some children have difficulty learning mathematics? Looking at language for answers*. Department of Special Education. 54(2).

Mouton, J. (2006). *How to succeed in your master's and doctoral studies: a South African guide and resource book*. Pretoria: Van Schaik.

Myhill, A. (2006). *Community engagement in policing: Lessons from the literature*. London: Home Office.

Naude, H., Pretorius, E. and Vandeyar, S. *Teacher professionalism: An innovative programme for teaching mathematics to foundation level children with limited language proficiency. Early Childhood Development and Care*, 173(2-3), 293-315.

Oleke, C., Blystad, A., Fylkesnes, K., and Tumwine, J.K. (2007). *Constraints to educational opportunities of orphans: A community-based study from Uganda. Aids Care,* 19 (3), 361-368.

Ormrod, J. (1995). *Educational psychology: principles and applications*. New Jersey: Prentice-Hall, Inc.

Pal, G.C. (2009). *Teaching and learning mathematics.* University School Resource Network 2009.

Papatheodorou, T. (2006). *Behaviour barriers in the early years*. New York: Library Cataloguing in Publication Data.

Pendlington, S. (2006). *Mathematics isn't easy*. Mathematics teaching incorporating micromath 197 July 2006.

Peterson, N.L. (1987). *Early intervention for handicapped and at risk child's*. United States of America: Library of congress cataloguing-in-Publication Data.

Perry, M. (2000). *Explanations of mathematical concepts in Japanese, Chinese, and U.S. first- and fifth- grade classrooms.* Cognition and Instruction, 18 (2): 181-207.

Piaget, J. 1952. *The origins of intelligence in children*. pp 1-20. New York: WW Norton and Co.

Pierangelo, R. (1994). *A survival kit for the Special Education Teacher.* United States: Library of Congress Cataloguing- in- Publication Data.

Pottinger, B. (2008).*The imperial presidency: P.W. Botha the first ten years*, Johannesburg: Southern Book Publishers.

Poulson, L. (2001). Paradigm lost? *Knowledge, primary teachers and education policy.* British Journal of Educational Studies, 49(1) 40-55.

Reddy, V with contributions from Anil K., Diedericks G., and Winnaar L. (2003). *Mathematics and science achievements at South African Schools in TIMMS*. Cape Town: HSRC Press.

Resnick, L.B. (1989). *Developing mathematical knowledge*. 44.(2), 162-169.

Reynolds, A. J., Mann, E., Miedel, W., and Smokowski, P. (1997). *The state of early childhood intervention: Effectiveness, myths and realities, new directions. Focus*, 19(3), 3–8.

Robertson, A. (2010). *Mamelodi Trust supporting pupils and teachers in South Africa*. Film City Production Ltd:

Schoenfeld, A. H. (2004). *The math wars*. Educational Policy, 18(1), 253-286.

Schminke, C.W., Maertens, N., and Arnold, W. (1978). *Teaching the child mathematics 2nd Ed.* United States of America: Library of Congress Cataloguing in Publication Data.

Schunk, D.H. (2004). *Learning theories*. 4th Ed. United States of America: Library of Congress Cataloguing in Publication Data.

Sharma, Mahesh 1989. *How children learn mathematics: Professor Mahesh Sharma, in interview with Bill Domoney.* London, England: Oxford Polytechnic, School of Education. 90 min. Educational Methods Unit. Video cassette.

Shulman, L. S. (1986). *Those who understand: knowledge growth in teaching*, *Educational Researcher*, 15 (2), 4-14.

Slavin, R., E. (2009). *Educational psychology: theory and practice*. Columbus, Ohio: Pearson.

Smith, F., Hardman, F., Wall, K. and Mroz, M. (2004). I*nteractive whole class teaching in National Literacy and Numeracy Strategies.* British Research Journal, 30(3).

Stakes, R and Hornby, G. (2000). *Meeting special needs in mainstream schools. A practical guide for teachers.* London: D Fulton.

Star, R., and Rittle – Johnson, B. (2007). *Flexibility in problem solving*: The case of equation solving. *Learning and Instruction,* 18, 565 – 579.

Steele, M.M. (2004) *Early Childhood Education Journal*, 32(2), 75-76.

Steinbring, H. (1998). *Elements of epistemological knowledge for mathematics teachers*, Journal for Mathematics Teacher Education 1, 157-159.

Stobie, I., Boyle, J., Woolfson, L., Truswell, E., and Connaughton, N. (2004). *Quality indicators for effective early intervention in literacy and numeracy.* International Journal of Early Years Education, 12(2),.

Swars, S. L. (2004). *Mathematics teaching efficacy beliefs of elementary preservice teachers and their relationship to mathematics anxiety*. Unpublished doctoral dissertation, University of Alabama.

Themane, M.J., Monyeki, K.D., Nthangeni, M.E., Kemper, H.C.G. and Twisk, J.W.R. (2003). *The relationship between health (malnutrition) and educational achievements (Maths and English) in the rural children of South Africa.* International Journal of Educational Development, 23, 637–643.

Terre Blanche, M. Durrheim, V., and Painter, D. (Eds) 2006. *Research in practice. Applied methods for the social sciences.* Cape Town: UCT Press.

The Star 29 June 2011:6.

The Star November 2008:6.

UNICEF. (2006). *The state of the world's children*. New York: Library of Congress Cataloguing- in- Publication Data.

Vaidya, S. R. (2008). *Understanding Dyscalculia for teaching*. 718/Education Vol. 124 No.4.

Vaill, P. B., (1996). *Learning as a way of being.* San Francisco, CA, Jossey-Bass Inc.

Van de Walle, J.A. (2007). *Elementary and middle school mathematics* (7th Ed). Boston, MA: Pearson Education Inc.

Van de Walle, J.A. (2006). *Elementary and middle school mathematics* (7th Ed). Boston, MA: Pearson Education Inc.

Van de Walle, J.A. (2004). *Elementary and middle school mathematics* (5th Ed). Boston, MA: Pearson Education Inc.

Van Kraayenoord, C.E., and Elkins, J. (2004). *Learning difficulties in numeracy in Australia.* Journal of Learning Disabilities, 37(1) 32-41.

Van Luit, J. E. H., and Schopman, E. A. M. (2000). *Improving early numeracy of young children with special educational needs. Remedial and Special Education 21(1),* 27-40. [Online] Available: ProQuest Educational Journals [2004, September 20].

Vithal' R., and Skomvose O. (1997).The end of innocence: A critique of Ethno mathematics. 1997 Educational Studies in Mathematics .Vol. 34, No. 2, Nov., 1997 Published by: Springer.

Vygotsky, L. (1978). *Mind in society*. Cambridge: Harvard University Press.

http://www.collinsmaps.com/maps/South-Africa,-Republic- of/Gauteng/ Mamelodi/P483322.00.aspx" title="Collins location map of Mamelodi"><img

Welch, T. Reaching Teachers? Curriculum challenges for distance teacher education in South Africa. Africa Education Review 324 – 327.

Welman, J.C. and Kruger, SJ. 2001. *Research methodology for the business and administration sciences.* 2nd ed. Cape Town: Oxford University Press.

Willis, S. (1998). *Which numeracy?* Unicorn, 24(2), 32-42.

White, C.J. (2005). *Research: a practical guide*. Pretoria. Ithuthuko Investment (Publishing).

Whitin, P., and Whitin, D. J. (2006). *Making connections through math-related book pairs. teaching children mathematics*, 13(4), 196-202.

Wright, R.J., and Stafford, A.K. (2000). *Early numeracy assessment for teaching and intervention*. London: Chapman.

Woodward, J., and Brown, C. (2006). *Meeting the curricular needs of academically low-achieving students in middle grade mathematics.* The Journal of Special Education, 40(3), 151-159.

Yackel, E, Cobb, P and McClain, K. (Eds.) 2000. *Symbolizing and communicating mathematics classroom: perspectives on discourse, tools, and instructional design*. Mahwah, N.J: Lawrence Erbaum Associates.

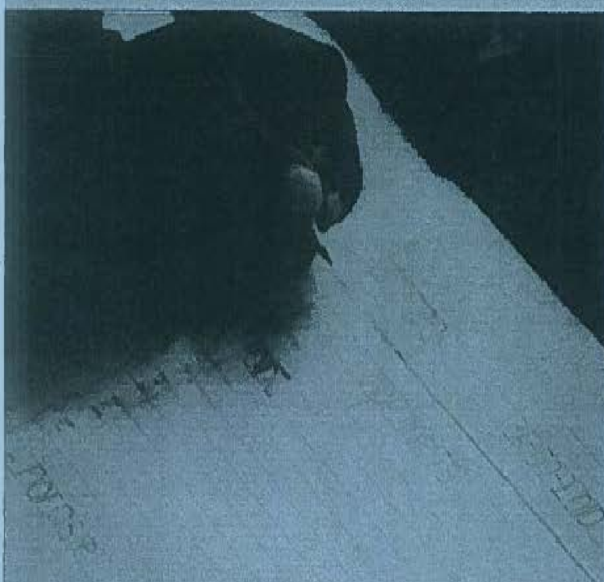
Yin, R. (2009). *Case study research design methods* 4th ed. United States: Library of Congress Cataloguing- in- Publication Data.

Appendix A: An example of ANA grade 3 mental mathematics test

THE STAR

Kids can't read or write

Study shows pathetic state of primary school educa



DISMAL RESULTS: A daily spelling test takes place in a Grade 3 class in Cape Town. Numeracy and literacy are constant struggles for most primary school pupils. PICTURE: MATTHEW JORDAAN

CONCERNED: Basic Education Minister Angie Motshekga speaking about assessme and evaluation at the Union Buildings.

NONTOBEKO MTSHALI, SHAUN SMILLIE AND SAPA

MOST GRADE 3 and 6 pupils can't count and can't understand what they were supposed to have been taught.

They scored a dismal 30 percent in numeracy and literacy in a countrywide assessment test earlier this year. In Gauteng, nearly 70 percent of the province's Grade 3 pupils can't read or count.

Basic Education Minister Angie Motshekga described the results as "very sad".

"Provincial performance in these two areas (literacy and numeracy) is between 19 percent and 40 percent, the highest being the Western Cape and the lowest being Mpumalanga."

The pathetic results confirmed earlier international surveys, in which South African Grade 3s and

Association of SA (Naptosa) said.

"We have also been concerned that when samples of learners in Grade 3 and Grade 6 were involved in writing similar literacy and numeracy tests... some years ago, the results did not seem to be used to inform interventions that could possibly have made a difference," it said.

The test now provided hard evidence on which to base decisions on "what must be done and where it needs to be done", and it was now up to the department's officials to take action. "The same mistakes cannot be repeated over and over again," Naptosa said.

Motshekga said the low levels of literacy and numeracy in primary schools were "worrying precisely because the critical skills of literacy and numeracy are fundamen-

Many learners lack the proper

reflected poor performance at lower grades.

The tests, which looked at the pupils' ability to write, read and count, were written in February this year by over 9 million pupils from public schools in all nine provinces.

The assessments were not used to grade the pupils, but to give the department and the education sector as a whole insight into whether the pupils know what they were meant to have studied in their previous grades.

According to the report, Grade 6 results for language – based on a sample of results from selected schools – show that as few as 15 percent of pupils scored more than 50 percent.

Among Grade 3 pupils, only 17 percent scored more than 50 percent in their numeracy

recognised to be key determinants of overall learner performance."

Kathy Callaghan, secretary of the Governors' Alliance, which represents more than 300 Gauteng schools, said that while this was bad news, the positive was that it was now out there. "We can build from there," she said.

Salim Vally, an education ana-

Appendix B: Observation guide

Observation guide

1. The classroom environment was observed to determine if it contributed to mathematics teaching problems. The following were observed:
   - Classroom resources
   - Classroom organisation
2. Teaching activities are important variables that influence successful teaching and learning. These include:
   - Teacher child interaction
   - Child participation
   - Child to child interaction
3. Methods used to teach mathematics computations are regarded as the major determinant of successful learning. The methods used were observed for their effectiveness as regards children's successful learning (see Appendix B).
4. The classroom environment was observed to determine if it contributed to mathematics teaching problems. The following were observed:
   - Classroom resources
   - Classroom organisation
5. Teaching Activities are important variables that influence successful teaching and learning. These will include:
   - Teacher child interaction
   - Child participation
   - Child to child interaction
6. Methods used to teach mathematics computations are regarded as the major determinant of successful learning. The methods used were observed for their effectiveness as regards children's successful learning (see Appendix B).

Appendix: C: Interview guide

Interview guide

- Which approaches do teachers use when teaching computations in mathematics?

- Which aspects of mathematics were most problematic?

- How do they resolve the problems?

- How do teachers identify children who experience mathematics problems?

What else do they do to help children understand mathematics computations?

Appendix D: An example of mathematics task from SA

Labone 20.01.2011

Match the number and the name

56 68 53 70 69

1 Sixty nine = 69

2 fifty the = 53

3 Sixty eight = 68

4 fifty six = 56

5 Seventy = 70

20.01.2011

Appendix D: An example of mathematics task from SB

17 Seventeen
18 Eighteen
19 Ninetech
20 twenty

Thursday 24 February 2...

25 twentyfire

1.6 onetundred

109 six

315 Threetlundret Fibe 24/02

20 twenty

Tuesday 1 March 2011

T	U
2	5
+	5
2	0

T	U
2	8
+1	7
3	5

1/03

Question1

T	U
2	5
+	5
3	0

Question1

T	U
2	8
+1	7
4	5

Appendix D:: An example of a child mathematics task from SC

21=thentyone
24 twentyfoyn
26 twentysix
25 twentfive
33 thirtyThree

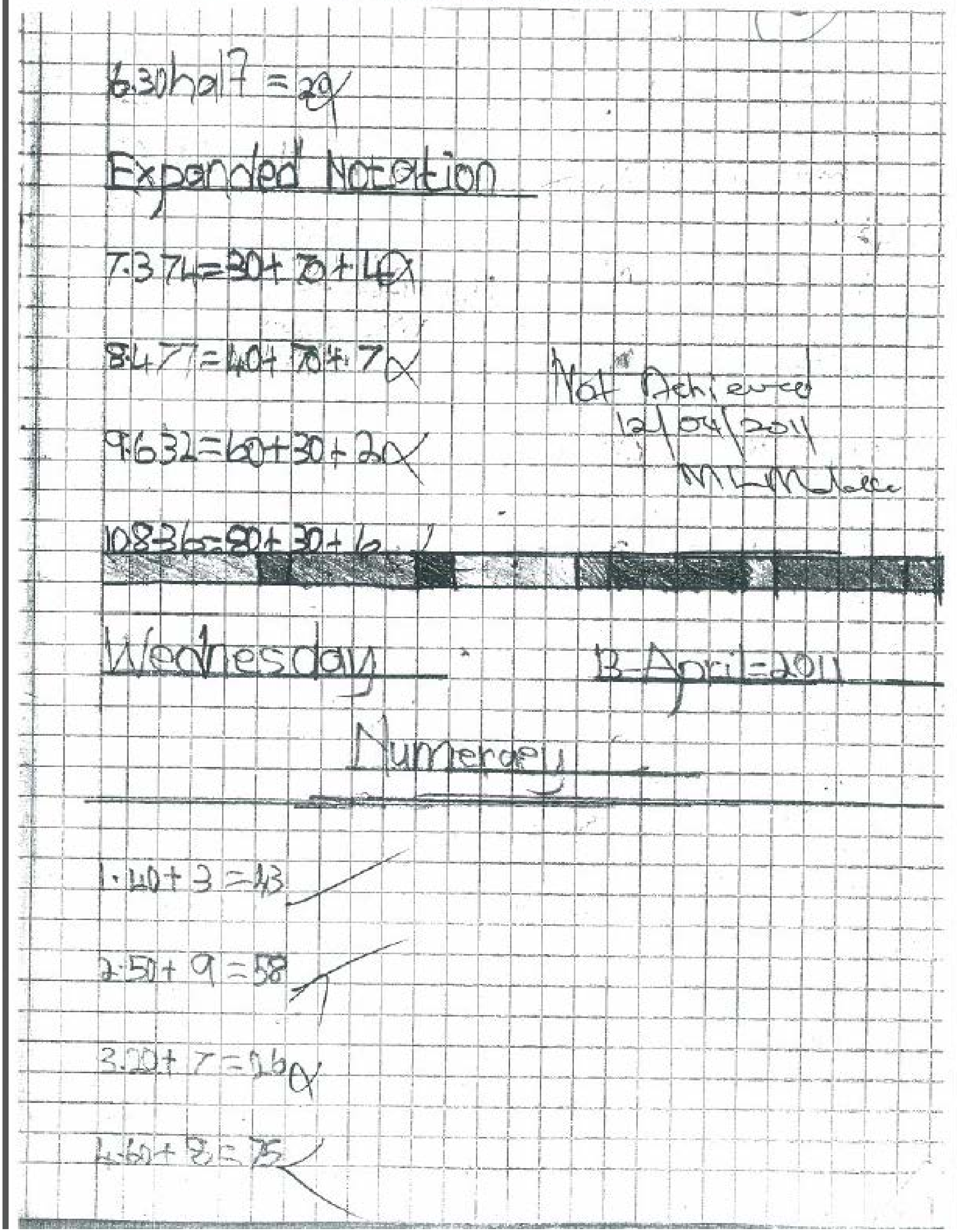
Numeracy

11April

1 20X2=40
2 11X2=12 X
3 21X2=12 X
4 42X2=42 X
5 22X2=22 X
6 18X2=12 X
7 25X2=22 X
8 46X2=42 X
9 5X2=5 X
10 2X2=7 X
11 10X2=10 X
12 12X2=14

11/04/11
Poor work

Appendix D: An example of mathematics task from SD



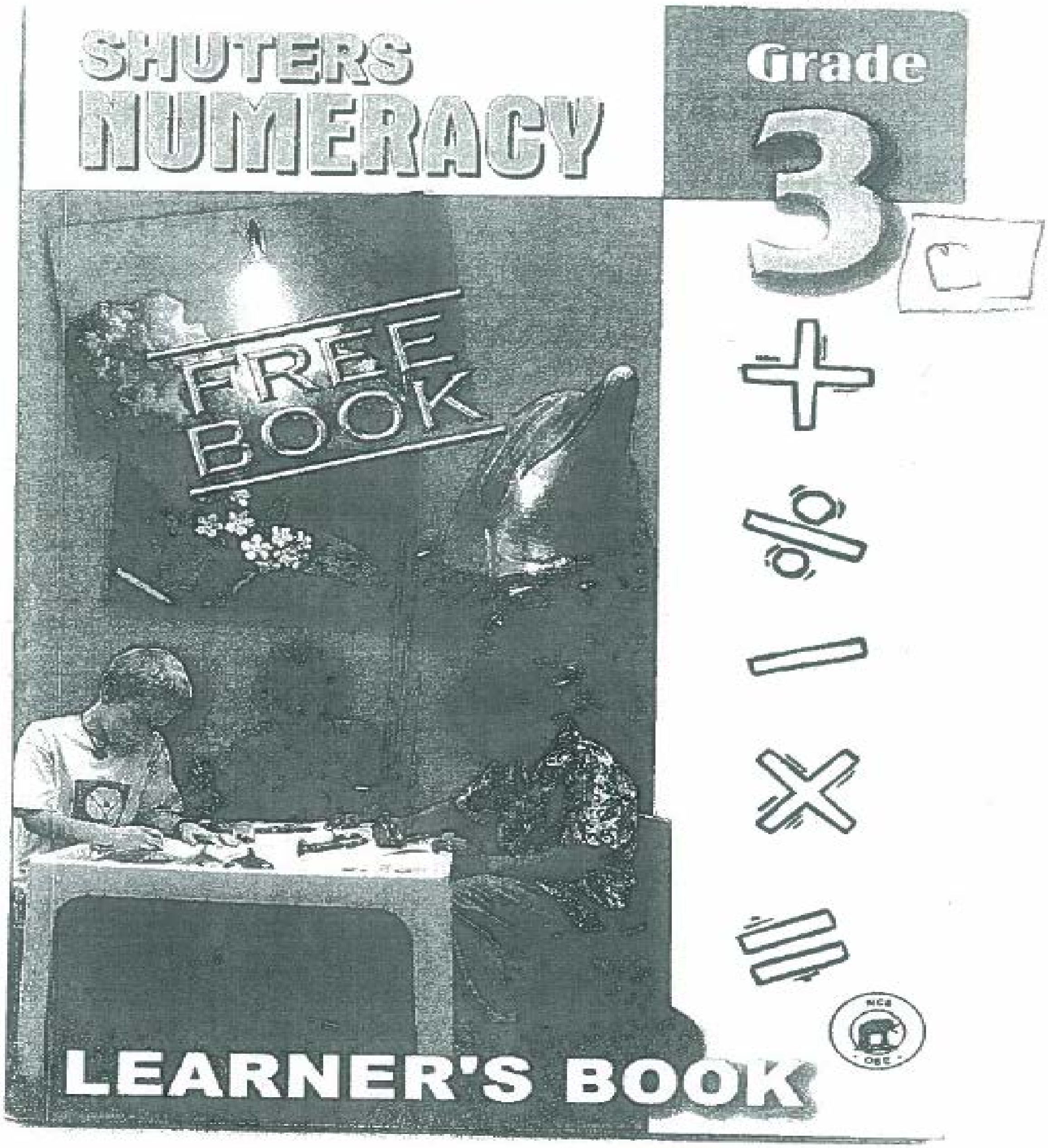
Appendix D: An example of mathematics task from SE

Wednesday 19 January 2

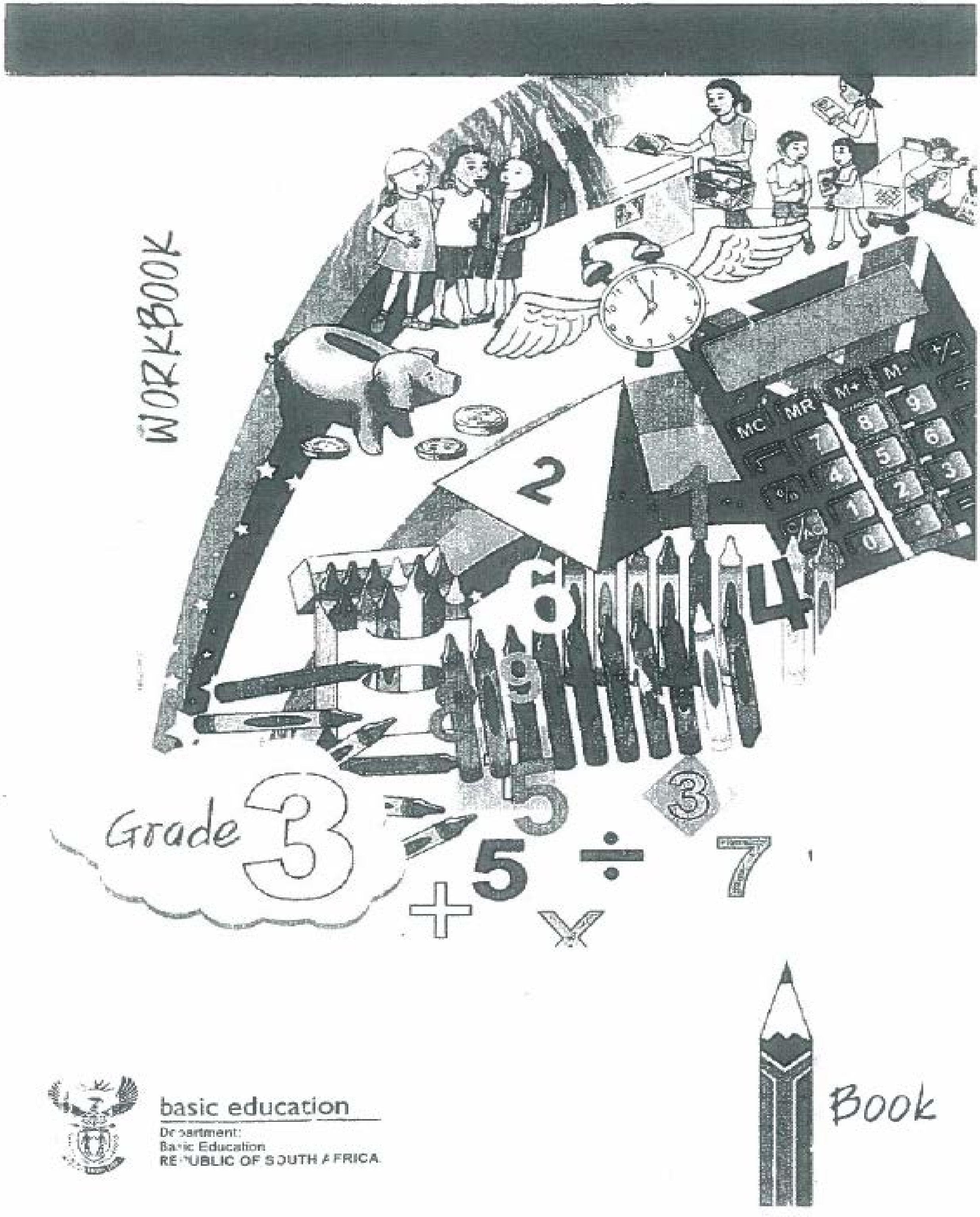
2/8

1. 10 + 4 = 30
2. 17 + 3 = 31
3. 15 + 10 = 15
4. 25 + 5 = 24
5. 18 + 6 = 25
6. 21 + 3 = 23
7. 30 + 6 = 36
8. 12 + 12 = 24

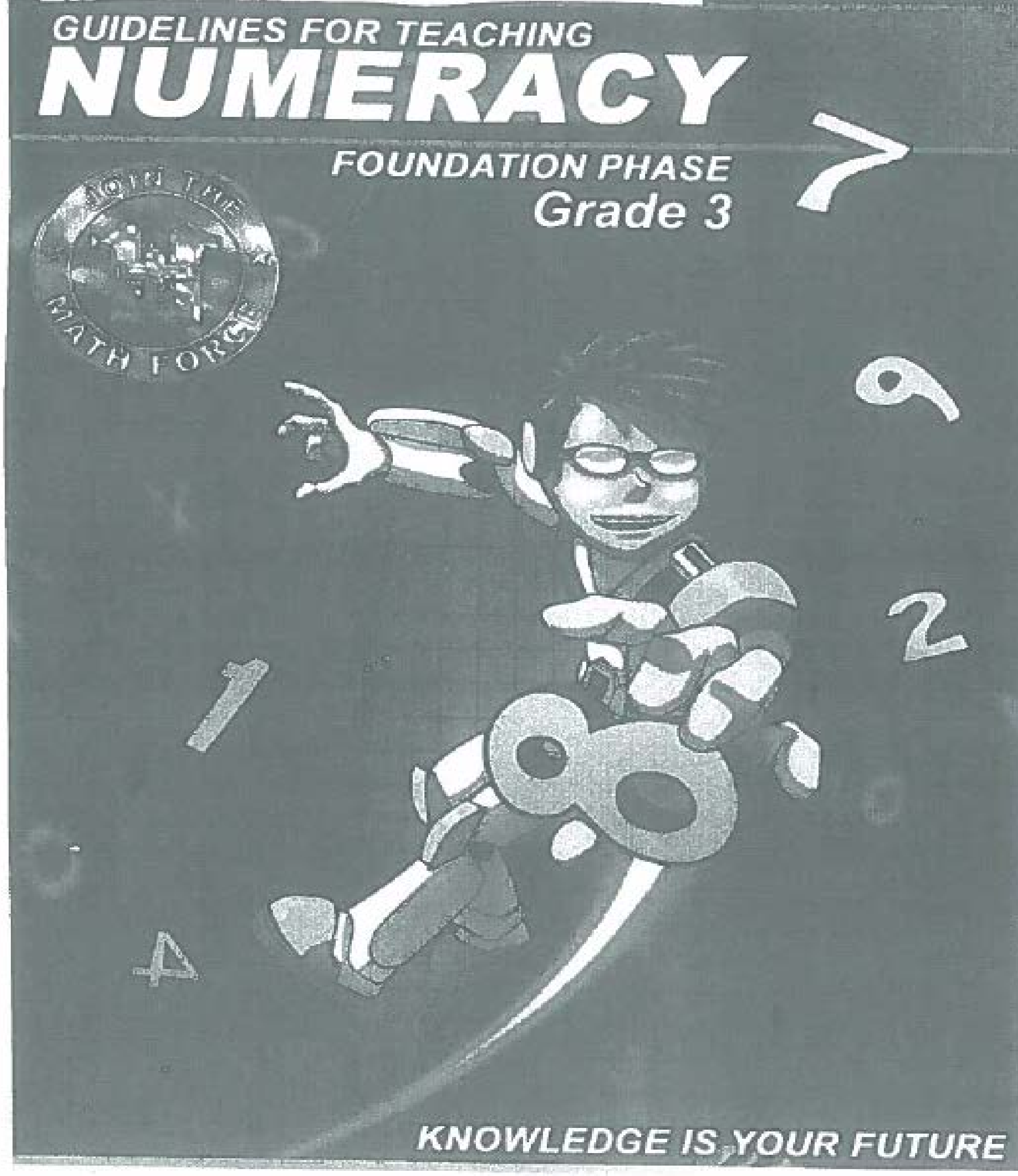
Appendix D: An example of children's mathematics book from SA



Appendix D: An example of children's mathematics book from SB



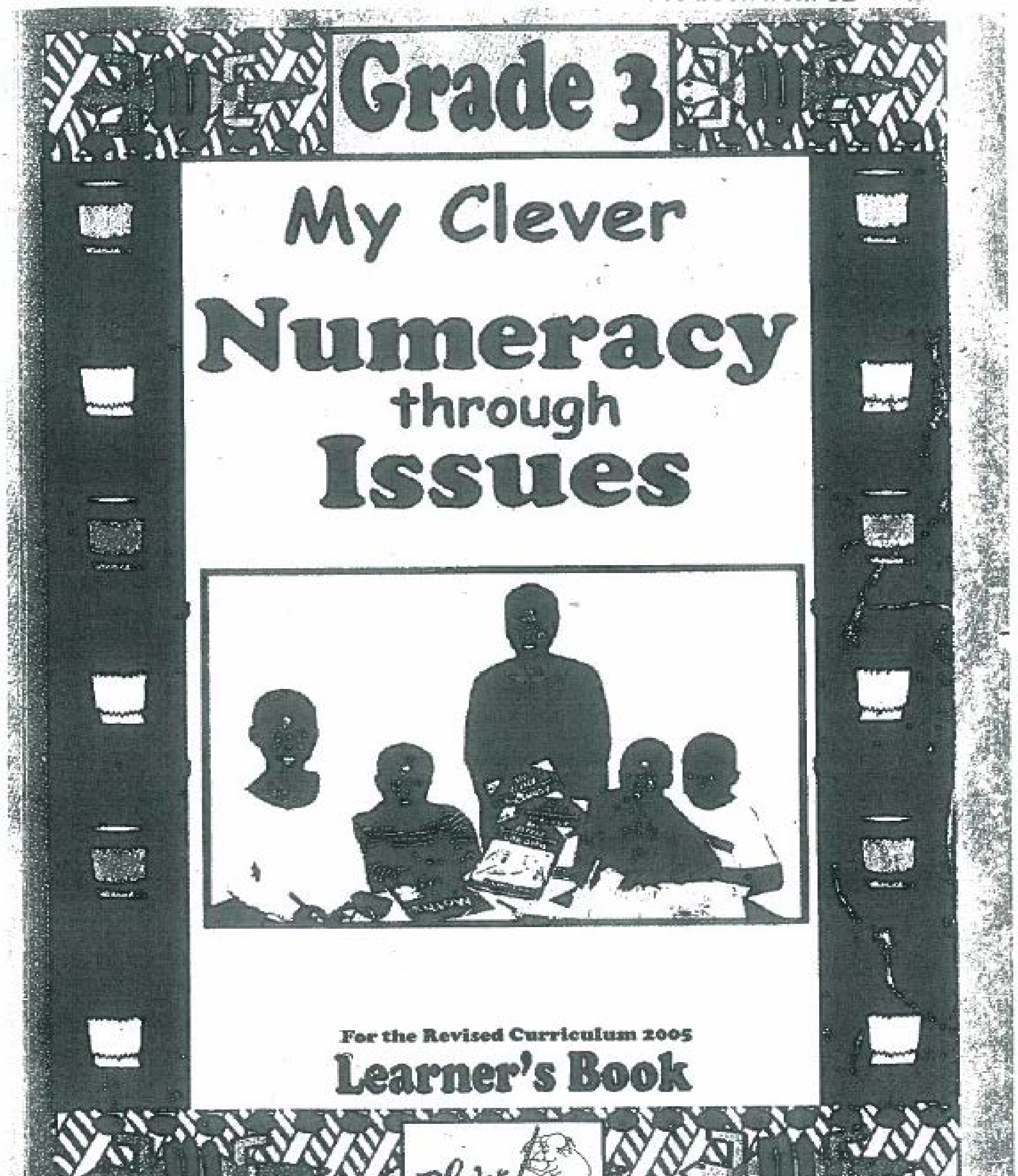
Appendix D: An example of mathematics task from SC



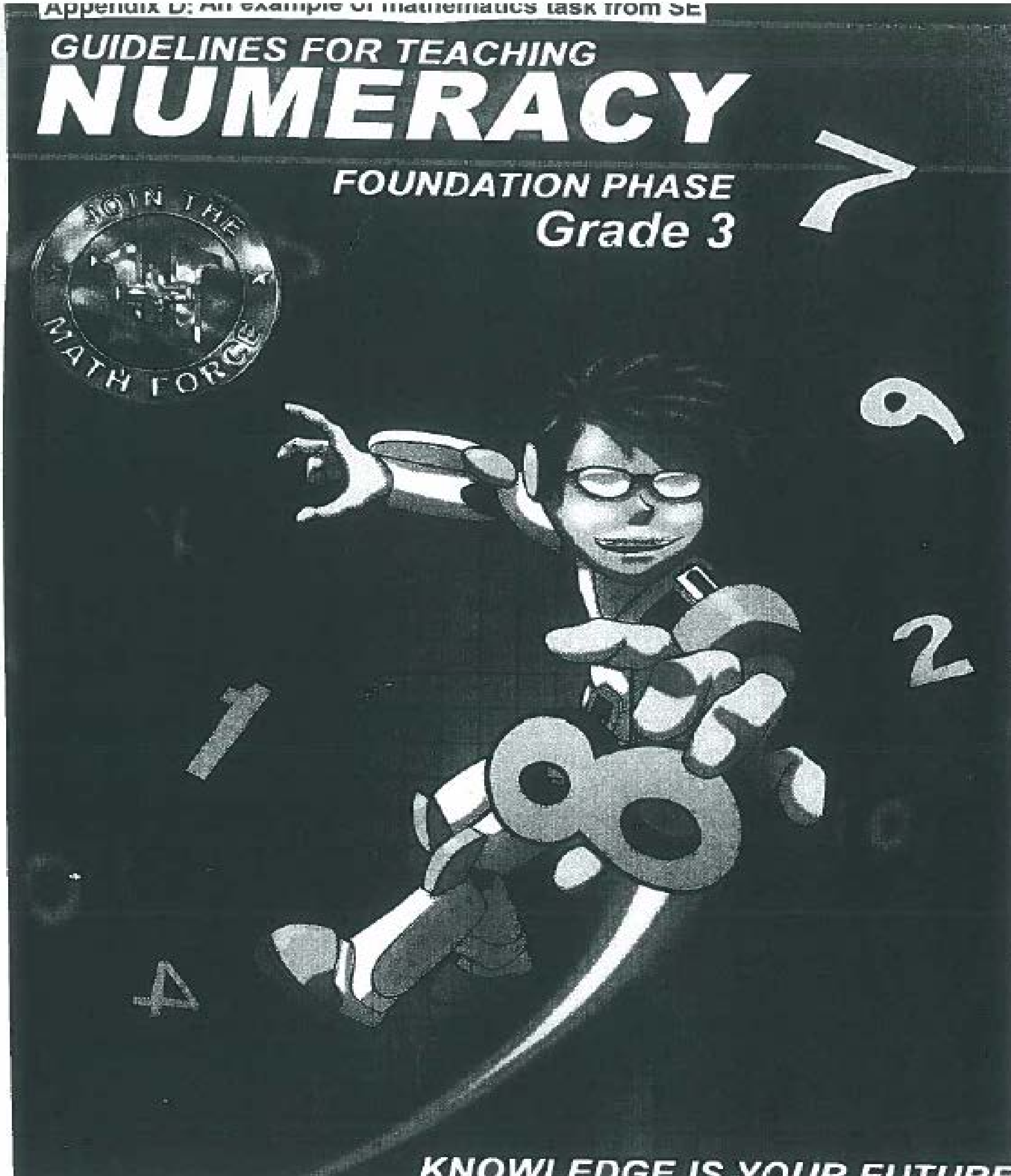
GAUTENG
PROVINCIAL GOVERNMENT

Open Rubric

Appendix D: An example of children's mathematics book from SD



Appendix D: An example of mathematics task from SE



GAUTENG
PROVINCIAL GOVERNMENT

Time Table

Time Table Grade 3 GPLMS Schools (HL 7 Hours FAL 4 Hours)

Time	08h00 – 08h05	08h05 – 08h30	08h30 – 09h00	09h00 – 09h30	09h30 – 10h00	10h00 – 10h30	10h30 – 11h00	11h00 – 11h30	11h30 – 12h00	12h00 – 12h30	12h30 – 12h45	12h45 – 13h15	13h15 – 13h45
Day	5	25	30	30	30	30		30	30	30		30	30
Monday	HL Morning Oral	Maths	Maths	Maths	Begin knowldg & Pers and social W/being		B	HL Phonics	HL Handwriting	HL Shared reading / -Reading for enjoyment	B	FAL Listening & Speaking	Preforming Arts
Tuesday	HL Morning Oral	HL Phonics	HL Listening & Speaking	HL Shared reading / Reading for enjoyment	Begin knowldg & Pers and social W/being	FAL Phonics	R	Maths	Maths	Maths	R	Physical Education	
Wednesday	HL Morning Oral	Maths	Maths	Maths	Begin knowldg & Pers and social W/being	HL Shared reading	E	HL writing	HL Handwriting	Preforming Arts	E	FAL Listening & Speaking	FAL Group guided reading
Thursday	HL Morning Oral	HL Listening & Speaking	HL Writing 45min	Reading for enjoyment	Physical Education 60 min		A	Maths	Maths	Maths	A	Begin knowldg & Pers and social W/being 60min	FAL Writing or Language
Friday	HL Morning Oral	HL Reading Comprehendsion	HL Phonics 30min	HL Writing 30min	Visual Arts		K	Maths	Maths	Begin knowldg & Pers and social W/being	K	FAL Writing activity	FAL Spelling Test

Life Skills – 7 Hours
Bkno & S&P - 3 hours pw
Creative Arts - 2 hours pw
Physical Ed - 2 hours pw

Maths – 7 Hours
4 days = 1hr 30 min
1 day = 1hour

Home Language – 7 Hours
Morning oral - 5x5 = 25
Phonics 30x3 = 1hr30
Sh read- 15x3= 45min
L & S - 30x2=1hr
HL writing - 1hr45 min
Handwriting – 30x2=1hr

FAL – 4 Hours p w
Listening & speaking - 1hr pw
Reading & phonics - 1hr30 pw
Writing - 1hr pw

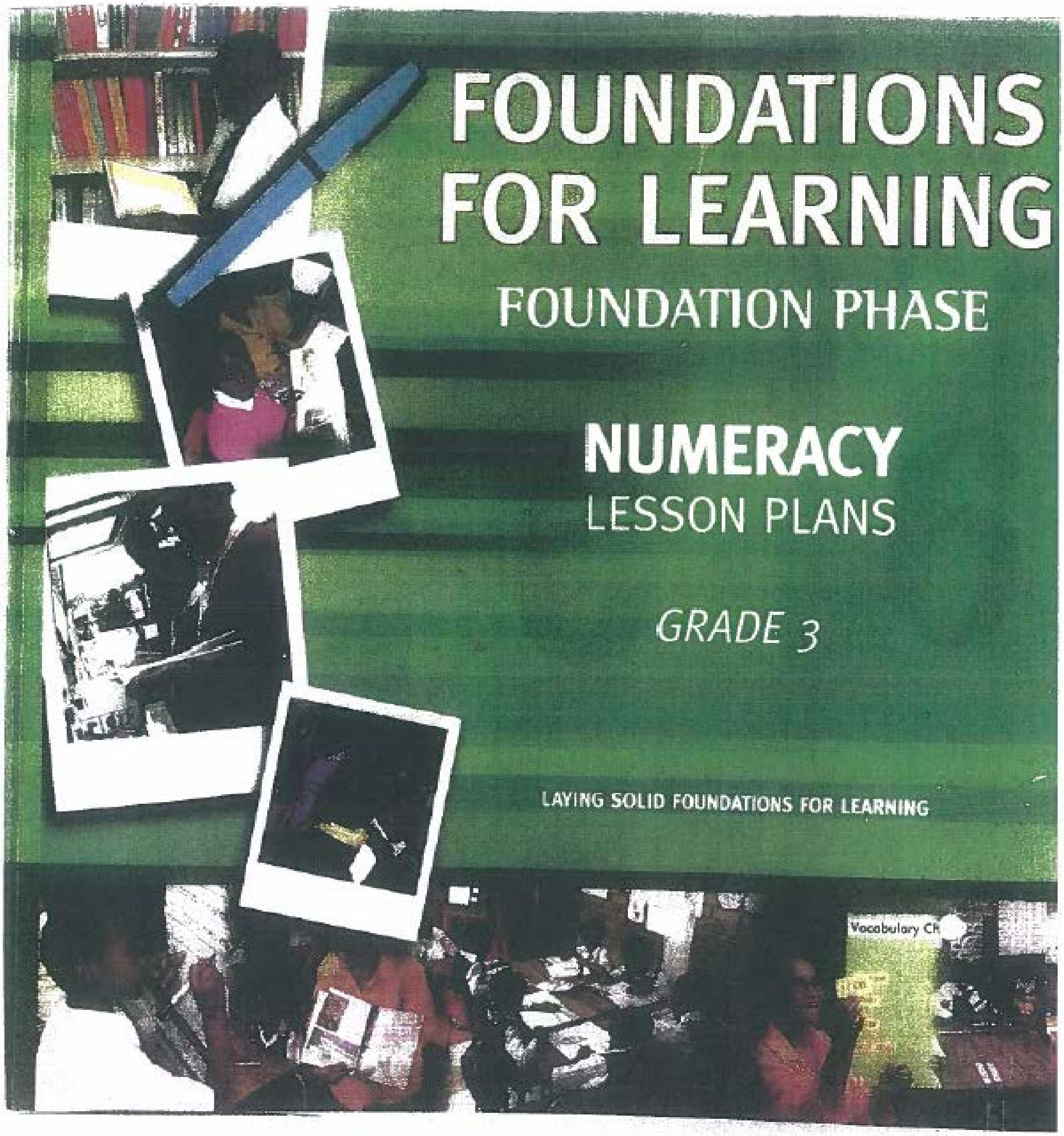
Teachers work schedule

Lesson Plan SECOND TERM

WEEK: 3 GRADE: THREE DATE: 01-05-2011 — 05.05.2011 YEAR: 2011

DAY		Mathematics	Assessment Activities	Resources
Mon	Oral	ASK LEARNERS WHICH CARDS WILL YOU NEED TO BUILD 34		
	Written	LEARNERS CHANGE NUMBERS AND RECORD THE ANSWER	ADDING AND SUBTRACTING	COUNTERS
	Group Work	LEARNERS IN THEIR GROUPS CHANGE NUMBER BY ADDING AND SUBTRACTING		– 100 CHART
Tues	Oral	ASK LEARNERS TO CONSOLIDATE AND EXPAND 3 DIGIT SUMS		ABACUS
	Written	EXPANSION NOTATION – 453, 768, 398, 508, 290	EXPANSION NOTATION	COUNTERS – 100 CHART
	Group Work	LEARNERS COUNT MATCHSTICKS IN GROUP OF 5, 10, 15, 20		ABACUS
Wed	Oral	GIVE EACH GROUPS 30 COUNTERS LEARNERS COUNT HOW MANY GROUPS OF 5		
	Written	LEARNERS WRITE HOW MANY GROUPS OF 5 IN 35, 20, 25, 10	MULTIPLICATION	COUNTERS – 100 CHART
	Group Work	LEARNERS WORK IN GROUPS EACH GROUP IS GIVEN 30 COUNTERS AND COUNT GROUP OF 5		
Thur	Oral	ASK LEARNERS TO WRITE NUMBER LINES		
	Written	LEARNERS WRITE MISSING NUMBERS ON THE NUMBERLINE	WRITING MISSING NUMBERS	COUNTERS – 100 CHART
	Group Work	IN GROUPS LEARNERS WRITE AS MANY FACTS ABOUT 5 TIMES TABLE		
Fri	Oral	LEARNERS COUNT IN TWO, THREE OR ANY GIVEN NUMBER		
	Written	208 + 2 – 8 ADD 2 ADD 2 SUBTRACT 3 144 – 10 + 2 =	ADDITION AND SUBTRACTION	COUNTERS – 100 CHART
	Group Work	LEARNERS ARE DIVIDED INTO 4 TEAMS EACH TEAM HAS A CAPTAIN		ABACUS

AppendixD: The Foundation for Learning Strategy



education
Department
Education
REPUBLIC OF SOUTH AFRICA

education
Department:
Education
REPUBLIC OF SOUTH AFRICA

Appendix E: A letter for requesting permission to conduct research

UMnyango WezeMfundo
Department of Education

Lefapha la Thuto
Departement van Onderwys

Enquiries: Nomvula Ubisi (011)3550488

Date:	01 June 2010
Name of Researcher:	Machaba Maphetla Magdeline
Address of Researcher:	133 Striga Street
	Doornpoort
	0017
Telephone Number:	0124294819/0823010328
Fax Number:	0124294819/0866550845
Research Topic:	A Model for Foundation Phase Teacher in Supporting Learners Who Experience Barriers Within the Foundation to Learning Campaign in Selected Tshwane East Primary Schools
Number and type of schools:	10 Primary Schools
District/s/HO	Tshwane South

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

Permission has been granted to proceed with the above study subject to the conditions listed below being met, and may be withdrawn should any of these conditions be flouted:

1. ***The District/Head Office Senior Manager/s concerned must be presented with a copy of this letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.***
2. ***The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.***
3. ***A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.***

Office of the Chief Director: Information and Knowledge Management
Room 501, 111 Commissioner Street, Johannesburg, 2000 P.O.Box 7710, Johannesburg, 2000
Tel: (011) 355-0809 Fax: (011) 355-0734

Open Rubric

4. *A letter / document that outlines the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.*
5. *The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.*
6. *Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Director (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.*
7. *Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year.*
8. *Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.*
9. *It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.*
10. *The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.*
11. *The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.*
12. *On completion of the study the researcher must supply the Director: Knowledge Management & Research with one Hard Cover bound and one Ring bound copy of the final, approved research report. The researcher would also provide the said manager with an electronic copy of the research abstract/summary and/or annotation.*
13. *The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.*
14. *Should the researcher have been involved with research at a school and/or a district/head office level, the Director concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.*

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

ffp. Martha Mashego

2014-06-04

ACTING DIRECTOR: KNOWLEDGE MANAGEMENT & RESEARCH

The contents of this letter has been read and understood by the researcher.	
Signature of Researcher:	
Date:	

Appendix E: A letter for requesting permission to conduct research

UMnyango WezeMfundo
Department of Education

Lefapha La Thuto
Departement van Onderwys

Reference :	Policy and Planning: Partnerships	Tel : 012 401 6322
Enquiries :	Sello George Ngwenya	Fax: 012 401 6323
E-mail :	Sello.Ngwenya@gauteng.gov.za	08 November 2010
Fax-2-email:	0865 674 276	

Machaba Maphetla Magdeline
133 Striga Street, Doornpoort, 0017
Telephone : 012 429 4819
Facsimile: 012 429 4819/ 0866560845
Mobile: 082 301 0328

Cc: Principal/s of school/s selected to participate in the research

Madam

PERMISSION TO CONDUCT RESEARCH: Machaba Maphetla Magdeline

Your research application has been approved by Head Office. The full title of your Research reads thus: **"A model for Foundation Phase Teacher in supporting learners who experience barriers within the Foundation to learning Campaign in selected Tshwane East Primary Schools".**

You are expected to adhere strictly to the conditions given by Head Office. You are also advised to communicate with the school principal/s and/or SGB/s regarding your research and time schedule.

NB Kindly submit your report including findings and recommendations to the District at least two weeks after conclusion of the research. You may be requested to participate in the District mini-research conference to discuss your findings and recommendations with District officials and other researchers.

The District wishes you well.

Yours sincerely

machabmm@unisa.ac.za

Mr. MJ Mokhosi
Director: Tshwane South District

DISTRICT DIRECTOR: TSHWANE SOUTH DISTRICT OFFICE
(Mamelodi/Eersterust/Pretoria East/Pretoria South/Atteridgeville/Laudium)
President Towers, 265 Pretorius Street, Pretoria, 0001
Private Bag X27825, Sunnyside, Pretoria, 0132
Telephone: 012 401 6317 Fax: 012 401 6318/ 6356
Web: www.education.gpg.gov.za

Appendix F: A letter to the principals

Date 14 April 2011

Name of School:

Dear Principal/ School Governing Body

Permission to conduct a study in your school

My name is Maphetla Magdeline Machaba I am a lecturer as well as doctoral research student at the University of South Africa. I am looking for a Grade 3 teacher from your school to participate in the research study. The purpose of the study to investigate the approaches teachers use in the teaching of mathematics computations.

The study proposes to develop a strategy that will help teachers in supporting children who experience Mathematical difficulties.

Participation in this study is voluntary and teachers may withdraw at any time. I will keep the identity of teachers as well as your school anonymous. The data collection methods will include observations, individual interviews and document analysis. The results of this study will be published in the form of a thesis and the collected data will be kept confidentially and will only be shared with my supervisors.

There are no risks involved in the study and participants will not be financially compensated. I will also ensure that I respect the teacher's constitutional rights for dignity as well as ensuring that they are not harmed in any way through this research.

Teachers will be given ample opportunity to ask questions about the study. I will also discuss the final result with you in the form of a feedback. The findings of the inquiry may also be presented at conferences, as well as appear in books or articles, where the teachers' names will be kept confidential.

Yours sincerely

Maphetla Magdeline Machaba   Prof E.M: Lenyai (Supervisor)

Appendix G: Informed Consent

INFORMED CONSENT FORM

Researcher: Maphetla Machaba (Telephone number: 082 3010 328)

Dear Principal

I request your Institution to grant me permission to take the following pictures that relate to my research:

- Classroom organisation
- Chalkboard (children activities)
- Foundation Phase block.
- School surroundings

I guarantee that the following conditions will be met:

1) Your real name will not be used at any point of information collection, or in the final writing up of the data.
2) Your participation in this research is voluntary. You have the right to withdraw at any point of the study, for any reason, and without any prejudice, and the information collected and records and reports written will be turned over to you.
3) You will receive a copy of the final report before it is handed in, so that you have the opportunity to suggest changes to the researcher, if necessary.
4) You were not forced into taking part, nor promised any form of incentive. This was a voluntary participation.
5) The collected information will be used for research purposes only.

Do you grant permission to be quoted directly: Yes_____ No ______

I agree to the terms

Respondent ____________________________ Date _____________

I agree to the terms:

Researcher ____________________________ Date _____________

Appendix H: The example of verbatim case evidence of participants

THE CASE EVIDENCE OF GRADE THREE TEACHERS

Introduction

The purpose of this chapter is to present the case evidence of participants involved in the study. The responses that are presented here are for phase one, two and three of the data collection. The responses were collected from grade 3 teachers by means of individual interviews.

Question	**1. Which approaches do teachers use when teaching mathematics computations?**
Participant	Response
TA P1	When asked which approaches do teachers use when teaching mathematics computations TA said I use whole class teaching because I have many children in my class.
TA P2	When asked which approaches do teachers use when teaching mathematics computations TA indicated that it is not possible to use group work when you have large numbers in your class. TA also mentioned that it is not all the children who understand what was taught when using whole class teaching.
TA T3	When asked which approaches do teachers use when teaching mathematics computations TA said I do not like to use group work because talkative children sometimes dominate the discussion and the shy ones do not participate.
TB P1	When asked which approaches do teachers use when teaching mathematics computations TB said I use whole class teaching although I'm aware that many children are not following what I taught them.

TB P2	When asked which approaches do teachers use when teaching mathematics computations TB indicated that group work yields positive results but she has a problem using it.
TB P3	When asked which approaches do teachers use when teaching mathematics computations TB said I use group work and it gives me a chance to give individual teaching to children who experience mathematics difficulties.
TC P1	When asked which approaches do teachers use when teaching mathematics computations TC also mentioned that group work encourages children to come up with different problem solving techniques.
TC P2	When asked which approaches do teachers use when teaching mathematics computations TC indicated that using group work helps children to work together.
TC P3	When asked which approaches do teachers use when teaching mathematics computations TC said I use group work, and I enjoy using it because I'm aware that children do not learn the same way. I know what to emphasise in each group when I teach.
TD P1	When asked which approaches do teachers use when teaching mathematics computations TD further mentioned that once children are used to working in groups, it is easy for them to work on their own.
TD P2	When asked which approaches teachers use when teaching mathematics computations TD also mentions she uses group work as it encourages team work.

TD P3	When asked which approaches do teachers use when teaching mathematics computations TD said she first uses whole class teaching when she teaches new concept and thereafter she arranges the children in groups.
TE P1	When asked which approaches do teachers use when teaching mathematics computations TE also mentioned that group work encourages children to come up with different problem solving skills.
TE P2	When asked which approaches do teachers use when teaching mathematics computations TE further said she uses group work and it gives her a chance to give individual teaching to children who experience mathematics difficulties.
TE P3	When asked which approaches do teachers use when teaching mathematics computations TE also mentioned that group work encourages children to come up with different problem solving techniques.

Question	**2. How do they resolve the mathematics computations problem?**
Participant	Response
TA P1	Asked about how do they resolve the mathematics computations problem TA indicated that they start with me in the classroom, but if you have a big group, it is not easy to give children, special attention. We use observation forms, but you must give it time, if the problem persists, we use the 450 form, and then we take it to the SBST committee. They meet on Thursdays to check how far you are in solving the problem, and then you can take them to specialists. TA further explained that representatives from all phases, the foundation phase intermediate phase, and senior phase are represented, with the principal as the coordinator. TA indicated that the principal, all HODs and one teacher from each grade forms a committee in the SBST whereby they meet on Thursdays to discuss about how best they can support children who experience difficulties in learning.
TA P2 TA P3	Asked about how they resolve the mathematics computations problem TA said In terms of strategies they had different programmes for different children. We have SBST, it is a mother body that deals with support that is needed in the school for both children and teachers. The committee deals with children who experience difficulties and not mathematics only. TA further explained that representatives from all phases, the foundation phase, intermediate phase, and senior phase are represented, with the principal as the coordinator. TA indicated that the principal, all HODs and one teacher from each grade forms a committee in the SBST whereby they meet on Thursday's to discuss about how best they can support children who experience difficulties in learning. Asked about how they resolve the mathematics computations problem TA indicated that it starts with her in the classroom, but if one has a big group, it is not easy to give individual children, special attention. We use

	observation forms, but you must give it time, if the problem persists, we use the 450 form, and then we take it to the SBST committee. They meet on Thursdays to check how far you are in solving the problem, and then you can take them to specialists. TA further explained that representatives from all phases, the foundation phase intermediate phase, and senior phase are represented, with the principal as the coordinator. TA indicated that the principal, all HODs and one teacher from each grade forms a committee in the SBST which they meets on Thursdays to discuss about how best they can support children who experience difficulties in learning.
TB P1 TB P2	Asked about how do they resolve the mathematics computations problem TB indicated that Yes they have afternoon classes for 30 minutes in supporting these children. She also indicated that a child who doesn't make any progress the children is then referred to SBST. TB also indicated that the management and one teacher from each grade form a committee in the SBST. TB further indicated that the coordinator in the SBST also gives support to these children. If all methods were used in supporting these children and still they do not show any progress then an official from the district office will be called in and all the 450s and the work that was done will given to the official. The official also gives support to these children if she/he sees that really there is no progress then the child is referred to specialists. Asked about how they resolve the mathematics computations problem TB indicated that they do have a programme for supporting children who experience Mathematics difficulties and that is conducted maybe twice during the school holidays. TE further indicated that the coordinator in the SBST also gives support to these children. If all methods are used in supporting these children and they still do not show any progress then an official from the district office will be called in and all the 450s and the work that was done will given to the official. The official also gives support

	to these children if she/he sees that really there is no progress then the child is referred. TB further indicated that the coordinator in the SBST also gives support to these children. If all methods were used in supporting these children are used still the children doesn’t show any progress then an official from the district office will be called in and all the 450s and the work that was done will given to the official. The official also gives support to these children if she/he sees that really there is no progress then the child is referred to specialists.
TB P3	Asked about how do they resolve the mathematics computations problem As I indicated before it starts with the teacher in the classroom and do support. TB also indicated that a child who doesn’t make any progress the children is then referred to SBST. TB also indicated that the management and one teacher from each grade form a committee in the SBST. TB further indicated that the coordinator in the SBST also gives support to these children. If all methods are used in supporting these children and they still do not show any progress then an official from the district office will be called in and all the 450s and the work that was done will given to the official. The official also gives support to these children if she/he sees that really there is no progress then the child is referred to specialists.
TC P1	Asked about how they resolve the mathematics computations problem TC indicated that they try to prepare learning aids / teaching aids. TC also indicated that all staff members in the Foundation Phase are part of the School Base Support Team. She indicated the inform parents that their (those who experience difficulties) they will remain behind on Tuesday, Wednesday and Thursday and the will intervention took place for 30 min. TC said that during the intervention children are given work lower than what they are doing in their grades for example they are given work that is done in Grade 1 and 2. If the SBST has tried all the intervention strategies and still the children are not showing any progress then children are

	referred to district and children are placed to ELSEN. TC advised children to rote the multiplication tables.
TC P2	Asked about how do they resolve the mathematics computations problem? TC also indicated that they keep children in the afternoon, we have intervention books. She further said that during the intervention children are given work lower than what they are doing in their grades for example they are given work that is done in Grade 1 and 2. If the SBST has tried all the intervention strategies and still the children are not showing any progress then children are referred to district and children are placed to ELSEN. TC indicated that every Tuesday and Thursday all staff members are ready to give support to children who experiences Mathematics difficulties. TC indicated that all staff members in the Foundation Phase are part of the School Base Support Team. She indicated the inform parents that their (those who experience difficulties) they will remain behind on Tuesday, Wednesday and Thursday and the will intervention took place for 30 min. TC said that during the intervention children are given work lower than what they are doing in their grades for example they are given work that is done in Grade 1 and 2. If the SBST has tried all the intervention strategies and still the children are not showing any progress then children are referred to district and children are placed to ELSEN. TC advised children to rote the multiplication tables.
TC P3	Asked about how they resolve the mathematics computations problem TC said Yes we do. We keep them in the afternoon, we have intervention books. She further said that during the intervention children are given work lower than what they are doing in their grades for example they are given work that is done in Grade 1 and 2. If the SBST has tried all the intervention strategies and still the children are not showing any progress then children are referred to district and children are placed to ELSEN. TC

	indicated that they try to prepare learning aids/ teaching aids. TC also mentioned that all staff members in the Foundation Phase are part of the School Base Support Team. She indicated the inform parents that their (those who experience difficulties) they will remain behind on Tuesday, Wednesday and Thursday and the will intervention took place for 30 min. TC said that during the intervention children are given work lower than what they are doing in their grades for example they are given work that is done in Grade 1 and 2. If the SBST has tried all the intervention strategies and still the children are not showing any progress then children are referred to district and children are placed to ELSEN. TC advised children to rote the multiplication tables. TC also said they keep children in the afternoon, and have intervention books. She further said that during the intervention children are given work lower than what they are doing in their grades for example they are given work that is done in Grade 1 and 2. If the SBST has tried all the intervention strategies and still the children are not showing any progress then children are referred to district and children are placed to ELSEN.
TD P1	Asked about how they resolve the mathematics computations problem TD indicated that the class teacher first starts to remedy / give support to the child the child by using concrete objects so that children can understand for example: she draws an empty circle and a circle with seven objects or children can also use an abacus. TD further elaborated that they first start with addition and subtraction and when children have mastered them it is then that they move to multiplication and division. If there is no progress it is then that the child is referred to the SBST. TD indicated that they have a special programme. Teachers in the SBST use concrete objects so that children can understand better.
TD P2	Asked about how they resolve the mathematics computations problem TD indicated that the class teacher first starts to remedy / give support to the child the child by using concrete objects so that children can understand

	for example: she draws an empty circle and a circle with seven objects or children can also use an abacus. TD further elaborated that they first start with addition and subtraction and when children have mastered them it is then that they move to multiplication and division. If there is no progress it is then that the child is referred to the SBST. TD indicated that they have a special programme. Teachers in the SBST use concrete objects so that children can understand better. Asked about how do they resolve the mathematics computations problem? TD indicated that the class teacher first starts to remedy/ give support to the child the child by using concrete objects so that children can understand for example: she draws an empty circle and a circle with seven objects or children can also use an abacus. TD further elaborated that they first start with addition and subtraction and when children have mastered them it is then that they move to multiplication and division. If there is no progress it is then that the child is referred to the SBST. TD said Foundation Phase teachers are involved in the SBST. TD indicated that yes they do have a special programme. Teachers in the SBST use concrete objects so that children can understand better.
 TD P3	
TE P1	Asked about how they resolve the mathematics computations problem TE indicated that child's who experience Mathematics difficulties are referred the child to the School Base Support Team (SBST) whereby the team uses easier methods so that they understand what is taught. In case a child does not make any progress the child's are referred to other institution like Tshegofatsong whereby children are diagnosed so that the children can be taught some skills. TE said they have a programme which is conducted by students from the University of Pretoria. The students from University of Pretoria (Thuthukani) come three times in a week and

	they asked the teacher where the problem lies and they request the child's files and work with the children.
TE P2	Asked about how they resolve the mathematics computations problem TE indicated that they use SBST whereby children are identified, grouped and given simple tasks. She further said that SBST use simple methods in supporting these children. TE indicated that the management and one teacher from each grade form a committee in the SBST. TE said they have a programme which is conducted by students from the University of Pretoria. The students from University of Pretoria (Thuthukani) come three times in a week and they asked the teacher where the problem lies and they request the child's files and work with the children.
TE P3	Asked about how they resolve the mathematics computations problem TE indicated that child's who experience Mathematics difficulties are referred the child to the School Base Support Team (SBST) whereby the team uses easier methods so that they understand what is taught. In case a child does not make any progress the child's are referred to other institution like Tshegofatsong whereby children are diagnosed so that the children can be taught some skills. TE said the management and one teacher from each grade form a committee in the SBST. TE also indicated that they have a programme which is conducted by students from the University of Pretoria. The students from University of Pretoria (Thuthukani) come three times in a week and they asked the teacher where the problem lies and they request the child's files and work with the children.

Question	**3. How did you identify children who experience mathematics difficulties?**
Participant	Response
TA P1	TA indicated that when children are working in groups from a distance you will think that all children have mastered what was taught. When children are supposed to do/perform individual work the teacher is able to see that a particular child did not master what was taught. The teacher then supports the particular child by using different strategies. Even if these children are given Grade 1 tasks, they are still unable to perform them.
TA P2	Asked how she identifies children who experience Mathematics difficulties TA said: In our classes, I would say, we have a specific way of identifying children who experience Mathematics problems. Every teacher uses her own way to do the identification. The DoE gave us Assessment tasks and Assessment standards which we use as a baseline where you look at your children's cognitive development.
TA P3	Asked how she identifies children who experience Mathematics difficulties, TA indicated that at the beginning of the year of all children who experience Mathematics/learning difficulties' support forms observation books are given to the next grade teacher, whereby the previous teacher indicates the following information: - date and what she observed in the child - why she thinks that it's a problem - when she observes that the problem persists she puts that in the 450 form and took the matter to the HOD and the matter will be forwarded to the district officials who deal with intervention. TA further indicated that some children have difficulty in confusing 21 and 12, 82 and 28 when see this in Grade 3 it tells you that the child has a problem. After the matter has been forwarded to district officials and there

	is no support that they can provide to the children, they refer the child to specialists for example a psychologist or eye specialist. TA indicated that that is usually the end of the child's future as parents are not working and cannot afford to pay for specialists. TA further indicated that when children are working in groups from a distance you will think that all children have mastered what was taught. When children are supposed to do/perform individual work it is when the teacher can see that this child did not master what was taught. It is where the teacher supports the particular child by using different strategies. Even if these children are given Grade 1 tasks they are still unable to perform them.
TB P1 TB P2 TB P3	Asked how she identifies children who experience mathematics difficulties, TB indicated that it is the child's work that tells you for example: if you have five counters, how many 2s do we have in 5. Then the child will count one, then one and so on instead of grouping the number of twos in five. Asked how she identifies children who experience mathematics difficulties. TB said: she always starts a mathematics lesson with oral work. TB further indicated that she goes around with the aim of seeing that all children are taking part. It is then that she notices that a particular child cannot count. Asked how she identifies children who experience mathematics difficulties, TB indicated that it is the child's work that tells you for example: count five counter for me and how many 2s do we have in 5. Then the child will count one, then one and so on instead of grouping the number of twos in five.
TC P1	Asked how she identifies children who experience Mathematics difficulties, TC indicated she identifies them through their written work after teaching a new lesson. After that lesson children are given tasks to perform. That is where you pickup children who experience Mathematics

	difficulties.
TC P2	Asked how she identifies children who experience Mathematics difficulties, TC said: she (TC) does a lot of activities and as she goes around she identifies the children who encounter problems. TC further indicated that through the child's written work, she identifies if a child has a problem. TC also mentioned that during the oral work TC can realise if a specific child has a problem.
TC P3	Asked how she identifies children who experience Mathematics difficulties, TC indicated she identifies them through their written work after teaching a new lesson. After that lesson children are given tasks to perform. That is where you pickup children who experience Mathematics difficulties.
TD P1	Asked how she identifies children who experience Mathematics difficulties, TD indicated that: When children are working in groups from a distance you will think that all children have mastered what was taught. When children are supposed to perform individual work it is where the teacher can see that the child did not master what was taught. Then the teacher supports the particular child by using different strategies. Even if these children are given Grade 1 tasks, they are still unable to perform them. TD indicated that: every week she gives her children a test. After assessing the children she can see children who experience Mathematics difficulties, and then those children are referred to the SBST.
TD P2	Asked how she identifies children who experience mathematics difficulties, TD indicated that: Every week she assesses her children by giving them a test. Through the outcomes of the test she can see the children who experience difficulties to Mathematics and then she refers those children to SBST.

TD P3	Asked how she identifies children who experience mathematics difficulties, TD indicated that: When children are working in groups from a distance you will think that all children have mastered what was taught. When children are suppose to do/perform individual work it is where the teacher can see that this child did not master what was taught. It is where the teacher supports the particular child by using different strategies. Even if these children are given Grade 1 tasks they still unable to perform them. TD also indicated that: every week she gives her children a test. After assessing the children she can see children who experience Mathematics difficulties, and then those children are referred to the SBST.
TE P1 TE P2 TE	Asked how she identifies children who experience Mathematics difficulties. TE indicated that these children normally do not understand instructions even if you can give them concrete tasks (see example below). Children don't understand even if you can give them concrete objects e.g. ^ ^ ^ ^ + ^ ^ ^ ^= Children who experience Mathematics difficulties are unable to give answer/solve the above given example. TE further indicated that for brighter children she gives challenging tasks and the slower ones simpler/easier tasks. TE said TE further mentioned that every Friday children are assessed through the writing of a test. Asked how she identifies children who experience Mathematics difficulties TE said: Whenever we do class work, we can see children who have problems. Every Friday children are also assessed through using a test method. TE also mentioned that through the outcomes from the test she is able to see which children are not taking part. TE further said even if you ask the child a personal question the child does not understand what you are talking about. Asked how she identifies children who experience Mathematics

P3	difficulties. TE indicated that these children normally do not understand instruction even if you can give them concrete tasks (see below example). Children don’t understand even if you show them concrete objects e.g. ^ ^ ^ ^ + ^ ^ ^ ^= Children who experience Mathematics difficulties are unable to give answers/solve the above problem. TE further indicated that for brighter children she gives challenging tasks and the slower ones she gives simpler/easier tasks. TE also said: whenever she does classwork she assesses them and it is where she notices the children who are experiencing problems in Mathematics. TE further mentioned that every Friday children are assessed through the writing of a test.

Question	**4. Which aspects of mathematics were most problematic?**
Participant	Response
TA P1	TA indicated that aspects that were most problematic vary from one school to the other and from one person to the other. Now with the situation here in SA, we are in an under developed environment, we have children from different backgrounds and there is a problem of language. In terms of the concept and content, the problem is mathematical terminology, for example the term “tessellation” must be translated into different languages.
TA P2	When asked about aspects of mathematics which were most problematic TA said: mathematics in Grade 3 is not much of a challenge, but the problem is the numerical concepts. TA said: language is a main problem, as children need to understand concepts in English. We are supposed to teach the children in their mother tongue. There is difference in mother tongue and home language, now you have to teach children in their mother tongue, the children have different home language and the concepts are written in English. TA further indicated the challenge they are faced with as teachers are how they deal with the concepts not the

	content. It is not easy to translate the concept to the level that the children would understand. The syllabus is there, the plans are there, how do I teach for example measurement there are a lot of aspects e.g. capacity, tessellation.
TA P3	When asked about aspects of mathematics which were most problematic TA said Word problems are also a challenge. Operators as well are a problem. Number confusion, for example 12 and 21. TA further said that the DoE expects Foundation Phase teachers to teach children in their mother tongue, TA said: this sounds easy but it is not real for example, If TA teaches “hlakantsha” (meaning the addition sign) only children who are Tswana speaking will be able to understand what about children who speak other African languages? The worst part will be children who are from outside the borders of South Africa.
TB P1	When asked about which aspects of mathematics were most problematic TB said: Grade 3 children seem to know how to count when they count in groups but when they count individually it is where you see that they are unable to count, for example, if you ask children which number comes before 99 they will say 190. Go and write 99 the child will write 1199 this shows that the children are not focused and they don’t understand. TB said: language can be a contributing factor, some of the children do not understand the language you are speaking. Because here the LoLT is isiZulu, unless if you change the LoLT, and speak in English.
TB P2	When asked about aspects of mathematics that were most problematic? TB said: Yes during those days it was easier as children started school (Grade 1) at the correct age i.e. 7 years. Of late children start school at age six, as a result children are not able to cope the work is too much for them. TB further indicated that the children are unable to read, add, cannot do phonic by not doing phonic children are unable to build and

	write words. Children are unable to perform basic operations (addition, subtraction, multiplication and division). When I (TB) do the tasks with them on one to one basis the children shows that they follow but: When children go back to their desks they just write what they think. I don't know whether children cannot concentrate or not. TB also mentioned that In their school there are children who are from different ethnic groups for example: Tsongas, Zulus, Swazis, and some are from African countries, whereas the school is predominantly Zulu speaking. TB indicated that although her class contained children from different cultural groups her children are able to communicate and answer when asked questions. Parents are not concerned with their children's education.
TB P3	When asked about aspects of mathematics that were most problematic TB said Grade 3 children seem to know how to count when they count in group but when they count individually it is where you see that they are unable to count for example: if you ask them which number comes before 99 they will say 190. Go and write 99 the child will write 1199 this shows that the children are not focused and they don't understand. TB also said: language is the contributing factor, some of the children do not understand the language you are speaking. Because here the LoLT is isiZulu, unless if you change the LoLT, and speak in English.
TC P1 TC P2	When asked about aspects of mathematics that were most problematic TC said children are unable to understand the concept of time, shapes, multiplication tables, children are unable to count backward and forward due to language barrier. TC also mentioned that the authors also use a language that creates difficulties to the children. The LoLT of the school is N.Sotho and many children who are admitted to the school are Zulus, Tsongas, and township language for an example when teaching money children will talk of "two bob" (meaning twenty cents) and some are from

	African countries. As they are expected to teach in the child’s mother tongue this become a barrier on her side as a teacher. TC further indicated that it is a challenge for her as the books are written in English and she should translate that to N Sotho which becomes more problematic in reading numbers in N.Sotho for example: “tee”, “pedi”, “tharo” instead of: one, two, three in English particularly to those children who are not N Sotho speakers. TC also said: children who did not attend preschool find it difficult to cope. TC said also mentioned that language also contributes to children’s problems as they speak different languages. When asked about aspects of mathematics that were most problematic TC said children do not understand the concept time, shapes, multiplication tables, children are unable to count backward and forward due to the language barrier. The authors of the books used also use a language that creates difficulties to the children. The LoLT of the school is N.Sotho and many children who are admitted to the school are Zulus, Tsongas, and township language for an example when teaching money children will talk of “two bob” meaning twenty cents and some are from African countries. As they are expected to teach in the child’s mother tongue this becomes a barrier on her side as a teacher. TC indicated that it is a challenge for her as the books are written in English and she should translate that to N Sotho which becomes more problematic in reading numbers in N.Sotho for example: “tee”, “pedi”, “tharo” instead of: one, two, three in English particularly to those children who are not N Sotho speakers. Also children who did not attend preschool find it difficult to cope. TC also said the problem encountered mostly is language i.e. more especially when teaching using English. The shapes, number line, money, division and multiplication are most problematic. Children cannot memorise the multiplication tables for example seswai ga sewai (meaning 8x8) TC further indicated that if children cannot read the children cannot write
TC P3	

	as a result children would not be able to read word sums. TC also said that this time of the year third term (15 August 2011) there is a little light among her children. TC also shared with me about a child in her class who is from a Zulu family as the LoLT of the school is N. Sotho. When the child is given tasks to perform in N. Sotho the child does not write but when the tasks are given in English the child is able to write. The child is also unable to read N.Sotho books as a result the child cannot get assistance from home as parents speak only Isizulu.
TD P1	When asked about aspects of mathematics that were most problematic Children are unable to understand the concept of time, shapes, multiplication tables, children are unable to count backward and forward due to the language barrier. The book also uses a language that creates difficulties to the children. The LoLT of the school is N.Sotho and many children who are admitted to the school are Zulus, Tsongas, and township language for an example when teaching money children will talk of “two bob” (meaning twenty cents) and some are from African countries. As they are expected to teach in the child’s mother tongue this becomes a barrier on her side as a teacher.
TD P2	When asked about aspects of mathematics that were most problematic TD further indicated that it is a challenge for her as the books are written in English and she should translate that to N Sotho which becomes more problematic in reading numbers in N.Sotho for example: tee, pedi, tharo instead of: one, two, three in English particularly to those children who are not N Sotho’s speakers. TD also said: children who did not attend preschool they find it difficult to cope.
TD P3	When asked about aspects of mathematics that were most problematic? TD said subtraction pose challenge to the Grade 3 child, she does not know whether the children are lazy or not, TD gave an example like

	20 – 7= 27 TD indicated that children formulate their own rule by adding 0+7 instead of borrowing from the tens. TD further said the problem is that children are too lazy, they don’t want to count they just guess the answers when you ask them for example 2 x 2 they will tell you that the answer is 4. TD also said that before she gives children tasks to perform she first explains. If you give them activities on addition children get them right but if you include addition and subtraction children mix up/ confuses the operations. TD further said that children copy wrong activities from the chalkboard (they are unable to copy). When asked about aspects of mathematics that were most problematic TD said subtraction poses challenges to the Grade 3 child, she does not know whether the children are lazy or not. TD gave an example like 50 – 7= 57 TD indicated that children formulate their own rule by subtracting seven minus zero instead of borrowing one ten from the tens. TD further said the problem is that children are too lazy they don’t want to count they just guess the answers. When you ask them for example 2 x 2 they will tell you that the answer is 4. TD also said that before she gives children tasks to perform she first explains. If you give them activities on addition children get them right but if you include addition and subtraction children mix up/ confuses the operations. TD further said that children copy wrong activities from the chalkboard (they are unable to copy).

TE P1	When asked about aspects of mathematics that were most problematic TE said that number sentences and pyramid as children are unable to read and does not understand the concept of reading. However most of the things like addition, subtraction children do understands. She indicated that language poses challenges among the children. Usually the books are written in English and the DoE expect Grade 3 teachers to teach children using the LoLT of the school (N.Sotho) it poses challenges to teachers as they do not know some concepts in N.Sotho for example “pyramid” they end up using the term in English. TE further said language poses challenges in the teaching of mathematics as most of the children are unable to read and reading is a big problem in the schools. If children can get the sounds correctly, later to words and lastly sentences. There are children who are from different ethnic groups among others Tsongas, Zulus, Swazi’s, whereas the school is predominantly N.Sotho speaking. TE indicated that as children are unable to read. They (teachers) read for the children so that children can understand what is expected of them.
TE P2	When asked about aspects of mathematics that were most problematic TE mentioned that number sentences and the concept pyramid as children are unable to read and do not understand the concept. However most of the things like addition, subtraction children do understands. She indicated that language pose challenge among the children. Usually the books are written in English and the DoE expect Grade 3 teachers to teach children using the LoLT of the school (N.Sotho) it pose challenge to teachers as they do not know some concepts in N.Sotho for example pyramid they end up using the term in English. TE further said language poses challenges in the teaching of mathematics as most of the children are unable to read and reading is a big problem in the schools. If children can get the sounds correctly, later to words and lastly sentences. There are children who are from different ethnic groups among others Tsongas,

	Zulus, Swazis, whereas the school is predominantly N.Sotho speaking. TE indicated that as children are unable to read. They (teachers) read for the children so that children can understand what is expected of them.
TE P3	When asked about aspects of mathematics that were most problematic TE said that number sentences and pyramid as children are unable to read and does not understand the concept of reading. However most of the things like addition, subtraction children do understand. She indicated that language pose challenge among the children. Usually the books are written in English and the DoE expect Grade 3 teachers to teach children using the LoLT of the school (N.Sotho) it pose challenge to teachers as they do not know some concepts in N.Sotho for example pyramid they end up using the term in English. TE further said language pose challenge in the teaching of mathematics as most of the children are unable to read and reading is a big problem in the schools. If children can get the sounds correctly, later to words and lastly sentences. There are children who are from different ethnic groups among others for example: Tsongas, Zulus, Swazis, whereas the school is predominantly N.Sotho speaking. TE indicated that as children are unable to read. They (teachers) they read for the children so that children can understand what is expected of them.

Question	**5. What else do they do to help children understand mathematics computations?**
Participants	Response
TA P1	Ask if what else do they do to help children understand mathematics computations? TA said I use The FFLC material provided by the department. TA also said it has helped her and she was beginning to like the FFLC. The work is already prepared for one in the files, so one has a lot of time to focus on implementing, instead of planning the work. But the problem is with the assessment. It is not clear because you have Mathematics assessment and literacy assessment. Her colleagues she claims also have the same problems. But the preparations and the tasks are good she would rate it eight out of ten. TA said: The FFLC helped her with the teaching of Mathematics. The problem was the assessment because it • is not clear as there are different sheets and records. As teachers they are confused on what and when to assess. When she discusses this with other colleagues, they also don't know what to do. • They also have enough time to fulfil their duties of teaching children rather than doing administration work. This also helps them to bring creative and interesting teaching media to the classroom. The FFLC also brings **uniformity** at all schools work at the same pace. When the DoE brings national assessment (Annual National Assessment) it would be on something that the children have done. The **campaign** is easier and enjoyable for the children. TA indicated that the content is within the children's average and now they know when to introduce a subject. FFLC takes children step by step of the problem and thus children understand better and easier. TA also mention that the FFLC is effective as it provides teachers with:

	• Lesson plans that are ready for teachers to use. • She was able to teach as the FFLC has all the preparations, hers was to get resources (less administration work) • The activities are interesting and teachers adapt them to suite their environment as long as they remain within the content. • Uniformity to all the schools • The FFLC is easier and enjoyable to the children.
TA P2	Ask if what else do they do to help children understand mathematics computations? TA said: I also use The FFL material provided by the department. TA also said: the FFLC is prescribed and you cannot change/amend anything. They have to follow it as it is. If she could have a say, she would leave out this or deal with that at a later stage. TA said FFLC worked in one way for her. The planning and the resources are there for them and they do have to think of resources to teach. She argues it saves them time in terms of preparation and a lot of paper work. No because everything is prescribed. Yes because the FFLC improved her performance and that of the child's TA said in the FFLC concepts are grouped and clearly explained in the (teachers) planning. There are lots of suggested activities. If the children do not understand they can refer and see what is expected of them.
TA P3	Ask if what else do they do to help children understand mathematics computations? TA said I use the examples used in the FFL document they are sufficient to help learners as they differ in their degree of difficulty I am beginning to like the FFLC, it has helped me, and the work is already prepared for you in the files, so you have a lot of time to focus on implementing, instead of planning the work. But the problem is with the assessment; there is a serious problem with the assessment. It is not clear; you have Mathematics assessment, literacy assessment. My

	colleagues also have the same problems. But the preparations and the tasks are good I would rate it eight out of ten. TA said the FFLC was effective however the problem is on the issue of: • **Assessment**. Assessment is not clear as there are different sheets and records. As teachers they are confused about what and when to assess. When she discusses this with colleagues, they also don't know what to do. • **Administration** as teachers they have enough time to fulfil their duties of teaching children rather than doing administration work. This also helps them to bring creative and interesting teaching media to the classroom. • **Uniformity** all schools work at the same pace. When the DoE brings national assessment (Annual National Assessment) it will be on something that the children have done. • The **campaign** is easier and enjoyable for the children.
TB P1	Ask if What else do they do to help children understand mathematics computations? TB said I try to use FFLC material provided by the department any book that I can lay my hands on as different books use different examples TB indicated that what she likes the activities in FFLC they are easy for the children as children are able to use concrete objects. The children are also able to see how they arrive at the answer rather than guessing. TB also indicated that FFLC helped her in the teaching of Mathematics as the campaign encourages her to prepare more teaching aids. TB also highlighted the importance of teaching aids for example children are encouraged to prepare the teaching aids, it captures the children's concentration. Children learn with understanding and they are interested in learning. TB further indicated that gradually the campaign has improved her mathematics teaching as a lot of children know how to add, write numbers, numbers that they are counting and can identify those numbers.

TB P2	Ask what else do they do to help children understand mathematics computations? TB said the FFLC strategy is recommended by the government for us to use as and it provides us with many examples TB also claims the campaign was effective but the problem is that the FFLC has many aspects to teach in a week. TB indicated that Mathematics is tops as children can count and write multiplication and division sums, children may struggle if the task is more difficult. TB said given time they will improve. TB said: the campaign is effective as children can now count, write, do multiplication and division sums. She further indicated that children may struggle if they are given more difficult tasks but given time children will improve. TB said not that much as the FFLC does not do one thing in a week. It would be better if for example, one taught multiplication for the whole week until most children mastered it and maybe on Friday you assess the children by giving them a test. TB also said that the problem is that in the FFLC one does not teach one thing in a week. In case the children did not master the work it is a problem as the teacher moves to a new activity.
TB P3	Ask What else do they do to help children understand mathematics computations? TB said the examples used in the FFLC document are sufficient to help learners as they differ in their degree of difficulty. The campaign was effective but the problem is that the FFLC has many aspects to teach in a week. TB indicated that Mathematics is tops as children can count and write multiplication and division sums, children may struggle if the task is more difficult. TB said given time children will improve. TB said: the campaign is effective as children can now count, write, do multiplication and division sums. She further indicated that children may struggle if they are given more difficult tasks but given time

	children will improve. TB said not that much as the FFLC does not do one thing in a week. It would be better if for example, one taught multiplication for the whole week until most children mastered it and maybe on Friday you assess the children by giving them a test. TB also said that the problem is that in the FFLC you do not teach one thing in a week. In case the children did not master the work it is a problem as the teacher moves to a new activity
TC P1 TC P2	What else do they do to help children understand mathematics computations? TC said .I use the FFL strategy that the department has provided. TC also indicated that that the FFLC is good, however, the time that they were trained in was too short (two weeks) as training was also done after school when they were tired. TC also mentioned that they got files, but did not know whether they were going or coming, the training is not enough. TC highlighted that It is effective even though it is a new thing but with time they will see the fruits perhaps in the following year. TC indicated that if the teacher is not conversant with the programme one can see herself in the child's performance. Ask what else they do to help children understand mathematics computations? .TC said I use the FFL strategy that the department has provided. TC indicated that children perform FFLC activities well and they enjoy most of them. Although some children find it difficult to cope. TC further indicated that they are implementing the programme even though they are not sure of what they are doing. They only do things that they are sure about. TC said there was a slight improvement even though some children would not make it to the next grade. Asked to elaborate about those who improved TC said 3-5 children in her class passed the common paper test Annual National Assessment (ANA) and those children had attended extra classes at the nearby German private school.

TC P3	Ask what else do they do to help children understand mathematics computations? TC. I use examples provide in the FFLC. TC further indicated that children perform well and they enjoy most of the activities. Although some children find it difficult to cope. TC further indicated that they are implementing the programme even though they are not sure of what they are doing. They only do things that they are sure about. TC said there was a slight improvement even though some children would not make it to the next grade. Asked to elaborate about those who improved TC said 3-5 children in her class passed the common paper test Annual National Assessment (ANA) and those children had attended extra classes at the nearby German private school.
TD P1 TD P2	Ask what else do they do to help children understand mathematics computations? TD said I use the FFLC strategy that the department has provided. She further said FFLC did not do much of improvement in some of her children. Some children did improve their performance as those children enjoyed working in groups and they have mastered most activities. TD said the FFLC was not effective as most children are still struggling to master mathematics. TD said the campaign was effective as she is a former High school teacher who used to teach children who understand and now I'm teaching in Foundation Phase. She has a lot from the FFLC and she is able to adapt her teaching approaches to work with younger children and she enjoys being in the Foundation Phase. Ask What else do they do to help children understand mathematics computations? TD said I use examples provide in the FFLC. The FFLC is very good as teachers attended workshops every quarter and implemented the programme to the children. TD further indicated that she likes the FFLC as in class it is not the teacher who only talks but children are hands on. TD also mentioned that children also demonstrate their understanding by writing on the chalkboard and also share ideas and work together.

TD P3	Ask What else do they do to help children understand mathematics computations? I use the FFLC because it is recommended by the department and is easy to use by the teachers. TD said the campaign did not make much improvement in the mathematics performance in some of the children. To some children it did improve the performance as those children enjoyed working in groups and they mastered most activities. TD said the campaign was effective as she is a former High school teacher who used to teach children who understood and now she is teaching in Foundation Phase. She has a lot from the FFLC and she is able to adapt her teaching approaches to work with younger children and she enjoys being in the Foundation Phase.
TE P1 TE P2	Ask What else do they do to help children understand mathematics computations? TE said .I use the FFLC strategy that the department has provided. The FFLC is a good programme, however the DoE officials did not train them properly. She claims that the teachers (teachers) were given the files to use while they were not sure what exactly to do. TE further highlighted that they were given “green books” but because it was not explained to them when, why and how to use them teachers started to use the green books. When the district official came to the school they told the teachers that the books they used were resource books and by then it was March. TE also said that what she likes about the activities in FFLC is that they were easy for the children as children were able to use concrete objects and children understand how they arrive at the answer rather than guessing. TE said: she thought it would improve the performance of the children as she has learned to use better methods that were included in the FFLC file rather than using old methods. She further indicated that, however, the DoE should ensure that the FFLC file is written according to the LoLT of the school.

TE P3	Ask What else do they do to help children understand mathematics computations? TE said I use the FFLC strategy provided by the department is very helpful in this regard that she enjoys the FFLC. The effectiveness of this campaign is that most of the children understand it as most of the things are concrete. Most of the children improved very much even, the reading has improved. The FFLC did not help her much as they were given the files without any training. TE further indicated that sometimes there is light at the end of the tunnel. TE also mentioned that there are some children who do not know how to read. She also indicated that when they are supposed to write a common paper from the DoE the examples that are in the common paper, there are no similar activities that were done by children in the FFLC. TE further mentioned that the old method should be brought back as it is a solution for children to learn better and with understanding. Ask What else do they do to help children understand mathematics computations? TE said I use the examples provided in the FFL strategy they are very helpful and easy to use. TE further indicated that the FFLC is a good programme; however the DoE officials did not train them properly. She claims that the teachers (teachers) were given the files to use while they were not sure what exactly to do. TE further highlighted that they were given green books but because it was not explained to them when, why and how to use them teachers started immediately to use the “green books”. When the district official came to the school they told the teachers that the books they used were resource books and by then it was March. TE also said that what she likes about the activities in FFLC is that they are easy for the children as children were able to use concrete objects and understand how they arrive at an answer rather than using guess work. TE said: she taught it would improve the performance of the children as she has learned to use

	better methods that were included in the FFLC file rather than using old methods. She further indicated that, however, the DoE should ensure that the FFLC file is written in the LoLT of the school.

Appendix I: Certificate for editing

CERTIFICATE

D N R LEVEY (DR)
FREELANCE LANGUAGE EDITOR AND CONSULTANT
t/a Expert English Editors CC 2007/147556/23
editsa@gmail.com
P O Box 14686, Hatfield, 0028, South Africa
***Tel.* +27 (0)12-333-5053. *Cell* +27 (0)83-384-1324. *Fax* 086-511-6439 [South Africa only]**

Member of South African Translators Institute. For bouquets or brickbats regarding quality of service please contact SATI at P O Box 1710, Rivonia, 2128. Tel. +27 (0)11 803-2681, sati@intekom.co.za.

TO WHOM IT MAY CONCERN

This is to certify that I have edited the following document for English style, language usage and consistency; it is the responsibility of the author to accept or reject the suggested changes.

Author: Ms M Machaba

Item: Dissertation on TEACHER CHALLENGES IN TEACHING OF MATHEMATICS AT FOUNDATION PHASE

Sincerely

DLevey

DAVID LEVEY
2013-02-06