AN INVESTIGATION INTO STRATEGIES FOR TEACHING
NUMERACY SKILLS IN PRIMARY SCHOOLS IN CHIPATA, ZAMBIA

BY

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A dissertation submitted to the University of Zambia in partial fulfillment of the requirement for the award of Master of Education Degree in Primary Education

THE UNIVERSITY OF ZAMBIA

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AN INVESTIGATION INTO STRATEGIES FOR TEACHING
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APPROVAL

This dissertation of Saidi Mwanamonga has been approved as partial fulfillment of the requirements for the award of the degree of Master of Education in Primary Education by the University of Zambia.

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ABSTRACT

Numeracy has been given prominence in most educational policy and curriculum documents in Zambia. There have been several interventions aimed at improving the quality of education in general and numeracy skills in particular. Nonetheless, several assessments of learning achievement over the last two decades have persistently shown poor levels of numeracy in primary schools in Zambia.

This study was conducted with the purpose of investigating strategies for teaching numeracy skills in selected primary schools in Chipata district of Eastern Zambia. The research questions were as follows: (1) what teaching strategies are used to teach numeracy skills in primary schools? (2) In what environment is numeracy taught in primary schools? (3) What are teachers’ perceptions regarding factors influencing numeracy skills among primary school pupils?

This was a qualitative research that followed a case study design, in which ‘purposeful sampling’ was used to select a sample of three schools, from which a grade four teacher was selected and ten pupils were picked each time during FGD from each school. Data was collected using interviews with teachers, lesson observations, and focus group discussions with pupils, which was analyzed manually through constant comparative method following Seidel model.

The results were that even though teachers made efforts to engage pupils through strategies like ‘question and answer’, ‘group activities’ just to mention a few, teachers predominantly used ‘teacher-centered’ strategies such as ‘demonstrations’ and ‘exposition’. Generally, the Zambian government and its co-operating partners are trying to improve the infrastructure outlook and the provision of TLA, but there is a lot needed to be done in order to inspire confidence in pupils. Lastly, among all factors influencing teaching and learning of numeracy skills is ‘language’. Again the education providers are working towards the improvement of provision of necessary books in local languages for teaching numeracy skills. The researcher is hopeful that these findings will help education providers to look into ways of enhancing the teaching of numeracy skills in primary schools. This could be done through regular school in-service activities through the already existing structures such as the INSET programs.
DEDICATION

I dedicate this work to my wife Olofu Ruth Phiri Sinasilia a source of inspiration that she was and also to my lovely daughters; Lombiwe, Phelecina and Kaluba who are always behind my advancement.
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>i</td>
</tr>
<tr>
<td>Copyright</td>
<td>i</td>
</tr>
<tr>
<td>Declaration</td>
<td>iv</td>
</tr>
<tr>
<td>Approval</td>
<td>v</td>
</tr>
<tr>
<td>Abstract</td>
<td>vi</td>
</tr>
<tr>
<td>Dedication</td>
<td>vii</td>
</tr>
<tr>
<td>Acknowledgement</td>
<td>viii</td>
</tr>
<tr>
<td>Table of content</td>
<td>ix</td>
</tr>
<tr>
<td>List of figures</td>
<td>xiii</td>
</tr>
<tr>
<td>List of tables</td>
<td>xiv</td>
</tr>
<tr>
<td>List of abbreviations</td>
<td>xv</td>
</tr>
<tr>
<td><strong>CHAPTER 1: INTRODUCTION</strong></td>
<td>1</td>
</tr>
<tr>
<td>1.0 Overview</td>
<td>1</td>
</tr>
<tr>
<td>1.1 Background</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Problem of the Statement</td>
<td>7</td>
</tr>
<tr>
<td>1.3 Purpose of the Study</td>
<td>7</td>
</tr>
<tr>
<td>1.4 Research Objective</td>
<td>7</td>
</tr>
<tr>
<td>1.5 Research Questions</td>
<td>8</td>
</tr>
<tr>
<td>1.6 Significance of the Study</td>
<td>8</td>
</tr>
<tr>
<td>1.7 Delimitation</td>
<td>8</td>
</tr>
<tr>
<td>1.8 Limitations</td>
<td>8</td>
</tr>
<tr>
<td>1.9 Definition of terms</td>
<td>9</td>
</tr>
<tr>
<td>1.10 Organization of the study</td>
<td>9</td>
</tr>
<tr>
<td><strong>CHAPTER 2: LITERATURE REVIEW</strong></td>
<td>10</td>
</tr>
<tr>
<td>2.0 Overview</td>
<td>10</td>
</tr>
<tr>
<td>2.1 Theoretical framework</td>
<td>10</td>
</tr>
<tr>
<td>2.2 Teaching based on constructivist principles</td>
<td>13</td>
</tr>
<tr>
<td>2.3 Authentic learning</td>
<td>15</td>
</tr>
<tr>
<td>2.4 Teaching numeracy in Zambia</td>
<td>16</td>
</tr>
<tr>
<td>2.5 Motivational teaching</td>
<td>16</td>
</tr>
<tr>
<td>2.6 Factors affecting numeracy skills</td>
<td>17</td>
</tr>
</tbody>
</table>
CHAPTER 3: METHODOLOGY .................................................................22
3.0 Introduction ..................................................................................22
3.1 Research Design ...........................................................................22
3.2 Target Population .........................................................................23
3.3 Sampling size ...............................................................................23
3.4 Sampling procedure ......................................................................24
3.5 Data collection methods ...............................................................25
  3.5.1 Lesson observation ...................................................................26
  3.5.2 Interviews .................................................................................27
  3.5.3 Focus group discussion ..............................................................28
3.6 Data analysis ..................................................................................28
3.7 Limitations of the methodology ......................................................32
3.8 Ethical consideration issues .............................................................32
3.9 Credibility and trustworthiness .........................................................32

CHAPTER 4: PRESENTATION OF FINDINGS ...........................................34
4.0 Introduction ....................................................................................34
  4.0.1 Information on the on the school, teachers and pupils ..................34
4.1 Strategies used to teach numeracy ......................................................37
  4.1.1 Facilitating learning .................................................................37
    4.1.1.1 Actual learning process .......................................................37
    4.1.1.2 Classroom practices ...........................................................37
    4.1.1.3 Pupils’ involvement .............................................................38
  4.1.2 Interactive learning .................................................................39
    4.1.2.1 Expository teaching ............................................................39
    4.1.2.2 Cooperative learning ..........................................................40
  4.1.3 Lesson activities .................................................................41
    4.1.3.1 Indoor games ....................................................................41
    4.1.3.2 Outdoor games ..................................................................41
    4.1.3.3 Variety of activities .............................................................41
4.2 Environment in which numeracy is taught .......................................42
  4.2.1 Learning context .................................................................43
    4.2.1.1 Classroom atmosphere .....................................................43
    4.2.1.2 Teacher/pupil interaction ....................................................44
  4.2.2 Resource constraint ...............................................................44
    4.2.2.1 Lacking TLRs ..................................................................45
    4.2.2.2 Making TLRs .................................................................45
  4.2.3 Teachers’ perception of pupils ...................................................45
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>List of figures</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1: Trend in Mean Performance in Mathematics</td>
<td>4</td>
</tr>
<tr>
<td>Figure 2: Qualitative Data Analysis model</td>
<td>29</td>
</tr>
<tr>
<td>Figure 3: Example of how theme were developed</td>
<td>31</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 1: Teaching strategies: Codes, Categories and Themes .................................................42

Table 2: Environment in which numeracy is taught in primary schools: Codes, Categories and
Themes ....................................................................................................................................46

Table 3: Teachers’ perceptions: Codes, Categories and Themes .............................................51
LIST OF ABBREVIATIONS

BESSIP- Basic Education for Sub-Sector Implementation Program
CDC - Curriculum Development Center
DEBS – District Education Board Secretary
ECZ - Examinations Council of Zambia
EFA – Education for All
ICT - Information Communication and Technology
GRZ – Government of the Republic of Zambia
MARK - Mathematical Rainbow Kit
MESVTEE – Ministry of Education, Science, Vocational Training and Early Education
MOE – Ministry of Education
SACMEQ – Southern and Eastern Africa Consortium for Monitoring Educational Quality
TLR/A- Teaching and Learning Resource (Aids)
UNZA - The University of Zambia
UPE – Universal Primary Education
ZAME – Zambia Association of Mathematics Education
ZNASR – Zambia National Assessment Survey Report
CHAPTER 1
INTRODUCTION

1.0 Overview

This chapter presents the background of the study, the statement of the problem, the purpose of the study, research objectives, research questions, and significance of the study, delimitation, limitations and operational definitions.

1.1 Background

Education is taken to comprise organized and sustained communication designed to bring about learning (UNESCO, 1976). In the world today, more than four decades after the United Nations Universal Declaration on Human Rights was adopted, it is widely accepted that all children and young people have the right to education (Kelly, 1996). The principle purpose of a school system is learners learning to think, investigate, question, reflect, discover, appreciate and achieving competency in essential skills of reading, writing and numeracy (Ministry of Education, 1992, p.27). In fact, even in colonial era education emphasis was also on the acquisition of the three skills: reading, writing and numeracy (Carmody, 1992).

Towards the turn of 21st Century, the focus of the global educational goals shifted from mere expansion or building of more schools to include concerns for quality education (Kelly, 1996). The concerns for quality in Zambia go as far back as the reforms of the 1970s. The reforms were necessary to make the education more relevant to the needs of the nation (MOE, 1977). One of the educational priorities at that time was the expansion of educational provision and the achievement of rapid output of high-level manpower. In order to implement these priorities a number of bold decisions had to be taken, among them was the structure and organization of education system. But later, there came about some problems that had given rise to a strong public concern that the quality of education was declining and that vast numbers of primary school-leavers were being eliminated from the school system without satisfactory preparation for adult life (MOE, 1977).
The world conference on Education for All in Jomtien in 1990 reinforced the global quest to make primary education not only universal but also of quality (Kelly, 1996). After the Jomtien conference, the focus of most participating governments shifted towards the raising of the quality of education, and Zambia continued with its education reforms towards addressing the issue of quality and equity in education (MOE, 1996). Equity issues included making education a right for every individual. Equity also meant enhancing the well-being and quality of life for the entire society. “The government’s role in raising the quality of education arose from its overall concern to protect the rights of individuals, promote social well-being and achieve a good quality of life for every person through all-embracing economic development” (MOE, 1996, p.3).

It is stated in the policy document, *Educating Our Future*, that the overriding educational goal for Zambia was the provision of quality education. This policy document also outlines a comprehensive national strategy on education. One of the goals for primary education is to ensure that pupils acquire “essential literacy, numeracy and communication skills” (MOE, 1996, p.30). It is also recognized in the policy document that children completing the lower and middle basic levels are not exhibiting the expected fundamental skills of reading, writing and numeracy, and yet the mastery of literacy and numeracy and the development of problem-solving skills are the essential vocational competencies needed by all pupils to maximize their life chances and to make a positive contribution to society as well as being able to make informed decisions. It is stated in Zambia’s education policy document as follows:

*A fundamental aim of the curriculum for lower and middle basic classes is to enable pupils to read and write clearly, correctly and confidently, in a Zambian language and in English, and to acquire basic numeracy and problem-solving skills. The levels of achievement to be attained should be such that those who leave school are able to function effectively in society, while those who continue in school have an adequate basis for further education* (MOE, 1996, p.34).

In the year 2000, the Ministry of Education produced the *Basic School curriculum Framework* in response to findings of the studies carried out during the latter part of the 1990s that targeted pupils in Grade 4, 5 and 6. Results of the studies showed unacceptably low levels of competencies in all subjects, particularly in the most vital areas of numeracy and literacy (MOE, 2000). This situation called for curriculum reform, in particular with emphasis on basic
numeracy and literacy and the use of more efficient pedagogical methods (MOE, 2000). Production of the *Basic School Curriculum Framework* document constituted an important step in the operationalization and implementation of “Educating Our Future”, the national policy on education. The *Basic School Curriculum Framework* document provided guidance and a set of binding regulations for teaching and learning in primary schools and to become a tool to assist teachers to put the national policy on education into practice. That is, the document was a link between policy and the subject syllabuses for Grades 1 – 7. Specifically, the purposes of the framework were to;

- define government’s aims and objectives for formal education system at lower and middle basic level and to guide teachers in translating these aims into effective teaching and learning.
- provide guidelines for teachers, head teachers, Ministry of education professional staff at national, provincial and district level, Parent-Teacher Associations and Education Board members on pedagogy, curriculum coverage and priorities.
- define the basic values of the education system and guide teachers, schools and education boards in translating these values into the teaching and learning process, including the entire school environment (MOE, 2000, p.5).

One of the most direct connections between the Basic School Curriculum Framework document and the teaching of numeracy was that the document provided a definition for *numeracy*. Numeracy was defined as the ability to:

- Understand and use numbers;
- Compute a range of numbers and performing the four basic operations of division, multiplication, addition and subtraction;
- Understand and correct use of fractions and percentages
- Apply all skills in typical everyday situations in the home, household and in commercial contexts. (MOE, 2000, p.14)

The Basic School Curriculum Framework recognized the fact that numeracy or mathematics was traditionally considered the most difficult subject by both pupils and teachers. The low levels of performance in assessment at various school levels in Zambia are consistent with the perception
that mathematics is a difficult subject to teach and to learn. Cockcroft (1982) acknowledged that “Mathematics is a difficult subject both to teach and to learn. One of the reasons why this is so, is that mathematics is a hierarchical subject”, (Cockcroft, 1982, p. 67).

To monitor progress towards attainment of educational goals stipulated in key curriculum documents, the Ministry of Education embarked on bi-annual assessment of learning achievement at the middle basic level, especially in areas of literacy and numeracy. The first of these bi-annual assessments was in 1991. The series of reports have gone under the title ‘National Assessment Survey of Learning Achievement at the Middle Basic School (Grade 5) Level’. The principal findings in successive survey reports are that the levels of learning achievement in Grade 5 were very low. Figure 1 below shows trends in the mean performance in mathematics for the surveys from 1999 to 2012

**Figure 1**: Trend in Mean Performance in Mathematics

![Trend in Mean Performance in Mathematics](image)

**Source**: MOE, (2012, p.20)

As can be seen from Figure 1, the mean performance in mathematics at the Grade 5 national assessment surveys have consistently been below 40%. According to National Assessment reports for 1999, to date, learning achievement at all levels either lower or upper primary in Zambia has consistently remained low. Kelly and Kanyika (1999) posits that “very little leaning of the type expected by society was occurring in Zambian schools” (p.8).
From the figure 1 above, mean performance in 1999 was at 34.3% but there was an increase to 35.7% in 2001. This trend continued up to 2003 when it was at 38.5%. Thereafter, stagnation was recorded between 2003 and 2006. But between 2006 and 2008 there was a minimal increase to 39.3%, then a decrease followed up to 2012.

Other than National Assessments, there has been international assessments too such as Southern and Eastern Africa Consortium for Monitoring Education Quality (SACMEQ) whose investigations indicate that “levels of learning achievement in Zambia were equally low compared to SACMEQ set minimum average mean score of 500 in both reading and mathematics”, (SACMEQ III, 2013. p.116). It is because of this status that the Ministry of Education has had programs aimed at improving numeracy. One such program was “Action to Improve English, Mathematics and Science” (AIEMS) in late 1990s which provided short courses in teaching skills for improved teaching of English, mathematics and science and also teaching materials. AIEMS project stated that:

“The initial purpose of AIEMS was to improve the quality of the teaching of primary and secondary English, Mathematics and Science in all schools in Zambia. This purpose shifted in early stages of the project to the strengthening of in-service provision in schools, more especially at the basic education level”, (MOE, 2000, p.1).

AIEMS equally laid foundation for the in-service provisions in the country; the School Based In-Service program for the term – SPRINT (World Bank 1999; Kelly & Kanyika 2000). AIEMS strengthened the existence of INSET system, and filled important gaps through its network of Provincial and District Resource Centers. The resulting demand for INSET provision spearheaded by SPRINT opened up the need for even closer support through Zonal centers (MOE, 2000)

Since the publication of the National Education Policy Document (Educating Our Future, 1996), very little has been done practically to raise the status of Numeracy and Mathematics in schools. This resulted in a number of related initiatives taking place in the area of Curriculum Development and quality of education especially in Numeracy and Mathematics. After National Assessment Report of 2001 recording Numeracy score at 28.7%, the Ministry of Education developed a Strategic Plan in 2003, with emphasis on development of relevant skills and
enhancing learning achievement by all learners, taking reference from the impact of Primary Reading Program (PRP) a similar program in Numeracy would also be required in order to “ensure a comprehensive improvement in learning achievement levels in Basic Education”, Strategic Plan 2003-2007 (p. 14). The Ministry of Education initiated the development and implementation of Mathematics Rainbow Kit (MARK) in 2004. MARK is a resource which provides support to teachers in Basic/primary schools, to help them teach Numeracy and Mathematics in a more “fun, exciting, positive, participatory and effective way. It includes ideas on methods, activities and resources, which will enhance the teaching and learning of Numeracy and Mathematics. It also gives guidance to teachers on how children should progress in Numeracy and Mathematics through the grades” (MOE, 2004, p.5). The following are the features of MARK:

- Class organization and management
- Clear progression and differentiated work according to stages/levels
- Talking walls
- Lesson and weekly routines
- Teaching Station Lessons and Independent Learning Activities
- ‘Day five’ for Revision and Remedial work
- Regular and continuous assessment and monitoring (MOE, 2004).

Another intervention relevant to the teaching of numeracy was the National In-service Training College (NISTCOL) module three that was provided for Primary Diploma by Distance Learning (PTDDL). It was noted that through this module on Numeracy, it greatly assisted in presentation of lessons with confidence. The effect of the PTDDL program included the “Improvements in teaching in groups according to the ability of children, helping pupils do exercise with the abacus, magic squares and word problems in mathematics” (PTDDL, 2005, p.45). Despite such efforts and initiatives meant to improve the teaching of numeracy in primary schools, still performance is not good enough. A lot of interventions have been done in developing policies, new curriculum framework but still learning achievements in numeracy remain unacceptably low.
1.2 Statement of the problem

Numeracy has been given prominence in most of education policy and curriculum documents (MOE, 1977; MOE 1996; MOE, 2000; MOE, 2004; MOE, 2013), but still primary school pupils performance in numeracy education has been of concern in Zambia. Further, several large scale interventions have been implemented aimed at improving the teaching of numeracy. These interventions include the AIEMS project, the Mathematics Rainbow Kit (MARK), and the Numeracy Module in the Primary Teachers’ Diploma by distance learning. However, in spite of consistent policy provisions and interventions, successive reports of learning achievement at the middle basic school level (Grade 5), pupils’ achievement levels in numeracy has remained very low (MOE,2013).

To date, changes in the mathematics curricula have been responding to changes in the political direction of the country. There has been a lack of influence from research or practitioners in the change processes. The net effect of this is that change has not been systematic and has been cosmetic. That change has been in the official documents but not percolating down to the classrooms where it has been ‘mathematics for life’ or ‘outcomes based’ (as opposed to objective based). The syllabus and the ways of teaching have essentially remained the same. The status quo has been the same for many years. The problem is that there has been no research conducted to understand what actually happens inside the numeracy classrooms. This has created a gap in our knowledge. This study, therefore, sought to investigate strategies used by teachers to teach numeracy in primary schools in Chipata district of Zambia.

1.3 Purpose of study

The purpose of this study was to investigate the strategies used by teachers to teach numeracy skills in selected primary schools in Chipata district. The interest developed upon reading of reports and statistics obtained from a number of studies regarding numeracy levels in Zambia such as Kelly and Kanyika (2000) and national assessments (2004-2013).

1.4 Research objective

The main objective of this study was to investigate the strategies being used by teachers to teach numeracy skills in primary schools and the circumstances in which numeracy is taught.
1.5 Research questions

The researcher sought to answer the following questions:

1) What teaching strategies are used to teach numeracy in primary schools?

2) In what environment is numeracy taught in primary schools?

3) What are teachers’ perceptions regarding factors influencing numeracy skills among primary school pupils?

1.6 Significance of study

The study resulted in information on the strategies used to teach numeracy in primary schools, the environment in which numeracy was taught, and teachers’ perceptions on factors influencing numeracy skills among pupils. Based on this information, teachers themselves, school managers, teacher educators and all those with a responsibility for providing continuing professional development for teachers will have a basis for action.

As stated earlier in the background, there have been several interventions aimed at improving the teaching of numeracy and yet learning achievement in numeracy in Zambia remains low. This study led to recommendations for strategies to improve numeracy skills based on teachers’ views. Therefore interventions could be designed aimed at improving the teaching of numeracy skills in accordance with what teachers themselves perceive right.

1.7 Delimitation

This study was conducted in the Eastern province of Zambia, specifically in Chipata district.

1.8 Limitations of the study

One major limitation to this study is that the findings cannot be generalized because it was done in one particular district. The other limitation is that the study was done during third term when public examinations are conducted thereby, limiting period of study in each school.
1.9 Definitions of terms

Numeracy: the ability to cope mathematically with the demands of everyday life, (DETYA, 1997)

Factors: are all conditions in a learning environment encompassing all objects, forces in and outside classroom which influence learners physically, intellectually and emotionally, (Dyson, 2004)

Authentic teaching/learning: is a practice that provides a learner to communicate an in-depth understanding of a problem/issues rather than memorizing sets of facts/rules and result in relevance beyond school, (Brown, 1998)

1.10 Organization of the study

Chapter 1 which is the introduction, presents the background to the study, statement of the problem, purpose of study, objectives, research questions raised, significance of the study, delimitations, limitations and operational definitions.

Chapter 2 highlights on the relevant related literature reviewed in line with the objective which was to investigate the strategies being used by teachers to teach numeracy skills in primary schools and the circumstances in which numeracy is taught

Chapter 3 deliberates on the methodology used in the study. It covers the research design, population, sample and sampling procedure used for gathering information on and methods for data collection and analysis, limitations of the methodology, ethical issues, credibility and time line/costs.

Chapter 4 presents the findings of the study in line with the research questions.

Chapter 5 discusses the major findings of the study with reference to the related literature.

Chapter 6 gives the conclusion of the study including summary of the findings, and recommendations for policy, practice and further research.
CHAPTER 2

LITERATURE REVIEW

2.0 Overview

This chapter on literature review endeavors to explore deeply on various perspectives of other scholars on what they have written about teaching strategies for numeracy skills. It highlights theoretical framework used in this research and it elaborates what constitute constructivism and authentic learning/teaching of numeracy. It also includes factors affecting the teaching of numeracy skills, importance of numeracy and motivational learning.

2.1 Theoretical framework

A theory of mathematics learning explains how humans from an early age learn mathematics, (Sidhu, 2006). One such theory is Jean Piaget’s theory of cognitive development. Piaget’s work on children’s cognitive development, specifically with quantitative concepts, has garnered much attention within the field of education. One contribution of Piaget’s theory is the understanding of the developmental stages of children’s cognition, (Hawkings, 2005). His work on children’s quantitative development has provided mathematics educators with crucial insights into how children learn mathematical concepts and ideas. According to this theory, a person’s knowledge is constructed by him/herself in the setting of some environment. It is believed that to gain knowledge of any kind, human beings go through mainly four stages of cognitive development: sensorimotor stage (0-2 years), pre-operational stage (2-7 years), concrete operational stage (7-11 years), and formal operational stage (11 years and beyond), (Hawkings, 2005). Piaget observed that individuals gain mathematical knowledge by means of two psychological processes, assimilation and accommodation. Assimilation comes into play when relating new information to pre-existing structures, while accommodation implies modifying these structures to cope with new information, (Hawkings, 2005). Hence, a general theory of learning which is applicable to learning mathematics because it encourages ‘building blocks’ approach and teaching from known to unknown.

Regarding the stages of cognitive development, at sensorimotor stage, an infant’s mental and cognitive attributes develop from birth until the appearance of language. This stage is
characterized by progressive acquisition of object permanence in which the child becomes able to find objects after they have been displaced, even if the objects have been taken out of his field of vision. An additional characteristic of children at this stage is their ability to link numbers to objects (e.g., one dog, two cats, three pigs, four chickens) (Piaget, 1977). To develop the mathematical capability of a child at this stage, the child’s ability might be enhanced if he is allowed ample opportunity to act on the environment in unrestricted (but safe) ways in order to start building concepts (Martin, 2000). Evidence suggests that children at the sensorimotor stage have some understanding of the concepts of numbers and counting (Fuson, 1988). Educators of children in this stage of development should lay a solid mathematical foundation by providing activities that incorporate counting and thus enhance children’s conceptual development of number. For example, teachers and parents can help children count their fingers, sticks, stones, seeds, fruits and many more.

Characteristics of the second stage of cognitive development, the pre-operational stage, include an increase in language ability (with over-generalizations), symbolic thought, egocentric perspective and limited logic (Thompson, 1990). It is in fact at this stage that children should engage with problem-solving tasks that incorporate available materials such as blocks, sand and water. While the child is working with a problem, the teacher should elicit conversation from the child. The verbalization of the child, as well as his actions on the materials, gives a basis that permits the teacher to infer the mechanisms of the child’s thought processes.

The third stage, which is concrete operational stage, is characterized by remarkable cognitive growth, whereby children’s development of language and acquisition of basic skills accelerate dramatically. Children at this stage utilize their senses in order to know; they can now consider two or three dimensions simultaneously (Piaget, 1977). For example, in the liquids experiment, if the child notices the lowered level of liquid, he also notices the dish is wider, seeing both dimensions at the same time. Additionally, serialization and classification are the two logical operations that develop during this stage (Piaget, 1977) and both are essential for understanding number concepts. Serialization is the ability to order objects according to increasing or decreasing length, weight or volume. On the other hand, classification involves grouping objects on the basis of a common characteristic. According to Burns & Silber (2000) stated “hands –on
experiences and multiple ways of representing a mathematical solution can be ways of fostering the development of this concrete operations stage” (p.55).

It is at this concrete stage that a child develops language, acquisition of basic skills accelerate dramatically and the ability to use senses in order to know emerge, (Piaget, 1977). Piaget acknowledged implications for this theory too. He believed that the amount of time each child spends in each stage varies by environment (Kamii, 1982). He further posits that all learners in a class do not operate at the same level. Therefore, teachers need to understand the levels at which their learners are functioning and try to ascertain their (learners) cognitive levels in order to adjust their teaching. This is critical in that teachers provide direction for learners to discover concepts through investigation, (Piaget, 1977).

Finally, at formal operation stage, the child is capable of forming hypotheses and deducing possible consequences, allowing the child to construct his own mathematics. Furthermore, the child typically begins to develop abstract thought patterns where reasoning is executed using pure symbols without the necessity of perceptive data (Anderson, 1990). For example, the formal operational learner can solve \( x + 2x = 9 \) without having to refer to a concrete situation presented by the teacher, such as, “Tom ate a certain number of sweets. His sister ate twice as many. Together they ate nine. How many did Tom eat?” Reasoning skills within this stage refer to the mental process involved in the generalizing and evaluating of logical arguments (Anderson, 1990) and include clarification, inference, evaluation, and application.

Piaget’s ideas on how children learn make him one of the early constructivists. Constructivism is a belief in pedagogical approaches that promote ‘Active Learning’ or ‘Learning by Doing’. Constructivism is a theory of knowledge that argues that humans generate knowledge and meaning from an interaction between their experiences and their ideas. According to Piaget, learners gain (mathematical) knowledge by means of two psychological processes, assimilation and accommodation. Assimilation comes into play when relating new information to pre-existing structures; while accommodation implies modifying these structures to cope with new information. This is why in a constructivist classroom, a teacher searches for learners’ understanding of concepts and the structures opportunities for learners to refine or revise these understandings by posing contradictions, presenting new information, asking questions,
encouraging research, and/or engaging learners in inquiries designed to challenge current concept (Brooks, 1993).

Therefore, this study acknowledges the fact that primary school teachers need to recognize that there are developmental levels and each stage of development demands particular manner and processes of teaching in this case numeracy skills. The focus in this study is lower basic, where teachers require therefore, to utilize strategies that involve manipulation of real objects to enable learners at this level acquire relevant numeracy skills through ‘hands-on’ activities. This theoretical framework provides the basis for teaching strategies that can allow pupils to construct knowledge from known to unknown. It is at concrete stage that pupils’ development of language and acquisition of basic skills such as numeracy skills accelerate dramatically. So every primary school teacher must be fully cognizant of this fact, hence it demands for adequate preparations of teaching and learning resources for every lesson in order to facilitate pupils’ acquisition of much needed numeracy skills and this is only possible in a constructivist classroom environment.

2.2 Teaching based on constructivist principles

Brooks (1993) describes five principles that are needed in a constructivist classroom for effective learning and teaching to take place. These principles are:

- Teachers seek and value their learners’ points of view
- Classrooms activities challenge learners’ suppositions
- Teachers build lessons around primary concepts and “big” ideas
- Teachers pose problem of emerging relevance
- Teachers assess learners learning in the context of daily teaching (Brooks, 1993:3)

The five principles constitute a constructivist classroom which most teachers view as usual practices in teaching. The expectations for a constructivist classroom as listed above are similar to the principles that the Cockcroft Committee of Inquiry into the teaching of mathematics in England and Wales had recommended. Cockcroft (1982) posits that it was neither desirable nor
possible to have definite way of teaching mathematics. However, the Committee recommended that good mathematics teaching at all levels should include the following six elements:

- Exposition by the teacher;
- Discussion between teacher and pupils and between pupils themselves;
- Appropriate practical work;
- Consolidation and practice of fundamental skills and routines;
- Problem solving, including the application of mathematics to everyday situations; and
- Investigational work (Cockcroft, 1982: p. 71).

Considering the views of Brooks and Cockcroft complement each other in that both principles once applied in the teaching of numeracy skills would promote authentic learning. For instance while Brooks regards teachers to seek and value learners’ point of view, Cockcroft recognizes the need for a discussion between teacher and pupils and between or among pupils themselves. Also, while Brooks commends classroom activities to challenge learners’ supposition, Cockcroft offers appropriate practical work and consolidation and practice of fundamental skills and routines. These two primarily offered solutions to this study in that the most productive strategies for teaching numeracy should constitute these principles and elements for good mathematics teaching and learning to take place in our primary schools. The elements that constitute good teaching of mathematics as recommended by the Cockcroft Committee and Brooks implied authentic teaching and learning of mathematics. This is in fact in line with the theoretical framework for this study which is based on constructivism theory.
2.3 Authentic learning

Authentic learning requires the learner to communicate an in-depth understanding of a problem or issues rather than memorize sets of isolated facts and it must result in achievements that have relevance beyond school (Brown, 1998). Therefore, for authentic learning to take place in mathematics, method or style of teaching needs to be innovative. Adewuyi (2001) noted that the style of teaching employed by teachers is a potent factor in motivating learners to learn. According to Adewuyi mathematics is a subject, which is very easy to make difficult and very difficult to make easy. The perennial methods of teaching mathematics through listening, looking and learning have not been successful. If anything, it has resulted in making pupils dislike mathematics (Akinsola, 2002). Akinsola, (2002) offers the following suggestions to teachers for targeting instructions to individuals following authentic teaching:

• Focus on outcomes rather than technique.

• Make learning experiential

• Give pupils control over their own learning

• Respect learners’ ability to engage in parallel thinking

• Highlight key point

• Motivate learner

• Provide challenges

These suggestions to teachers made above were in tandem with what Brooks (1993) and Cockcroft (1982) stated that for a good teaching of mathematics to occur, such are the conditions satisfying authentic learning. In all these conditions, a learner has been put on the centre of the activities for learning to take place. The demand is that learners must be actively engaged and active. Therefore, these suggestions might not be possible using a single instructional strategy, process or style of teaching. So a combination of strategies might be required. However, use of multiple strategies of teaching at primary school level in Zambia does not seem to be a regular feature of classroom practice, (Kelly, 1996).
2.4 Teaching numeracy in Zambia

With respect to teaching in Zambia, the official school going age in Zambia is seven years. This means that at Grade 4, the school level of interest in this study, the majority of pupils will be between 10 and 11 years old. According to Piaget’s stages of cognitive development, the pupils will be at the concrete operations stage. Therefore, the activities expected in a mathematics class at this level are hands-on through the use of learning aids. These activities provide learners an avenue to make abstract ideas concrete, allowing them to get their hands on mathematical ideas and concepts as useful tools for solving problems. Because concrete experiences are needed, teachers might use manipulative tools with their learners to explore concepts such as place value and arithmetical operations. Existing manipulative materials include: pattern blocks, algebra tiles, cubes, geo-boards, droughts, counters, dice and spinners. Even using games like: Touch, Pada, Chidunu, and many more. However, teachers can also use convenient materials in activities such as paper folding and cutting, wire folding and cutting as they make wire-cars. As learners use the materials, they acquire experiences that help lay the foundation for more advanced mathematical thinking. Furthermore, learners’ use of materials helps to build their mathematical confidence by giving them a way to test and confirm their reasoning. This approach in teaching has been utilized and investigated elsewhere but not in Zambia.

2.5 Classroom Environment

A study to investigate the effect of simulation-games environment on students’ achievement in attitudes to mathematics revealed that pupils’ poor academic achievement in mathematics was partly due to the method of teaching used, (Akinsola, 2002). But it also, revealed that, the use of simulation-games environment led to improved achievement and positive attitude towards mathematics. This study substantiated that teachers’ use of stimulating teaching methods does go a long way in sustaining and motivating pupils’ interest in learning mathematics (Akinsola, 2002). Unlike in Zambian primary schools, teachers seemingly do not value much simulation-games environment. This is evident from the amount allocated to numeracy of 30 minutes a period, (MOE, 2013). As a result teachers are always in a hurry to accomplish the planned work in accordance with the syllabus, thereby not giving any slight chance for pupils in lower grades to play, manipulate with real objects satisfactorily.
Research in mathematics education shows the difficulties pupils have in acquisition of mathematical concepts. Various studies have shown that an instructional strategy is crucial to the understanding of mathematical concepts, (Akinsola, 1997). Effective instruction requires the teacher to step outside the realm of personal experience into the world of the learners (Brown, 1997 as cited in Ball, 2008). It is the learners who must be engaged for learning to occur, the learner is the one who must make the commitment to learn. In fact, Neumann (2003) pointed out that for learning to be meaningful (authentic) it must be individually constructed. This is possible because learning takes place as pupil process, interpret and negotiate the meaning of new information. This is heavily influenced by the prior knowledge, values, expectations, reward and sanctions that shape the learning environment, (Brown, 1998). This is the core of this study that teachers need to consider several factors in order to develop appropriate teaching strategies for numeracy skills. And this is possible if all primary school teachers would prepare adequately for every lesson in numeracy, unfortunately they heavily depend on text books with little effort applied to satisfy constructivist teaching.

Since the 1990s national-wide surveys have indicated unsatisfactory learning results in numeracy among primary school children in Zambia (e.g. Kelly, 1991; Kelly and Kanyika, 2000; MOE, 2001; 2003; 2006; 2008). The National Assessment of Learning Achievement at Middle Basic School level concluded in the report (Kelly and Kanyika, 2001) that in terms of education, Zambia was a nation at risk – very little education of the type society expects was taking place in our schools. Hence, the paradigms shift in the current Zambian Education Curriculum.

2.6 Factors affecting numeracy skills

Previously, through Basic Education Sub –Sector Implementation Program (BESSIP) which was undertaken between 1999 and 2002, intended to address among other issues the access and quality of education by providing teaching resources, curricular reform, training of teachers, and reforming education management and administration through decentralization of the system. This was done with a view of improving learning achievement especially in mathematics, (MOE, 2002, p. 37) but unfortunately very little, if any change, did take place to improve on factors affecting the teaching of numeracy skills in this country.

Regarding factors affecting numeracy skills, they range from environment outside and inside classroom. In fact, factors affecting numeracy include learning environment that encompass all the objects, forces and conditions in and outside classroom which influence the pupils physically, intellectually and emotionally, (OECD, 2014). In this case, factors of child’s home and school background to include parental occupation, parental level of education, family size and availability of learning resources in class and classroom atmosphere, (MOE, 2012).

According to Bishop (2006), environment is referred to as the sum of all conditions an organism is exposed to and therefore which influence the organism in particular direction. As human beings, we operate in an environment and are influenced or shaped by it. This is why the location of a school and classroom layout greatly affects the behaviors of all those in it. The learning environment should be dedicated to promoting feelings of well-being in both the teacher and the learner, thereby promoting the motivation and focus to acquire numeracy skills.

The teaching and learning environment which obtains at a school greatly influences learners’ well-being as well as their academic performance in class. There are school, classroom and teacher factors which play a vital role in shaping the teaching and learning environment. The classroom factors involve conditions that constitute climate or atmosphere which prevail inside the classroom as well as outside the classroom vis-à-vis the pedagogy of numeracy skills. School factors include conditions which obtain at a school in relation to teaching and learning such as staffing levels, the physical infrastructure of a school, the availability of text books as well as the leadership quality at a school. According to Dyson, Farrell, Polat and Hutcheson (2004) ‘the building inspires the people inside it’. Pleasing surroundings lead to better attendance, improved concentration and to a healthy dose of motivation and self-esteem in the acquisition of numeracy skills, even though, learning environments are complex.
Other factors include safe and an orderly environment, strong leadership, high expectation for pupils achievement, uninterrupted time devoted to numeracy instruction, assessing learner progress and providing guidance and good class management. The number of teachers at a school as well as their qualifications, also impact on learners’ numeracy skills acquisition. The physical infrastructure of a school in terms of the state of the school buildings availability and none availability of a library are seen as environmental factors that impact on learners’ numeracy acquisition.

In summary, Dyson et al (2004) expounds that learning oriented ambiance and other fine facilities in numeracy classroom, play an important role in making numeracy learning easier and interesting. Many experts have associated learners’ responsiveness to physical conditions of a numeracy classroom and its surrounding environment. It is said that an excellent classroom is a “home away from home” for the teacher and learners (Dyson et al, 2004). This implies that making a numeracy classroom attractive, friendly and functional, thereby considering grade/age level appropriateness, the type of classroom activities to be implemented, including physical aspects such as room arrangements, availability of furniture, notice boards and general classroom atmosphere. A suitable numeracy classroom environment indeed brings great comfort for learners, making learners more interested in their lessons (Dyson et al, 2004). These are factors that should be incorporated into strategies used to teach numeracy in primary schools.

2.7 Importance of numeracy

When ‘numeracy’ first officially entered the English language as an important element of education, it had a broad meaning of ‘scientific literacy’ (DfES, 1959). However by 1976, ‘numeracy’ was understood to mean the ability to employ number skills and concepts in real-life contexts (Bishop, 2006). More recently, there is no longer any clear distinction between numeracy and mathematics at primary school level (Good & Brophy, 1997). But, the National Numeracy Strategy of England shifted the interpretation to emphasize competence at abstract number skills and relations, to include data handling and measurement (DfES, 1998). Meanwhile there is now a growing appreciation of the socio-cultural nature of numeracy practices in homes and workplaces which differ substantially from school-taught methods (Good & Brophy, 1997). The term “numeracy” is used in the adult education community to include an array of mathematically related proficiencies that are evident in adults’ lives and worthy of attention in
adult education settings (Thompson, 1990). All in all, numeracy comprises the knowledge, skills and understanding necessary to move around in the world of numbers with confidence.

Universalization of schooling has important implications for the mathematics curriculum. Mathematics being a compulsory subject of study in India (Indian National Council of Educational Research and Training (2006) access to quality mathematics education is every child’s right. Polya (1998) stated that among the aims for school education, there is a good and narrow aim, that of turning out employable adults who contribute to social and economic development through mathematics. The Indian National Council of Educational Research and Training (2006), posits that mathematics education for every child must be affordable and enjoyable. In the words of Goos, (2012), it is “more useful to know how to mathematize than to know a lot of mathematics”.

In 1997, the National Numeracy Benchmarks Taskforce in Australia, defined numeracy as the effective use of mathematics to meet the general demands of life at home, in paid work, and for participation in community and civic life. In some cases, they linked numeracy with a capacity for critical thinking and/or effective communication: Numeracy involves abilities which include interpreting, applying and communicating mathematical information in commonly encountered situations to enable full, critical and effective participation in a wide range of life roles (Queensland Department of Education, 1994, cited in Department of Education Training and Youth Affairs, 1997). Numeracy is an ability to cope mathematically with the demands of everyday life. Numerate and literate persons in mathematics are those who can appropriate mathematics as a tool to guide their reasoning, help them to solve problems in their everyday lives, communicate and justify their ideas, as well as to understand the ideas of others (Australian Research Curriculum Frameworks, 1996, cited in DETYA, 1997). In school education, numeracy is a fundamental component of learning, performance, discourse and critique across all areas of the curriculum. It involves the disposition to use, in context, a combination of: underpinning mathematical concepts and skills from across the discipline (numerical, spatial, graphical, statistical and algebraic); mathematical thinking and strategies; general thinking skills; and a grounded appreciation of context (DETYA, 1997, p.15).

According to DETYA (2000), “Numeracy like literacy provides key enabling skills for individuals to participate successfully in schooling. Furthermore, numeracy equips students for
life beyond school in providing access to further study or training, to personal pursuits, and to participation in the world of work and in the wider community”. It is from this understanding that I regard numeracy to comprise the knowledge, skills and understanding necessary to move around in the world of numbers with confidence. This is so because a numerate person is one who does not necessarily follow standard procedures when solving a mathematical problem. He/she uses non-formal methods and mental arithmetic. Goos, (2012), in his definitions recognized that mathematics and numeracy are related but are not synonymous. Mathematics is abstract and context-free, unlike numeracy. It does not so much lead upwards in an ascending pursuit of abstraction as it moves outward and ever richer engagement with life’s diverse contexts and situations.

Poor numeracy affects individuals’ ability to succeed in the workplace and acts as a brake on the country’s economic growth. Improving the national skills quota (from basic skills, including numeracy and literacy, to higher skills, such as engineering) is fundamental to increasing productivity and therefore economic growth (OECD, 2014). Nevertheless, it appeared that for the individuals in England, innumeracy is a more significant handicap to employment than is illiteracy (Akinsola, 2002).

The Zambian Government designated attainment of essential numeracy as the priority target for primary mathematics education (MOE, 1996; 2000). However, it seemed that nothing was being done differently at classroom level to achieve these goals. What is lacking in the literature reviewed is a description of what actually transpires in a numeracy classroom in Zambia.

In summary, this chapter covered relevant literature related to the teaching and learning of numeracy. Firstly, it highlighted the theoretical framework which is the basis for this research, thus constructivism theory. Two schools of thought were identified these were Brooks and Cockcroft, whose principles of authentic teaching and learning were emphasized. Then the chapter further pointed out what was expected in Zambian primary schools in teaching of numeracy skills. It also covered motivational ways of teaching mathematics, as well as factors affecting numeracy skills and the importance of numeracy.
CHAPTER 3

RESEARCH METHODOLOGY

3.0 Introduction

Research methodology is the term used for the type of research one intends to do and the methods to be used. According to Kombo and Tromp (2013), research methodology can either be quantitative or qualitative pieces of work. It states the methodology and describes the methods applied in carrying out the research study. The chapter as well discusses the research design, scope of the study, study population, sample size, sampling procedure, data collection instruments, data analysis methods and ethics that were considered when carrying out the research.

3.1 Research design

According to Kombo & Tromp (2006) a research design “is the structure or plan of research. It is the ‘glue’ that holds all of the elements in a research project together. It constitutes the blueprint for the collection, measurement and analysis of data” (p.70). Creswell (2009) stated that “research designs are plans and the procedures for research that span the decisions from broad assumptions to detailed methods of data collection and analysis” (p.3). According to Patton (2015), a qualitative research design inquires into documents and interprets the meaning-making. Ritchie & Lewis (2003) highlight the following key elements of qualitative research design:

- The aim is to provide an in-depth and interpreted understanding of the social world of research participants by learning about their social and material circumstances, their experiences, perspectives and histories
- Samples are small in scale and purposively selected on the basis of salient criteria
- Data collection methods usually involve close contact between the researcher and the research participants. The methods are interactive and developmental and allow for emergent issues to be explored
• Data are very detailed, information rich and extensive

• Data analysis is open to emergent concepts and ideas and which may produce detailed description and classification,

• Output tends to focus on the interpretation of social meaning through mapping and “re-presenting” the social world of research participants (Ritchie & Lewis, 2003).

It is against this background that for this study, a case study design was used, which Kombo and Tromp (2013) define as the study of a unit in detail, in context and holistically. This was used in order to acquire an in depth understanding of strategies grade 4 teachers were using to foster numeracy skills. This required understanding not just the actions of the teachers in the classroom, but also the reasoning behind what they did or did not do and to understand learners’ reaction to what they were experiencing in the numeracy class. Detailed data were collected using a variety of data collection procedures that included interviews, lesson observation and focus group discussion over a sustained period of time.

3.2 Target population

Target population is defined as “a group that is unique and worthy of study in its own right. This can be members of any well defined class of people, events, or objects”, (Patton, 2015, p. 285). It is the population that the researcher is interested in studying. Neumann (2000) stated that it is where the researcher draws samples from. In this study the researcher collected data from teachers teaching grade 4 and grade 4 pupils themselves.

3.3 Sampling design and Sample size

There are no fixed rules for the sample size in qualitative research since there is no intention to generalize the findings, but instead, the aim is to have a deep understanding of a phenomenon. Patton (2015) said, “sample size depends on what you want to know, the purpose of inquiry, what is at stake, what will be useful, what will have credibility, and what can be done with the available time and resources” (p. 311). Ritchie & Lewis (2003) qualitative samples are usually small in size. This is so due to three factors. Firstly, if the data are properly analyzed, there will come a point where very little new evidence is obtained from each additional fieldwork unit. This is because phenomena need only to appear once to be part of the analytical map. There is
therefore a point of diminishing return where increasing the sample size no longer contributes new evidence. Secondly, statements about incidence or prevalence are not the concern of qualitative research. There is therefore no requirement to ensure that the sample is of sufficient scale to provide estimates, or to determine statistically significant discriminatory variables. Thirdly, the type of information that qualitative studies yield is rich in detail. There will be many hundreds of 'bites' of information from each unit of data collected.

In this study, the sample size was three schools selected purposively by the DEBS, such that each of these schools should be located in urban, peri-urban and rural area. And each head teacher of these selected schools purposively selected a grade 4 class and its class teacher. However, each time during FGDs, 10 grade 4 pupils were purposively selected by each class teacher with the help of the researcher. The researcher felt that picking schools form three different locations would provide enough evidence regarding the purpose of the research of investigating into strategies used to teach numeracy skills in primary schools. This is because each school is in different environment and in different society with different economic and social backgrounds, just to mention a few conditions.

### 3.4 Sampling procedure

Sampling is the procedure a researcher uses to gather people, places or things to study. Patton (2015) writes that the most appropriate procedure for qualitative study is ‘purposeful sampling’ this is so because “the logic and power of purposeful sampling lies in selecting information-rich cases for in-depth study” (p.264). Creswell (2009) stated, “The idea behind qualitative research is to purposefully select participants or sites that will best help the researcher understand the problem and the research question” (p.178). Ritchie & Lewis (2003) also stated that qualitative research uses non-probability sample for selecting the population for study. This is so because units are deliberately selected to reflect particular features of or groups within the sampled population. It is this feature that makes the sample well suited to small-scale and in-depth studies. In this study, the researcher used purposive sampling. This was to ensure that all the key constituencies of relevance to the subject matter are covered and that within each of the key criteria, some diversity is included so that the impact of the characteristics concerned can be explored, (Ritchie & Lewis, 2003).
In this study, the selection of 3 schools was done with the help of the office of Chipata District Education Board Secretary (DEBS). This office is responsible for all schools in the district as such they have data regarding performance of all schools in the district. So having been briefed by the researcher they were able to provide appropriate guidance as which schools to visit according to guidelines provided for that these schools should belong to urban, peri-urban and rural settings. This is how the 3 schools were picked for this purpose and introductory letters were provided to the researcher to present to these respective schools upon arrival. Then, the head teachers of these 3 selected schools helped the researcher to purposively select appropriate grade 4 classes and its teachers to work with. Thereafter, the researcher briefed the concerned class teachers before starting research work that after teaching some mathematics lessons, he/she would help to select 10 pupils to participate in FGDs. And indeed whenever it was time for FGDs with pupils, the class teachers selected pupils purposively, who could express themselves during FGDs. The guidelines used to select such pupils were that, must be pupils who were able to talk, argue and reason with other pupils in the discussions constructively.

3.5 Data collection methods

Patton (2015) posits that in qualitative research, collection of data is from in-depth interviews, focus group discussions, open-ended questions through direct observations in the field and analysis of documents. Creswell (2009) recognizes data collection as steps that include setting the boundaries for the study, collecting information through unstructured or semi structured observations and interviews.

In order to generate data from the teachers on teaching strategies and their perceptions on factors influencing numeracy skills among primary school pupils, un-structured and semi-structured interview guides were employed. Instrument of interviews had both features for semi-structure and structure, (Appendix B). This document was initially developed and piloted before the actual research; this is how the researcher decided to audio record each interview in order to have enough time to conceptualize the deliberations in totality. The researcher decided to use this instrument as a tool that can help to probe the participants in regard of the study. The instrument was interactive and flexible, especially that each interview was recorder it provided room to adjust to accommodate other upcoming issues.
Similar format of a guide was used to generate data from pupils selected to participate in a focus group discussion. It had guidelines mainly consisting issues such as pupils’ and teachers’ attitude, pupils home background, accessibility to textbooks and other resources, activities done, likes and dislikes and many more. The researcher found that the instrument was very friendly and flexible too. What assisted was audio recording of FGDs; the researcher had enough time to listen to the discussions away from disturbances.

Another instrument utilized was observation schedule or guide used to collect data from actual lessons. This document covered pedagogical knowledge of the teacher, conceptual understanding and problem solving, eclecticism of a teacher, lesson preparation, teachers’ and pupils’ activities, use of TLR, methods, skills development and many more. Equally, the researcher opted to record lessons which were played at a later time to listen how lessons were done, then transcribed for the sake of analysis.

3.5.1 Lesson observations

The researcher observed lessons of the participating teachers in classes they have been teaching for at least two school terms. Each of the three teachers was observed for two weeks. Creswell (2009), “Qualitative observations are those in which the researcher takes field notes on the behavior and activities of individuals at the research site” (p.181). Takeshi (2007, describes lesson observation as lesson study which is a process by which teachers at several schools work together to research teaching materials, develop teaching plans (lesson plans) and practice teaching lessons, whose focus is on the cultivation of pupils’ interest and the quality of learning. Under the observation method, the information is sought by way of investigator’s own direct observation without asking from the respondent. Secondly, the information obtained under this method relates to what is currently happening; it is not complicated by either the past behavior or future intentions or attitudes (Kothari and Gauray (2014:96). Patton (2015) stated that direct personal contact with the observations of a setting have several advantages. First, the researcher is better able to understand and capture the context within which people interact. Secondly, firsthand experience with a setting and the people in the setting allows a researcher to be open, discover oriented and inductive responses because by being on-site the observer has less need to rely on prior conceptualizations of the setting, whether those prior conceptualizations are from written documents or verbal reports. Thirdly, strength of observation fieldwork is that the
researcher has the opportunity to see things that may routinely escape awareness among the people in the setting.

In this study, a co-observer and the researcher observed mathematics lessons for each of the three teachers three times in a week, a period lasting for thirty minutes. The co-observer was co-opted into the collection of data to help the researcher not to be biased in the process, thereby making the research credible and trustworthy. In fact all lesson observations were audio recorded. This enabled the researcher to have ample time to replay several times in order to transcribe the data correctly. The interest of the researcher during the lesson observations ranged from the involvement of pupils in the lesson, the attitude for both a teacher and pupils during every lesson, pedagogical knowledge of the teacher, conceptual understanding and problem solving, eclecticism of a teacher, lesson preparation, use of TLR, methods, skills development, freedom pupils were given to think and how they were encouraged to participate in the lesson just to mention a few. The researcher used an observation check list for lesson observations. The observation checklist is in appendix A.

3.5.2 Interviews

The second means of data collection were interviews with the participating teachers. Seidman (2006) stated that in-depth interviewing is an interest in understanding the lived experience of other people and the meaning they make of that experience. In-depth interviews are not simply getting responses to questions or to evaluate but lived experience. In this case it is about teachers’ experience and pupils, meaning what they make out of the teaching and learning of numeracy skills in class. Creswell (2009) proposes to use an interview protocol to ask questions and record responses during a qualitative interview. Interview provides access to the context of people’s behavior and thereby provides a way for researchers to understand the meaning of that behavior and the meanings people attribute to their experiences and social worlds. In this study, the interviews with teachers were aimed at seeking clarification and explanation of aspects of the lesson that the researcher took note, as well as other issues related to their teaching of numeracy skills. Both semi-structured/unstructured interviews were used in this study in order to make the instruments flexible, accommodative and collect more data. This is so because the researcher interviewed teachers before and after each observed lesson. In fact, every interview was recorded
in order to have an opportunity to replay while transcribing. The sample of interview transcript is appendix B.

3.5.3 Focus group discussions

The third means of data collection was focus group discussions with pupils. Silverman (2002) wrote that a focus group comprises of 8 to 12 participants who sit together and are interviewed by a researcher in order to have collective views. Bloor (2001) as well defines Focus Group Discussion as a special approach of data collection where a pre-chosen group of research respondents is gathered with a view to discussing a set of issues from which a particular researcher gains a deeper understanding of ideas surrounding the topic under study. Many writers regard this method as an ancillary method which complements other methods in this case interviews and observations which can operate at the beginning, middle and at the end of a project. According to Neumann (2007), focus group is a special qualitative research technique in which people are informally "interviewed" in a group-discussion setting. In this case a grade four class teacher helped the researcher to select ten pupils each day after a lesson in numeracy for a discussion with the researcher on that days’ lesson. The teacher was asked to select pupils based on ability to talk and participate in the focus group discussions.

In this study 10 pupils were selected at a time after observing a lesson by the class teacher to participate in a FGD. The composition of such a group was never the same each time the FGD was conducted. This helped the researcher to have a variety of experiences and observations from pupils, thereby making the process of data collection credible. The researcher used audio recorder during FGDs with the pupils in order to capture useful information that observation and interviews would have missed out. The FGD guide is appendix C.

3.6 Data analysis

According to Kombo & Tromp (2006), “data analysis refers to examining what has been collected and making deductions and inferences”, (p.117). Creswell (2002) noted as well that “unquestionably, there is no one single way to analyze qualitative data”. It is an eclectic process in which you try to make sense of the collected information through data generating instruments, such as interview guides, focus group discussions and observation guides. Seidel (1998)
recognizes a model of qualitative data analysis that involves; noticing things, collecting things and thinking about things, as shown below:

**Figure 2: Qualitative Data Analysis model**


It is evident from the diagram that qualitative data analysis is not linear. It has the following characteristics:

- Iterative and progressive, implying that it is a cycle that keeps repeating
- Recursive, because one level can take you back to the previous one
- Holographic, in that each level contains the entire process.
This is what makes qualitative data analysis complex in nature because the process involves going back and forth, such as from codes to categories and themes then back. Patton (2015) writes that “qualitative data analysis method involves coding data, finding patterns, labeling themes and developing categories. Raw observation notes and verbatim transcripts from interviews, and focus group discussions recordings constitute the undigested complexity of reality, and as such there is need to develop some manageable classification or coding scheme. This is referred to content analysis because it involves identifying, coding, categorizing, classifying, and labeling the primary patterns in the data”. (p. 553).

The researcher utilized constant comparative method (CCM) in order to increase internal validity of the findings. This was in quest to describe and conceptualize the variety that exists within the subject under study by looking at commonalities and differences in behavior, reasons, attitudes, perspectives and so on. According to Strauss and Corbin (1998) the art of comparison has to do with creative process and with the interplay between data and researcher when gathering and analyzing data. The researcher used the following analysis procedures:

- Comparison within a single interview, single observation and single focus group discussion
- Comparison among interviews, observations and focus group discussions

The aim of internal comparison was to develop categories and to label them with the most appropriate codes. In the second comparison, the aim was to conceptualize the subject hence the use of axial codes, meaning searching for indicators and characteristics for each concept. Also, the other aim was to discover the combinations of codes that existed in the qualitative data mainly from all the available data collected through the said instruments through either audio recordings or written texts. This was made possible with the help of Seidel model.
Figure 3: Below is an example of the description of the classification and categorization of data collected:

<table>
<thead>
<tr>
<th>Observation transcripts/notes</th>
<th>Interviews transcripts/notes</th>
<th>FGD transcripts/notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>.pupils hesitant to answer questions, pupils had difficulties to comprehend in local language, Use of familiar language, Other pupils were willing to do activities, Teachers mostly demonstrated every work, Teachers provided solutions, teacher was not familiar to local language</td>
<td>.Teachers talked good of themselves, .routine teaching, teachers accepted not used to making TLR, teaching resources not provided, Teachers directing pupils, Teachers asked questions though of knowledge level mostly, Teachers acknowledged that pupils came from different background</td>
<td>.Pupils background was different, language problem, fear to ask, teacher not friendly, Other pupils were shy, Pupils acknowledged not taking part in making any TLR, Pupils played out of class activities, Pupils acknowledged not having text books</td>
</tr>
</tbody>
</table>

Classification of Codes
Low level questions, Mostly teacher was active, Pupils not/ willing to play, Variety languages used, Pupils answering

Classification of Codes
Non use of TLR, Teacher centred , No class activities, Making of TLR, Lack of text books

Classification of Codes
.poor background, Language, No freedom, Fear, Singing in class, dancing

Once all the transcripts were ready with the help of a co-researcher, the next step in the data analysis was to manually analyze and use of QDA software called Miner 32, the core content of interviews, observations and FGDs notes to determine what was significant. QDA software application assisted in data and text management that included managing codebook, which is about adding, modification, deleting, splitting, merging and virtually classification of code into categories. It also helped in text retrieval, thesaurus editing, clustering cases and codes. Through the use of dendrogram or tree diagram classification and categorization of codes into themes was simplified.

Following the above procedure, the researcher also read through each transcript a number of times and then categorized them. The researcher developed several tables with appropriate labels. It is these themes which were used to structure his presentation and discussion of results, which was supported with appropriate verbatim quotes from what the teachers and pupils said.
3.7 Limitations

The sample was of the different socio-cultural background. Time constraints of the school calendar due to other engagements of the teachers which implied less time spent than might have been ideal for a qualitative research study. For example, the researcher only managed to observe lessons for two weeks in each school which was not adequate enough. However, the researcher managed to collect relevant data under difficult circumstances.

3.8 Ethical considerations

Permission to conduct field work was sought from the University of Zambia before the researcher begun data collection. Thereafter, the researcher sought permission from the Chipata DEBS and from respective Head teachers of the selected schools. The purpose of this study was explained to each participant. Further, the participants were assured of confidentiality of all information obtained and that participation in the study was voluntary. At most care was paid to ensure that interviews ended in a manner that left respondents in a safe emotional state. Participants were informed that there was no payment for participation in the study but that their participation would contribute to knowledge of the teaching of numeracy skills. Based on this understanding, action could be taken to improve the teaching.

3.9 Credibility and trustworthiness

Creswell (2009) identified multiple strategies for making research credible. These included the following: (a) Triangulation of data sources of information; (b) Use of rich, thick description; (c) Reflectivity—meaning systematic solicitation of feedback from pupils through focus group discussion and interviews with teachers; (d) Use of peer debriefing; (e) Use of member checking; and (f) Use of external auditor, such as the supervisors to this research. In this study, the researcher used triangulation, reflexivity, peer debriefing and external audit. Triangulation was by use of three different data collection procedures namely lesson observation, interviews, and focus group discussions. Peer debriefing was by way of enlisting a co-observer and discussing with a fellow researcher conducting a similar study but at the pre-school level.

To ensure credibility and trustworthiness, the interview guides and observation schedules used in the study were first piloted. Revised instruments were then administered to selected pupils in one
school within the town ship in order to attest their usefulness and applicability. Among the changes that were effected in the revised instruments were the formats of interview and focus group guides from structured to semi structured and unstructured, as well as sample size was reduced from the initial ten schools to only three. This was meant to be manageable considering the time and distance between rural and urban schools.

This chapter discussed the introduction to research methodology, research design and target population, sampling procedure, sampling design and sample size, methods of collection of data, data analysis, validity and reliability, limitations, delimitation, and ethical considerations. It is these codes, patterns, categories and themes that generated the findings that were discussed thematically in the next chapter.
CHAPTER 4
PRESENTATION OF FINDINGS

4.0 Introduction

The focus of this chapter is to present findings that were obtained from the field using the research questions of the study. The study used a case study research design in view of the purpose to investigate the strategies for teaching numeracy in primary schools. The following were the three research questions that guided the study:

1) What teaching strategies are used to teach numeracy in primary schools?
2) In what environment is numeracy taught in primary schools?
3) What are teachers’ perceptions regarding factors influencing numeracy skills among primary school pupils?

The data were collected from interviewing and observing three grade 4 class teachers and through FGDs with grade 4 pupils from the 3 selected primary schools in Chipata district. Each of these schools, were located either in urban, peri-urban or rural area of the district.

4.0.1 Information on the schools, teachers, and pupils

The schools from which data were acquired from were coded as A, B, and C following the order of the visits from day one.

School A: This is an urban school located within Chipata town, very close to the offices of the Provincial Education Office and District Education Board Secretary. The school has a female head teacher. The school has 55 members of staff, 8 male and 47 female. All teachers in this school have upgraded qualification to primary teachers’ diploma and a few are on distance learning degree programs one of the universities such as The University of Zambia, Rusangu, St. Eugene or Zambia Open Universities.

This school has good infrastructure although classroom space is inadequate both by way of size of classrooms and number of classrooms. The school has been performing very well in Grade 7
and 9 examinations and as such, most parents send their children to this school—making it highly populated. This school has enough teaching and learning aids including information communication technologies (ICT) and its environment is very clean and sanitation facilities are very good. The school has an enrolment of 872 boys and 950 girls with four streams for all grades with minimum of 50 pupils per class. The teacher participant in the study was female in the age range of 40 to 45 years. She holds a primary school certificate and primary school diploma from National In-service Teachers College (NISTCOL) and she is currently studying with Zambia Open University. She has been teaching for over 15 years and this was her sixth year of teaching Grade 4 numeracy.

Each time the researcher had FGDs with pupils in each school the class teacher selected purposively 10 pupils composed of 5 girls and 5 boys, aged between 10 and 11 years old. These pupils had access to ICT facilities from their homes such as phones, calculators, television and computers and were all fluent in English and as such discussions were very easy to handle. These children appeared to come from above average socio-economic background and were able to consult even from their parents at homes after school. So, learning to them was not restricted to school environment alone.

**School B**: This school is located in peri urban about 20 km west of Chipata town on Great East Road. The school is grant-aided and was built more than 60 years ago and headed by a male teacher. It has 8 male and 14 female teachers whose qualifications ranged from primary school certificate to primary school diploma and a few still studying for diploma programs with Solwezi and Chipata Colleges through distance learning. The teacher participant in this study was female in the age range of 35 to 40 years. She holds a primary school certificate and currently on distance learning at Chipata College studying for primary teacher’s diploma. She had been teaching for over 10 years and this was her first year of teaching Grade 4 numeracy.

The school has relatively good infrastructure and fairly good environment with minimal standard of sanitation, although inadequate for the population around it. The school has two streams at lower primary and single stream at upper primary because it has very few classrooms. The enrolment of the school is not bad, although it is surrounded by farms and a few villages. The school enrolment is at 761 pupils; thus 430 boys and 331 girls with average of 48 pupils per class. The performance of the school in Grade 7 examinations is above average even if it has
minimal teaching and learning resources. This is so because, the church split the school into two schools, thus secondary and primary section, leaving primary section with fewer structures, thereby creating unnecessary over enrolment.

Like in School A, each time the researcher undertook FGDs with pupils the class teacher purposively selected 10 pupils of 5 girls and 5 boys. In this particular school the age of the pupils ranged between 10 to 15 years. These pupils came from humble homes with minimal access to ICT facilities such as calculators, and computers. They did not have learning resources such as text books, and whose learning was somehow restricted to school only. A few only were able to speak English otherwise the majority of them were fluent in Nyanja.

**School C:** This school is located in the remotest rural part of Chipata district about 96 km North-East away from town. The school has poor learning environment with poor sanitation and without clean drinking water. The school has 7 teachers, 3 female and 4 male out of which one is the head teacher. All teachers at this school have primary school certificates and are on distance learning diploma program at Chipata College. The teacher participant in the study was a male in the age range of 45 to 50 years. He holds a primary school certificate and currently on distance learning at Chipata College studying for primary teacher’s diploma as stated earlier. He has been teaching for 20 years and this was his fifteenth year of teaching Grade 4 numeracy.

The school has old and dilapidated infrastructure even though it has Grade 8 and 9 classes. The school has an enrolment of 260; thus 126 girls and 134 boys. About its performance, the school was relatively below average mainly because it lacked TLRs and its management was lazy-fare type may be because it is far from the DEBS office, and that it was rarely monitored by Education Standards Officers so teachers were not serious with teaching at all, this was according to the report the researcher got from DEBS office.

Equally, like the other two schools, each time the researcher wanted to have FGDs with pupils, the class teacher selected 10 pupils comprising 5 girls and 5 boys. In this particular school the average aged was 15 years. None was fluent in English but in Nyanja. These were disadvantaged children with poor background and whose learning is dependent on a teacher in school only. They walked long distances to school, had no access to any ICT facilities and not even a text book in school. The attendance in class was poor, hence the introduction of school health
nutrition (SHN) in this school by the Ministry of Education as a way to encourage pupils to attend lessons.

4.1 Strategies used to teach numeracy skills in primary schools

This is the first research question investigated strategies used to teach numeracy skills in primary schools in Chipata. This was to confirm the strategies teachers use in numeracy class in these schools. As pertaining to this research question three major themes emerged namely: Facilitating learning, Interactive learning and Lesson activities.

4.1.1 Facilitating learning

Under this theme, there were 3 sub-themes which sometimes may be referred to categories

4.1.1.1 Actual learning process

From interviews teachers had this to say:

“I always show my pupils what to do” (Teacher A)

“Sometimes I simplify things for them, by guiding them what to do” (Teacher B)

Through FGDs pupils had the following to say over this:

“Our teacher shows us how to go about everything like class activities even games she does demonstrate to us” (Pupil A)

“Ba ticha wama tithandiza kwambili poti onetsa momwe tifunikila kuchitila zonse zimene anena kuti tichite mumasamu” (The teacher is helpful very much, we are shown what to do in all the work in mathematics) (Pupil C)

4.1.1.2 Classroom practices

Research findings revealed some unique classroom practices that took place in these primary schools. Both teachers and pupils said that there was learning taking place in their classrooms.

“After giving examples, I give group work to allow pupils discuss and attempt practical activity” (Teacher A)
“I always use whole class mode of teaching because it is easy to maintain order and quicker to deliver my lesson unlike individual work” (Teacher B)

“I sometimes ask pupils to sing songs and play some games” (Teacher C)

Below are exact responses from interviews with teacher participants regarding classroom activities:

Researcher: Madam, what games are your pupils engaged in class?

Teacher A: Playing droughts and snakes and ladders.

Researcher: What outdoor games do your pupils like playing?

Teacher B: Sheep -sheep, come home and singing songs.

Researcher: When are your pupils most active?

Teacher C: During whole class and while working from the board.

In different FGDs, pupils were asked to mention some activities that took place in their mathematics lessons. The following were some activities:

“Cidunu, pada and touch” (Pupil B)

“Playing cards, snakes and ladders and drought” (Pupil A)

“Singing songs such as: finger one, finger one; Kalulu Vula Vula pa mehenga” (Pupil C)

4.1.1.3 Pupils’ involvement

From the FGDs with pupils, the following is what was said:

“We are encouraged to work from the board by our teacher” (Pupil A)

“Sometimes we are told to go and find out then the following day we come to report to the whole class” (Pupil B)

“We are engaged in group work though time is usually not enough always” (Pupil A)
“We are rarely given chance to do things in groups not even working from the board it is not allowed for a child to write on chalk board” (Pupil C)

4.1.2 Interactive learning

Under this theme there were 3 sub-themes emerged.

4.1.2.1 Expository teaching (At school C)

Teacher: mwauka bwanji kalasi (good morning class)

Pupils: tauka bwino kaya namwe (good morning to you too)

Teacher: sabata lata tima peza utali wa tebulo, mabuku anu sitelo (last week we were measuring lengths of tables, books is it n’t?)

Teacher: lelo muzaona momwe ndizapezela utali wa msinku wa ena mwa inu (today you will see how I will measure some of your heights)

Pupils: quite and listening

Teacher: iwe bwela kuno (you come here) gwila nthambo iyi pa mutu wako) hold the string on top of your head

Teacher: mwaona momwe nacitila, (have seen what I have done it)

Pupils: inde (yes)

Teacher: mukatelo nupima utali wamunzako pa ruler mwamva (after that you find the measurement using the ruler, are you clear)

Teacher: lomba, aliyense ayimilile ndi mzace ndi mupime utali wace (can you stand in pairs and measure your partners height)

Teacher: nthawi yathela, mawa tifunika tika pitilize kupimana (time is over, we will continue the following day)
4.1.2.2 Cooperative learning (At school A)

*Teacher: (entered the classroom) good morning class.*

*Pupils: good morning madam.*

*Teacher: what did we do in our previous lesson?*

*Pupil A: we were measuring things.*

*Teacher: can you list what things we measured?*

*Pupil A1: yes.*

*Teacher: go ahead listing them down please for me.*

*Pupil A2: desk tops. Our board, classroom*

*Pupils A3: even our exercise books*

*Teacher: what instrument did we use?*

Pupils: ruler, (some) shouted) a tape, others said a string, a rope

*Teacher: ok, who can come and measure the teachers table?*

(several pupils opted to do it, but the teacher choose one girl and a boy who measured one after the other.

*Teacher: what was its length?*

*Pupil: 180*

*Teacher: 180 what?*

(some pupils said) 180 centimeter

*Teacher: what was its width girl?*

*Pupil A4: almost 75 centimeter*
(teacher at this level asked pupils to measure their heights of each other using strings that was provided for)

Teacher: come in front in pairs and tell the class the height of your friend

Pupils: (came in front and gave out measurements some just said teacher he is tall others said she is short)

Teacher: why are you not giving us proper measurements?

Pupils: it was difficult using strings

Teacher: But you have rulers use them

Pupils: No our rulers are short

Teacher: (at this time she pulled out a one meter ruler and demonstrated how to use it and it was time up)

4.1.3 Lesson activities

Under this theme there were 3 sub-themes. These were mainly activities that pupils were engaged in during lessons and after lessons.

4.1.3.1 Indoor games

These were those games that were played during lessons within the classroom.

4.1.3.2 Outdoor games

These were games that pupils did from outside classroom, mostly after lessons.

4.1.3.3 Variety of activities

Under this category, pupils said they were made to dance, debate and undertook field trips.

Below is the table 1 of codes, categories and themes for this research question.
Table 1 Strategies practiced in schools: Codes, Categories and Themes.

<table>
<thead>
<tr>
<th>Code</th>
<th>Category</th>
<th>Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Being a facilitator, Being a guide, Being an instructor, Showing leadership, Allowing a teacher to get ready for the lesson</td>
<td>Actual learning process</td>
<td>Guidance in Learning</td>
</tr>
<tr>
<td>Always asking them to think hard, Persuading them to ask from friends, Working from the board</td>
<td>Classroom practices</td>
<td></td>
</tr>
<tr>
<td>Preparing minds , focusing on pupils, Attracting pupils’ attention , Seeking concentration</td>
<td>Pupils’ involvement</td>
<td></td>
</tr>
<tr>
<td>Using mostly question and answer, Lecturing. A provider of information, Using teacher exposition</td>
<td>Expository teaching</td>
<td></td>
</tr>
<tr>
<td>Using group work, Sometimes using discussion, Sometimes using practical work, Involving pupils through group work, Pupils demonstrating to fellow pupils</td>
<td>Cooperative learning</td>
<td>Interactive Learning</td>
</tr>
<tr>
<td>Using whole class activity, Working individually , Working in pair, Involving only two pupils</td>
<td>Variety of teaching practices</td>
<td></td>
</tr>
<tr>
<td>Singing songs, Computer games, Playing games i.e: drought, snakes and ladders and chiyato</td>
<td>In door games</td>
<td></td>
</tr>
<tr>
<td>Sporting games, i.e: foot ball, net ball, Social games i.e: touch, sheep sheep come home</td>
<td>Outdoor games</td>
<td></td>
</tr>
<tr>
<td>Social activities i.e: dances, Interactive activities i.e: debate, Inter group/class school quiz, Class tests/homework, Field trips</td>
<td>Variety of activities</td>
<td></td>
</tr>
</tbody>
</table>

4.2 Environment in which numeracy is taught

Both teachers and pupils were asked to describe the environment in which mathematics lessons took place. The following are the three themes that emerged.
4.2.1 Learning context

This mainly was about classroom experiences ranging from freedom provided for in class, opportunities allowed by the teachers for their pupils to do, and many more.

From FGDs pupils said the following:

“We freely talk to each other during mathematics lessons” (Pupil A)

“We are encouraged to ask questions but most of us are shy to speak in class” (Pupil B)

“Aphunzisi satilola kulankula mukalasi. Tili ndi malamulo, imodzi mwaiyo ndiyakuti, tiyenela kakhala chete mukalasi” (our teacher is strict; we are not allowed to talk to each other in class. In fact, we have classroom rules of which one of them is to remain quite in class) (Pupil C)

“In our class we have text books, manila paper and plenty of things that we use during mathematics lessons” (Pupil A)

“Our class is not attracting, but the teacher tries to hung or paste on the wall pictures and some drawings” (Pupil B)

“Ayi, kalasi yathu mulibe choti ungawerenge kapena kutchako, muli bwenku chabe”

(Our class is empty, there is nothing to read or watch) (Pupil C)

4.2.1.1 Classroom atmosphere

Below is an exact extract of responses from focus group discussion with pupils from school C.

Researcher: Are you free to discuss among yourselves in class? (kodi muma kambilanako pa imwe mweka mukalasi)

Pupils: Haa… awa a ticha salola izo (hey, this teacher does not allow that)

Researcher: How free are you with your teacher? (kodi ndinu womasukilana bwanji ndi aphunzi anu?)

Pupils: Hmm… alibe chiwesha awa a ticha.(hm.. this teacher has no familiarity)
Researcher: Kodi mumapangako chiayani mukalasi? (what do you make in class?)

Pupils: Ayi, sanatiuzepo kuti tipange. ( No we have never been asked to make anything.)

Researcher: Nanga nikakupemphani kuti mupange zili zonse mukabwelese mawa bwanji? (now would you make anything and bring the following day?)

Pupils: Inde, inde, tizabwelesa mawa. ( yes, we will bring the following day.)

Equally teachers had the following to say during interviews:

“I do allow my pupils to interact among themselves freely during mathematics lessons” (Teacher A)

“My pupils have freedom to discuss educational issues” (Teacher B)

“I have made few regulations in class in order to have control over classroom activities” (Teacher C)

4.2.1.2 Teacher / pupil interaction

From the interviews with teachers the following is what they said:

“I rarely ask my pupils to make anything in class” (Teacher C)

“Most of my pupils are still young hence I provide almost everything for them”

(Teacher A)

“They make things like counters, plastic balls” (Teacher B)

4.2.2 Resource constraint

Both teachers and pupils revealed the following:

“We do not have text books in this school” (Teacher C)

“It has been difficult to teach because the school lacks both teachers and pupils’ text books”

(Teacher B)
“The school has few computers, but at least every child has personal text books, so teaching becomes easy. (Teacher A)

The researcher observed that in one school, the teacher had to photocopy some pages of pupils’ text book from nearby school. And this situation made the teaching very difficult as alluded to by teacher B and C whose schools did not have any teachers and pupils’ text books.

4.2.2.1 Lacking TLRs

Apart from school A, other two schools did not have even teachers’ guides. Worse still with furniture in these schools was not enough as such pupils shared one desk to six pupils.

4.2.2.2 Making TLRs

Only a teacher from school A was seen engaging her pupils in making shapes, number models, pattern cards to mention a few.

4.2.3 Teachers’ perception of pupils

This theme was what teachers perceived their pupils, which included class control and management.

4.2.3.1 Pupils focus

Teacher A: I have written rules clearly spelled and pinned on the wall, outlining dos and do not, for my pupils to observe as a way of maintaining order in class.

Teacher B: I am strict with my pupils as a way of making peace in class.
### Table 2 Environment in which numeracy is taught: Codes, Categories and Themes

<table>
<thead>
<tr>
<th>Code</th>
<th>Category</th>
<th>Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pupils freely talk to me, Only few pupils can talk to me, Freedom to discuss anything educational, We are free to talk in groups</td>
<td>Classroom atmosphere</td>
<td>Learning context</td>
</tr>
<tr>
<td>Not managing to see all in each lesson, Sometimes we are assisted, It was somehow a good lesson, It was fine although with difficulties, Shared responsibilities to deserving pupils</td>
<td>Teacher/pupil and vice versa interaction</td>
<td></td>
</tr>
<tr>
<td>Difficult to find pupils text books, Do not have pupils text books, Do not have teachers’ guides. No provision of teachers’ and pupils’ books. Value for TLA is it makes teaching real, Help to consolidate concepts/ideas, Accessibility to ICTs, It was hard teaching without TLAs, Provision of reading materials;</td>
<td>Lacking TLRs</td>
<td>Resource constraints</td>
</tr>
<tr>
<td>Making of TLA may be done by the teacher, We do not make any thing in class, Rarely do pupils make anything, , Sometimes pupils make some models, Not necessary to involve pupils,, It is expensive to acquire materials, Making of TLA sometimes is done by pupils,, Some of TLA are bought by the teacher</td>
<td>Making of TLRs</td>
<td></td>
</tr>
<tr>
<td>We are not allowed to talk, discuss, interact among ourselves in class, Some of us are shyWe not given tasks that involve discussions</td>
<td>Lacking Freedom</td>
<td>Teachers’ perception of pupils</td>
</tr>
<tr>
<td>Grade 4s are young kids, They make noise, They are difficult to manage, Am close to them, Grade 4s are playful, Pupils need control, care, Made class rules for pupils to follow, Am friendly and firm</td>
<td>Pupils focus</td>
<td></td>
</tr>
</tbody>
</table>
4.3 Factors influencing numeracy skills.

Teachers were asked on what they know and feel that influences numeracy skills among primary school pupils and the following five themes emerged.

4.3.1 Teaching skills

Among many issues that the three teachers said were the following:

“My pupils are able to measure, read, count, calculate and manipulate figures without difficulties at all” (Teacher A)

“Pupils in my class not all that can count, read, calculate and measure on their own, they require my assistance always” (Teacher B)

“Only a few can add and subtract” (Teacher C)

4.3.1.1 Authentic teaching

Teacher A: I involve my pupils in group work, and marking of models.

Teacher B: well, I engage them in discussions and demonstrations

4.3.1.2 Eclecticism in teaching

Teacher A: I always combine several ways of delivering my lessons, for example I may start with demonstration, thereafter ask pupils to work in groups, then pupils’ demonstration and end with exposition.

Teacher C: I lecture with few examples then they do exercises

4.3.1.3 Numeracy skills

In FGDs, pupils reviewed that they can add, subtract, calculate, read, count and many more

4.3.1.4 Resources

As earlier stated under research question 2, apart from school A that had text books, other two schools did not have adequate teaching and learning resource
4.3.2 Variety of Languages

Teachers had the following to say:

“I have no problem with my pupils because I easily code switch from Nyanja to English and vice-versa” (Teacher A)

“I do not originate from this place so teaching in local language is a challenge” (Teacher B)

“I wish the Ministry of Education could provide both teachers and pupils’ text books” (Teacher C)

4.3.2.1 Language used in class

Pupils as well said the following:

“We are able to understand what she teaches because almost in our class we do speak English” (Pupil A)

“Tittha kubvetsa zomwe tiphunzila angakhale chizungu chitivuta chifukwa aphunzitsi athu salankhula citundu chakuno kwathu” (We are able to learn in English though it is difficult especially that our teacher does not speak our local language) (Pupil B)

4.3.2.2 Usual teaching routine

From the interviews teachers said the following regarding usual teaching:

“I start with examples one or two then group work thereafter, class exercise” (Teacher A)

“I first demonstrate by giving examples, then few pupils will solve from the board then class exercise is given to consolidate a days’ lesson” (Teacher B)

“I always give examples, then class exercise” (Teacher C)

4.3.3 Attitude and expectations

Teachers had the following to say:
“My pupils are positive and willing to learn and participate in any mathematics activities” (Teacher A)

“Only a few boys are willing to do independent work like class exercises” (Teacher B)

“Most of my pupils do not like mathematics lessons, no matter how I encourage them” (Teacher C)

4.3.3.1 Teachers attitude towards mathematics

Below is an extract of the responses from the interviews with teachers:

Researcher: How often do you allow pupils interact and have control over their own learning?

Teacher: Not with this age, once left alone they become noisy and cannot do anything productive.

Researcher: How often do you give your class independent work such as practical or investigational work?

Teacher: Again, I feel not with this age, I have not given them such work before.

Researcher: Do you allow your pupils read books?

Teacher: In this school we do not have books, even among ourselves teachers it is difficult to find books to use in our teaching.

4.3.3.2 Pupils attitude towards Mathematics

Pupils as well said the following:

“We find mathematics lessons interesting and easy because most of us have text books, bought by our parents and we are assisted from homes too” (Pupil A)

“Ife tilibe ma texti buku na makolo athu sanga kwanilise kutigulila ta” (We do not have text books and our parents cannot afford to buy at all, (Pupil B)

“Ife masamu ni kumanzele, sitiyabvela napang’ono ponse, ndiponso ma buku tilibe, ndipo ambili mwa ife tilibe cidwi mumasamu chifukwa niyolimba kambili” (Mathematics is difficult with us,
we hardly understand anything, we do not have books and most of us have no interest in the subject because it is very hard. ) (Pupil C)

4.3.4 Home background

Teachers had this to say:

“Most pupils in my class have most resources required in mathematics lesson such as text books, instruments and many others, sometimes I supplement too” (Teacher A)

“Only a few may have instruments like ruler, not text books they cannot afford at all” (Teacher B)

“It has been very difficult to teach in this class because even pupils do not have resources to use for themselves at all” (Teacher C)

4.3.4.1 Supportive families

From FGDs with pupils, the following was said:

“Sir, most of us parents are very supportive they buy us resources required at school, even helping us at home when we are given homework” (Pupil A)

“Not all of us are supported sir, only those whose parents are well to do, but in terms of homework, our siblings assist us” (Pupil B)

“Ife tinga waone kuti woti thandizila, anga khale makolo ndiwosa phunzila” (We do not have anyone to assist us, worse still most of our parents are not educated) (Pupil C)
**Table 3** Factors influencing numeracy skills: Codes, Categories and Themes,

<table>
<thead>
<tr>
<th>Code</th>
<th>Categories</th>
<th>Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiential learning Investigational work, Working in groups, Practical work, Creative learning, Allowing playtime for pupils</td>
<td>Authentic teaching</td>
<td>Teaching skills</td>
</tr>
<tr>
<td>Working independently, Pupils’ own working, Interacting among pupils, Constructing on their own, Pupils own thinking, Checking each others’ work, Connecting between lessons, Confirming their solutions, Encouraging homework</td>
<td>Eclecticism in teaching</td>
<td></td>
</tr>
<tr>
<td>Measuring skills, Reading skills, Counting skills, Calculating skills, Manipulating skills</td>
<td>Numeracy skills</td>
<td></td>
</tr>
<tr>
<td>Using teaching and learning aids, Accessing books, Lacking text books, Lacking magazines</td>
<td>Teaching/learning resources</td>
<td>Resources</td>
</tr>
<tr>
<td>Using English, Using local language, Code switching</td>
<td>Language</td>
<td>Variety of Languages</td>
</tr>
<tr>
<td>Pupils’ attitude, Pupils’ interest, Teachers’ attitude, Lacking individual commitment, Lacking inspiration</td>
<td>Teacher/pupil attitude</td>
<td>Attitudes and expectations</td>
</tr>
<tr>
<td>Motivating pupils, Being their nature, Being below average</td>
<td>Expectations</td>
<td></td>
</tr>
<tr>
<td>Supportive parents, head teacher, family, Helped at home, No assistance, Family social status, Poverty, Rich/ Poor families</td>
<td>Supportive families</td>
<td>Home backgrounds</td>
</tr>
</tbody>
</table>

This chapter dealt with ‘Presentation of Research Findings’ as obtained from the field. The next chapter presents the “Discussion of Research Findings”.  

51
CHAPTER 5
DISCUSSION OF THE FINDINGS

5.0 Introduction

This chapter discusses the research findings which were presented in Chapter Four on the investigation into strategies for teaching numeracy skills in primary schools in Chipata, Zambia. The findings are discussed according to the following three research questions of the study:

(1) What strategies are used to teach numeracy skills in primary schools?
(2) In what environment is numeracy taught in primary schools?
(3) What are teachers’ perceptions regarding factors influencing numeracy skills among primary school pupils?

The researcher undertook this study on the premise that despite the prominence given to numeracy in most educational documents, still performance of primary school pupils in numeracy skills have been of concern, (SACMEQ, 2013). According to the purpose of the study, the target groups involved were 3 grade 4 class teachers and grade 4 pupils in selected primary schools in Chipata district of Zambia.

5.1 Strategies for teaching numeracy in primary schools

It was imperative to ask teachers and pupils all about strategies used to teach and learn numeracy in these three primary schools in Chipata district so as to confirm that they are practiced in these selected primary schools. Although a lot was said by teachers and pupils in these selected schools that several teaching strategies are practiced, very little was being achieved as evidenced from surveys conducted by the Ministry of education.

5.1.1 Strategies for teaching numeracy as revealed by teachers and pupils

Facilitation of learning was among some teaching strategies mentioned by all the teachers. It was important to note that teachers had said they either guided or instructed their pupils. This would have enhanced the learning of numeracy if practiced in totality and well coordinated manner.
Facilitation is typically learner centered strategy of which it is supported by one of the documents the Ministry of Education (2004) published, that encourages the use of ‘MARK’. This resource provides support to teachers in primary schools. It helps them teach numeracy in a more fun, exciting, positive, participatory and effective manner. It includes ideas on methods, activities and resources, which would enhance the teaching and learning of numeracy skills (MOE, 2004.p5). Unfortunately, this resource is not fully implemented at all in primary schools. Teachers talked to said “it is very involving and expensive way of teaching numeracy because it demands a lot of teaching and learning aids”. So, this failure of teachers to appreciate such useful tool to use in order to improve numeracy skills need to be re-visited.

Such strategies as Brooks (1993) stated, constitute constructivist classroom practices which would be ideal to teaching and learning of numeracy skills. This is where a teacher searches for learners’ understanding of concepts and then structures opportunities for learners to refine or revise these understandings by posing contradictions, presenting new information, asking questions and encouraging inquiry. Unfortunately, despite teachers saying they guided, instructed and facilitated learning, some teachers did not encourage any of these conditions that offer independent thinking of pupils. For instance they rarely asked any open ended questions.

Most often times, teachers used question and answer, and some group work activities designed for pupils to do in pairs or groups of more than three pupils or so (OECD, 2014). These methods to the contrary, they do less in enhancing individual development of potentialities. Though both teachers and pupils said that there was an engagement of some sort through group discussions, group work, not much was taking place in these primary schools. Mostly, when it was time for group work, many pupils were seen playing and running around the classroom, only a few were seen to be leading discussions. To say the least, such activities were disorderly done, thereby defeating the purpose of unlocking potential in pupils as stated by OECD (2014).

Other strategies mentioned included practical work, investigational activities that were not practiced at all. Apart from playing games and singing before and after a lesson which may have had very little or no effect to lesson development or consolidation of concepts. Mostly of which was practiced encouraged competition among learners and very often benefitted the fast learners as they were quick to seize every opportunity for participation (OECD, 2014).
Both teachers’ and pupils revealed that very minimal of teacher to pupil and pupil to pupil discussions were taking place in these schools. In limiting discussion in numeracy/mathematics lessons the teachers and the learners were missing out on an essential ingredient for the learning on numeracy. Cockcroft (1982) posits that good teaching of mathematics at all levels should include opportunities for discussion between the teacher and pupils and among pupils themselves. Additionally,

*The ability to 'say what you mean and mean what you say' should be one of the outcomes of good mathematics teaching. This ability develops as a result of opportunities to talk about mathematics, to explain and discuss results which have been obtained, and to test hypotheses. Moreover, the many different topics which exist within mathematics at both primary and secondary level should be presented and developed in such a way that they are seen to be interrelated. Pupils need the explicit help, which can only be given by extended discussion, to establish these relationships; even pupils whose mathematical attainment is high do not easily do this for themselves (Cockcroft, 1982, p.246).*

However, application of all these strategies as revealed in Chapter 4 was teacher centered as the nature of the activities kept the teacher in the centre as a main participant instead of focusing on learners. This is contrary to the expectations of Primary School Syllabus (2013) and Zambia Education Curriculum Framework (2013) that aims at “enabling learners acquire mathematical knowledge, values and skills to apply in real life. These two documents encourages primary school teachers to focus on communication of mathematical ideas among learners, emphasizes problem solving and application to real life situations besides cultivating interest in the subject. Despite good strategies revealed by teachers and pupils, not much was visible in most lessons observed. Pupils were not very much involved in ‘Active learning’ through engagement of several hands-on activities especially that pupils in Grade 4 are at concrete operational stage, they needed to do more.

Among other activities mentioned was whole class activities which may have its demerits, but it offered opportunity for pupils to share ideas if well managed. This is so because discussions between or among pupils of same level motivates increased participation. Equally question and answer as well is a way of identifying pupils with difficulties as they fail to respond. All teachers under this study acknowledged carrying out such activities but still from the lesson observations
carried out by the researcher, it was evident that very minimal was achieved as evidenced from pupils’ performance through the exercises in their books.

5.1.2 Classroom common teaching practices

The following is an example of a typical lesson observed from one of these schools. It was conducted in almost the same manner as the rest of the lessons that were observed in these three schools under study. The lesson for the day was measurement specifically, on length. The teacher gave the definition of the lesson/topic and wrote it on the board, and pupils were asked to copy it down. She also wrote the forms of units: mm; cm; m; km then moved on to give some examples.

Example: The distance of a longer side of your desk/ my table (She showed pupils the sides), she said come around me see what I will do to measure these sides of the table and a desk. She asked pupils to identify instruments used to measure distance (length). Then the teacher asked again who has a ruler in here then all pupils raised their instrument (rulers) in air. [Surprisingly, I supposed that the teacher must have told pupils to come with them]

Then she demonstrated how to measure sides using a 100cm ruler. Then asked pupils to measure sides of their desks both long side and short side. She went round confirming the measurement but before she finished, she distributed some rectangular shapes cuttings which she cut in several sizes; asked pupils to measure both long and short sides of the given shapes.

Now, the teacher made some explanations as she measured her table and asked some basic questions, which few pupils responded to. Some of the questions the teacher asked were answered by her just after a brief pause, without any show of hands from the pupils to answer. The teacher used text book questions, which were in the lesson notes she was referring to during her lessons and she used both the chalk board and ‘cut outs’ for rectangular shapes she gave to pupils to measure sides. This was one of the typical lessons observed in one of the schools in this study. At the end of this lesson, she asked the pupils if they had followed very well and could proceed.

The researcher realized that the teacher had prepared a lesson plan, and she felt that it was more important to complete all the work planned than to allow ‘disturbances’ through questions and
observations by pupils. She even ignored the bell for time up, signaling another lesson by herself again, so as to reach the end of her lesson plan. The researcher wondered how often we as teachers feel enslaved by our own lesson preparations. This is against Cockcroft report (1982) that states that there is need to take account of, and to respond to, the answers which pupils give to questions asked by the teacher as the exposition develops. Even if an answer is incorrect or is not the one which the teacher was expecting or hoping to receive, it should not be ignored. This is so because exploration of a pupil’s incorrect or unexpected response can lead to worthwhile discussion and increased awareness for both teacher and pupil of specific misunderstandings or misinterpretation, (p.245).

It was evident from the findings of the study that participating teachers knew what they needed to do in their teaching in order to make their classroom much more interactive – and yet they did not do much to translate their theoretical knowledge into practice. What they did and what they said did not match, as evidenced from the findings. There were some disparities between what was said during interviews and what was actually done during lesson delivery, which is supported by Anderson (2005), who argued that teachers say one thing and do another. He referred to what teachers said as ‘espoused’ and what they did as ‘enacted’ theories of mathematics teaching. It is not clear what causes discrepancies between espoused and enacted theories of teaching and this was not the subject of this study. However, some causes could be speculated. From the interactions, teachers presume that lecture method is the easiest teaching method because it is possible for teachers to memorize the concept without having proper understanding of it. This is the more reason why it is widely used by most teachers.

Zoller, (1993) observed that although lecture and copying notes has been a normal feature of teaching has little mental processing in the activity so much so that it does not result in proper understanding of the learners. In fact this study has also shown that lecture and copying notes mainly lead to rote learning (Zoller, 1993).

As noted in the example of a lesson above that the teacher was not really practicing what he talked about. She had almost rigid way of teaching, and rarely using variant methods. She did not engage the learners in the ways she spoke about. She applied no meaningful group work at all, such that even when she gave an exercise for the class to measure, pupils measured individually incompetently. The lessons observed in the study were very similar with very minor variations.
As the case was with this example of a lesson, the class was arranged in rows and columns that did not encourage pupil-to-pupil interaction. From all the lessons observed, there was a similar pattern of lesson format presentation, as shown below:

- Greet the class and settle down;
- Write the lesson title on the board;
- Write the definition of the lesson title on the board and pupils copy;
- Teacher works out examples while pupils answer a few recall questions and copy the examples;
- Teacher gives exercise and goes round marking;
- Teacher gives homework (not always);
- Lesson ends minutes after time, teacher asks the class monitor to collect exercise books for marking.

Looking at this scenario concerning a lesson mentioned above, the researcher deduced that the teacher had a full cycle which did not permit any new inclusions, hence her not paying attention to pupils’ concerns and questions. The researcher imagined that the teacher had set this agenda to help her complete the prepared work, at the expense of pupils’ understanding. However, the researcher made good use of her agenda to introduce the aspects of the constructivist approach and authentic teaching in her lesson delivery.

For example, the researcher asked her if she could allow for the pupils to realize the meaning of a topic through questions and tasks rather than giving definitions the way they were in the textbooks, to help learners understand what such definitions meant. It should be mentioned here that the lecture method is the most widely used form of presentation. This is so because it is used to introduce new concepts, summarizing ideas, showing relationships between concepts and re-emphasizing main points. Moreover, it is adaptable to many different situations, i.e. small or large classes, which was in fact alluded to by these teachers talked to. But, Sidhu (2006) argued that the lecture method which teachers seemed to apply so much did not allow for active pupil interaction.
participation. Very few mathematical topics lend themselves to effective treatment by this method.

The researcher was fully cognizant that there was no specific strategy that one would suggest that every teacher should use, because what might work for one class might not necessarily be suitable for the other. However, Cockcroft (1982) suggested that the following elements need to be present in successful mathematics teaching to pupils across ages. Mathematics at all levels should include opportunities for: expositions by the teacher; discussion between teacher and pupils and between pupils themselves; appropriate practical work; consolidation of practice of fundamental skills and routines; problem solving, including the application of mathematics to everyday situations, and investigational work, (Cockcroft,1982, p.242-252). These are the elements that constitute authentic teaching and learning of mathematics. The questions that were being asked were almost always answered by the same few pupils and the teacher herself. Little or no efforts were made to get the rest of the class to participate in the limited question and answer sessions. The teacher seemed unperturbed by this, supposedly because she had set her agenda to accomplish the task of completing the syllabus as evidenced in the lesson above.

As noted in the lesson above that the teacher took almost no time to reflect on what pupils were talking about either, she felt challenged by the questions and observations made, so she brushed them aside. The researcher felt that this was an area that needed to be addressed, because it left the pupils in a state of not comprehending what they were being taught and unable to attach meaning to it. This is one strategy that would reduce learners to mere listeners who just had to take that which their teacher gave as a Bible truth. While rote learning has its own merits; it would be too much for learners to memorize everything. I noted that in most cases the pupils were not given the freedom to construct their own knowledge, that is, coming up with their own way of measuring, or ways of doing an activity, and build on it as argued by Piaget (1977) and Anderson (2005). Such teaching strategies make pupils lose confidence in the teacher as well as losing interest in the subject.

Contrary to what was said during interviews by teachers that during lesson preparations they would change teaching strategies or make explanation clearer. In reality, the researcher observed the opposite of this. Teachers could have taken the various opportunities to let pupils discuss their friends’ ideas and build on them. The researcher saw the teachers placing themselves at the
center of the whole learning process, instead of allowing learners to be active participants too. For instance, in this lesson above, she made most of the explanations and asked questions which she ended up answering herself.

Sowder (2007), argued that the basis for teaching mathematics is not only based on the mathematical skills but “attending to the mathematics in what one’s pupils are saying and doing, assessing the mathematical validity of their ideas, listening for the sense in children’s mathematical thinking even when something is amiss and identifying the conceptual issues on which they are working”. In line with this view, during my lesson observations, I saw pupils who wanted to understand what they were faced with and a teacher who did not create space for such opportunities in her lessons neither attempts to cater for individual differences in pupils.

This teacher talked of her lesson evaluations in terms of her covering the planned work and being under pressure to mark since many pupils wanted to have their books marked. The teacher’s assessment of the success of her teaching was also based on how many ticks for correct work she gave to the pupils. It did not really seem to matter if some pupils copied from their friends who were fast and got the measurements right. Looking at her lesson plan/ notes, they were made in terms of whether she succeeded in achieving what she set out to do: Vis avis completing her planned work.

The results from the study indicated that there was very little of constructing knowledge by learners. The examples provided in class work and homework exercises were always the same, with minor variations but the same wording like those in the pupils’ text books. Explanations by the teachers in most cases were laborious, and the tasks that followed offered little mathematical challenge as they were a replica of the examples done. The pupils seemed so used to their teachers’ explanations and depended on them so much that there was little evidence of them doing any creative or original thinking, apart from isolated cases where some pupils asked constructive questions.

Further, the examples and exercises mostly lacked connection to context, since they were drawn straight from the pupils’ textbooks. In constructivist terms, it was hard to tell what sense the pupils made of the mathematics they encountered. This was an area that could be explored and perhaps improved on in accordance with what Dembo (1994) stated that learning activities, tasks
and assignments should increase pupils’ interest and involvement in learning. It is not enough to have pupils’ complete activities, tasks and assignments comprising boring exercises rather than providing them with activities designed to stimulate curiosity and an interest in learning.

The overall picture of teaching strategies for numeracy skills was below standards. Teaching strategies were being influenced by many factors. The most common strategies used were mostly teacher centered hence, failure to guide, instruct and facilitate learning numeracy skills. This was so because teachers did not encourage any independent thinking of their pupils. Only one out of the three teachers seemed to create interactive lessons even though lesson cycle was common to all. All factors considered in this study, facilitation of learning greatly influenced teaching strategies the most.

5.2 Environment in which numeracy is taught

This is the second research question which sought to establish the existing environment in these schools regarding the teaching of numeracy. It is here that the themes which were generated from the research findings of this question were discussed.

5.2.1 Classroom atmosphere

Findings revealed that in one school under study pupils were allowed to freely mingle, talk and discuss among themselves. This was not the case with other two schools, where pupils revealed during FGDs that they were not allowed to ask nor discuss anything because their teachers were strict. Of course other pupils said they were shy to talk in class. In over all, these classrooms were not conducive environment because pupils could not freely participate in lessons. Other pupils lamented the fact that they had even classroom rules that restricted them from talking in class.

But from interviews with teachers, one of them said she allowed her pupils to discuss in groups each time it was numeracy lesson. Yet another teacher revealed that she had classroom rules meant to regulate pupils’ behavior and conduct in class. From these findings it is possible to say classroom atmosphere of most primary schools were not conducive for learning numeracy. This is so because according to Brooks (1993) a conducive classroom environment has the following attributes:

- An accommodating teacher who is not threatening or frightening, but rather, friendly and caring.
- Peaceful, with friendly language. Pupils enjoy learning, are highly motivated and interested in mathematics lessons.
- Attractive classroom with ‘talking walls’. Talking walls are things like posters, photos or any drawings made by either a teacher or pupils that can be used during and even after lessons.
- Democratic tendencies whereby pupils freely participate in lessons, i.e. the teacher allows interactions and pupils make and take responsibility for their behaviors.
- Sizeable class enrolment, meaning manageable class

Findings revealed that classrooms were not attractive at all. They did not have any ‘talking walls’ that could be useful to pupils to experience independent learning. Out of the three schools, only the urban one had a few of charts and counters in a carton box for safe keeping. It was worse with the other two schools whose infrastructure was dilapidated, with inadequate furniture and teaching and learning resources.

Moreover, findings from interviews with teachers revealed that there were classroom rules, implying that teachers may not have been accommodative, friendly and caring but threatening and frightening to learners thereby making the environment un conducive, contrary to conditions set and proposed by Brooks.

Dewey (1997) observed that “a primary responsibility of educators is that they must not only be aware of the general principle of the shaping of actual experience by environmental conditions, but that they also recognize in the concrete of which surroundings are conducive to having experiences that lead to growth. Above all, they should know how to utilize the surrounding that exists – physical and social – so as to extract from them all that they have to contribute to building up experiences that are worthwhile” (p.40). What came out from this study is that very little of constructive learning was taking place in primary schools. This is due to the fact that teachers rarely encouraged creativity or originality to emanate from learners. The teaching was text book oriented thereby making it very difficult for learners to connect to real context. Although, there was marginal exposition of the teachers and discussion between teachers and pupils and among pupils themselves there was no meaningful practical works and investigational work taking place in these mathematics lessons.
Additionally, numeracy levels are largely affected by the failure of teachers to provide a supportive environment in which children feel confident as learners and risk-takers. Teachers need to encourage the provision of positive, non-threatening, language-rich environment in numeracy lessons. For instance creation of numeracy corner library and quiz clubs just to mention but a few. OECD (2014), suggested a number of numeracy activities relating to classification, space, pattern and measurement that build on the types of experiences that children have outside the classroom. Where concepts are less familiar, OECD (2014) argued that teachers must ensure that pupils are exposed to the concepts, must have the opportunity to experience or live the idea before it is formally taught. For example, before teaching pupils to count they must be immersed in a happy, secure classroom environment where the pupils are in control of their learning, have access to a wide range of concrete materials, and freedom to work in situations in which they feel comfortable. However, what was observed in this study was that teachers were unable to carry out hands–on activities due to lack of teaching and learning resources in primary schools.

In summary, the findings from this study in the aspect of environment in which numeracy is taught varied greatly from school to school. There were several factors contributing to this situation ranging from infrastructure, teachers’ perception of their pupils and availability of teaching and learning resources. For instance, School A had better infrastructure, with good classrooms that have even the storage facilities for teaching and learning resources. The teacher as well from this school was able to create a constructivist classroom, i.e. a classroom in which pupils discussed with the teacher and among themselves, had practical work and investigational activities. The atmosphere in the classroom inspired confidence that meaningful numeracy lessons could be conducted. Unlike the situation at School B and School C which had poor infrastructure with classrooms that had deplorable blackboards, not enough desks and inadequate teaching and learning resources. Even though there were efforts to improve the situation by improvisation of teaching and learning resources, the situation was not conducive for meaningful teaching and learning of numeracy, such as lessons in which teachers seek and value their learners’ point of view, teachers build lessons around primary concepts and “big” ideas and teachers assess learners’ learning in the context of daily teaching just to name a few. Overall, learning context and resource constraint were outstanding environmental factors affecting
teaching/learning of numeracy skills.

5.2.2 Pupils participation in making TLR

Findings from both teachers and pupils revealed that pupils were not given any opportunity of making any thing in class that they would use for understanding or consolidating concepts in numeracy. And yet if pupils could be accorded the chance of making any teaching and learning resource it would help pupils manipulate and figure out concepts using real objects. Brown (1998) posits that authentic learning requires the learner to communicate an in-depth understanding of a problem rather than memorizing isolated facts and that is what would make numeracy relevant beyond school. Furthermore, Adewuyi (2001) argued that in fact it is this kind of teaching without involving pupils in making items/things in class that does not motivate learners at all to learn. Further, Akinsola (2002) said that these methods of teaching mathematics through listening and looking have not yielded better results in fact it has made pupils not to like the subject. So this is only possible when there is a combination of strategies when teaching every lesson in numeracy.

5.2.3 Resource constraint

Findings from teachers and pupils revealed that there were no teaching and learning resources in schools. This was in contrast with the 2006 statistics in the National Assessment Survey of Learning Achievement Report. It revealed that text books for numeracy were available. This could have been necessitated by the change of the curriculum, which was recently introduced in schools. The government had not yet provided text books to schools at the time this research was undertaken.

From the findings, furniture in schools was inadequate. The sitting and writing conditions have been unchanged similar to the findings of 1999, 2001, 2003 and 2006. This could be attributed to high enrolments since the introduction of free primary school education (MOE, 2006). From the FGDs with pupils from urban school revealed that they shared a textbook between 3 and 4 pupils except that most of them had acquired personal textbooks. The situation was different at the other two schools, where one teacher said she photocopied pages of pupils textbook to allow pupils have a resource for a particular numeracy lesson.

Greenwald, et al (1996) carried out meta-analysis of 60 research studies to assess the direction
and magnitude of relations between a variety of school inputs and student achievement. Their conclusion was that school resources were systematically related to student achievement and that these relations between resources and student achievement are large enough to be educationally important. If what Greenwald, et al (1996) concluded was indeed the case, the book situation in the participating schools was unlikely to lead to high learner achievement.

5.3 Teachers’ perception regarding factors influencing numeracy skills among primary school pupils

This is the third research question which sought to identify various factors influencing learning numeracy skills among primary school pupils. According to Dunphy (2014), factors are those conditions that influence learners’ achievement, positively or negatively in the learning/acquisition of numeracy skills. These factors can emanate from a single entity or multiple entities with varying degrees on how much they affect learning. Several themes where generated from the research findings that highlights a range of factors that impinge on numeracy skills.

Theoretically, it has been contended that there exist a number of factors surrounding the school system that may cause learning of numeracy to be ‘un natural’. These include home background factors, school background factors and processes, teacher factors and finally, learner factors.

5.3.1 Teaching skills

Findings from teachers revealed that there was an attempt to impart skills through involvement of pupils in activities such as measuring, counting, and calculating using objects. But this was not a common feature to all schools. One teacher said her learners were very young to fully engage them in doing any activity all by themselves. This is against the expectations of authentic learning that demands to give pupils control over their own learning. According to Brown (1998), authentic learning demands a learner to communicate an in-depth understanding of a problem or issues rather than memorizing sets of isolated facts that must result in achievements that have relevance beyond school.

In the focus group discussions with Teacher A’s learners, it was clear that pupils enjoyed practical work in their mathematics lessons. They said ‘Sir, we enjoyed doing work on our own
because we become free to talk to each other. One child even said, Sir when we do it by ourselves we cannot forget’. Indeed, the researcher observed that pupils were very willing to measure any object the teacher mentioned. This illustrates the point that authentic teaching allows learners to enjoy the learning experience and to construct their own meanings. Unfortunately, such a lively approach to teaching was not quite evident at the other two schools. At Schools B and C, there was no evidence of teachers fully engaging their pupils in any serious practical work. The teachers mostly worked from the board.

Regarding teaching strategies, OECD (2010), stated that teaching strategies ranged from the ways in which classrooms and resources are organized and used to the ways in which teachers and pupils engage in day-to-day activities in order to facilitate learning. In this study, most teaching merely followed a daily routine, where an example is given, and then pupils write one or two questions then a revision that was all. Only one teacher was seen to be fully engaging her pupils in various activities thereby making her lessons lively and interesting. The ‘daily routine’ type of teaching seemed to bore pupils. For example, at School B, pupils were seen dosing and others made regular trafficking in and out of the class. This was confirmed during the focus group discussion with the pupils. They said most of them dosed off in class while others made a lot of noise. This was evidence enough that the lesson was not interesting at all and pupils were not involved. This teaching is non productive to pupils in that they do not develop any skill, (OECD, 2010).

5.3.2 Language
Language of instruction came up as a noticeable issue as well in this study. Firstly, the national policy on language instruction in schools has been that “all pupils will be given an opportunity to learn initial basic skills of reading and writing in a local language; whereas English will remain as the official medium of instruction” (MOE, 1996, p.39), i.e. Mathematics was to be taught in English simultaneously as the learning of English. In 2013, there was a review of the policy on language of instruction to say that “all the teaching and learning in all the learning areas at the Lower Primary level will be in familiar Zambian Languages... English will be offered as a subject, beginning at Grade 2” (MESTVEE, 2013b, p.19). In this study, teachers found it very difficult to use the right words in local language to mean the same as the intended concept in
English. For instance at School C, the teacher was not fluent in the local language of the area and he needed to instruct pupils to say trace or measure, He said: tiyeni tipange line’, meaning let us make a line. The more accurate local language expression should have been ‘tiyeni tipeze katalika’ meaning let us measure the distance or length; Another example is ‘tiyeni tipime mutunda’ meaning let us find distance or length. So even just with English there were difficulties in understanding the spoken or written instructions, such as ‘draw a line between…,’ ‘ring…’ or find two different ways to…’ in grade four pupils were not be familiar with mathematical vocabulary, such as ‘difference’, ‘subtract’, ‘divide’ or ‘product’. They were confused with terms like, ‘odd’ or ‘table’ or ‘area’ which has different meanings in everyday English. At School A, the teacher used English mostly, and most pupils in this school were able to understand instruction in English because, as said earlier, the catchment area of the school is of mostly middle class families (Chapter 4). Pupils at Schools B and C had difficulties to understand English. Most of the time teachers were code switching from English to local language and vice versa. Uchida & Nkhata (2007) acknowledged that number of local languages in a class in Zambia was large, such that there was no common language which every pupil could understand easily.

Therefore, findings from the teachers and pupils revealed that pupils from urban school did not have much difficulty in using English and local language, unlike the pupils from the other two schools B and C, where it was either the teacher who was not familiar with local language or pupils. Even Uchida & Nkhata (2007) reported that because pupils failed to add fractions and to understand English because the teaching was in local language. This also compromised the learning of some pupils whose local language was different from their mother tongue, the situation that might give some influence to pupils’ achievement.

Consistently, the National Assessment Surveys have shown that learners who speak English and a Zambian language at home perform better than those who speak either English or a Zambian language only. The learners who speak English are presumed to be from high social economic status background and urban schools. In the Zambian context, for a learner to develop holistically, she/he needs a blend of the local language and English language. This therefore entails having a language policy which promotes both languages (MOE, 2012, p.47). This has...
been changed in the current curriculum that from Grade 1 to 4, all pupils in Zambian schools will be taught in local and familiar language.

**5.3.3 Attitude and expectation**

Findings from the teachers revealed that not all of them had pupils with positive attitude towards mathematics. One of them said only a few boys were willing to do class exercises at a time. The worst was the teacher from rural school who said his pupils did not like mathematics lessons. This was confirmed with pupils themselves during FGDs, only pupils from urban school said they found mathematics lessons interesting and less demanding. Unlike pupils from rural schools who lamented that they did not have interest in the subject, because it was hard to comprehend it.

On teachers’ attitudes and expectations, research has shown that if a teacher has a negative attitude towards learners or a low expectation of what learners can do, performance tends to be affected (Spady, 1988). As for pupils’ own attitude and expectations, Spady (1988) suggested that:

- a significant positive correlation exists between pupil attitudes and mathematics achievement,
- extremely positive or negative attitudes tend to predict mathematics achievement,
- and gender-related differences in attitudes towards mathematics exists, including difference in confidence or anxiety measures relative to learning mathematics, just to mention a few.

It is important to consider the implication of poor attitude by both teachers and pupils if learning of numeracy is to improve in these primary schools.

**5.3.4 Pupils’ background**

Findings were that in families where parents/relatives were educated, such pupils were assisted in their out-of-class activities such as home work and projects. Pupils talked to said that some of them were not assisted in their home work at homes because they did not have either siblings or parents who could come to their aid. At School C, the researcher observed that only one child had done his home work he was helped by parents. Clarkson (1991) stated that a pupil whose father is working in some professional occupation can be expected to have some advantage in school compared to a pupil whose father is a subsistence farmer. He further said parents who have progressed through a substantial number of years of schooling may well be better placed to
help their children with school related issues than parents who had little or no opportunity to go to school. Exactly, this was what was found out in this study. Even teachers as well confirmed that in fact pupils whose parents have been to school help their children with learning resources such as text books.

Moreover, even home environment plays a major role in pupils’ acquisition of numeracy skills. Pupils who live in a home that has electricity connected and has a radio, TV, refrigerator, a car etc may well have a home environment in which it is easier to complete home work and have access to information that will complement school learning. (Clarkson, 1991).

Generally, social-economic status is indeed one of the factors that affect pupils’ acquisition of numeracy skills (OECD, 2014). Pupils learn better if they are from above-average or average income family, with well-educated parents who participate in the schools’ education process and encourage children to learn. When parents are involved in their children’s education, children perform well and have better attitudes and behavior (Brown, 1998). In addition, pupils’ achievement in numeracy skills in school is affected not only by the home environment but also by the neighborhood where the pupil lives. Safe neighborhoods that value education and participate in school events and projects can provide additional reinforcement for pupils’ acquisition of numeracy skills.

The MOE has tried to provide schools as closer as possible to people in Zambia. At least within a radius of 5km now there is a primary school or a community school thereby issues about pupils walking long distances to school has reduced, (MOE, 2013). Although, levels of poverty could be high in some rural areas which may still inhibit access to both electronic and print teaching and learning resources somehow pupils in either urban or rural are being taught numeracy skills.
CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.0 Introduction

The purpose of this study was to investigate teaching strategies of numeracy in primary schools in Chipata district. Data related to this study were collected using qualitative methods that included lesson observations, interviews and focus group discussions. The aim of this chapter was to summarize the main findings of the study. In view of this, the rest of the chapter was structured as follows. Section 6.1 draws the conclusions based on the findings of the study; Section 6.2 provides recommendations of the study: (i) For practice by the teachers, (ii) For further study. In addition, the study sought to explore environment in which numeracy was taught and find out teachers’ perceptions on factors influencing numeracy skills among primary school pupils.

6.1 Conclusions

This study established that the teaching of numeracy was predominantly teacher centered. This is the kind of teaching where teachers suffer from ‘I know it all syndrome’ where a teacher is very active than learners. These methods do not have room for learners to even answer questions and even allowing independent thinking. This was influenced by many factors such as lack of creativity of teachers in making lessons practical and learner centered. From all the lessons observed, there was a similar pattern of lesson presentation that is, example, followed by teacher demonstration and exposition, then class exercise marking the end of the lesson. Teachers rarely engaged pupils in active learning and hardly used teaching and learning aids.

The study also looked at the environment in which numeracy was taught. The finding was that, classrooms’ atmosphere was hardly inspiring confidence in the learners. For instance school B and C had poor infrastructure with classrooms that had small, poor, hard to write on blackboards, inadequate desks and teaching/learning resources. Teachers in these schools struggled to make lessons enjoyable and meaningful to pupils.
The study also established that there were several other factors influencing teaching and learning of numeracy skills. These included language, attitude, expectations and home background of individual pupils. From the observations of lessons in these schools, it was difficult to tell if any authentic learning took place in these classes because there was hardly any in-depth understanding of classroom work other than memorization of concepts resulting in no relevance beyond school. Of course only teacher A was able to demonstrate meaningful, interesting and authentic lessons unlike the other two teachers.

Language was another issue that even though teachers were able to code-switch from English to Nyanja and vice versa still pupils in schools B and C had difficulties to understand and comprehend instructions and worse still concepts. In fact, the situation could be more difficult to teachers who may not be comfortable speaking local language in these schools thereby confusing pupils more. This situation was caused by the government pronouncement that teaching from Grade one up to four will be in familiar local language in all Zambian schools without making text books and pupils books available in schools. Other factors were social-economic status of families of every pupil in class. From focus group discussions, pupils were able to say that those children from above-average or just average income families learnt better than those from poor homes. They equally said those pupils whose parents were literate facilitated and monitored their children progress in education even assisting them in home work.

One wonders that pupils “Sitting in the same classroom, reading the same textbooks, listening to the same teacher, pupils receive different education”, (Sadker and Sadker, 1994, p.1). However, from the present study, this is not necessarily as a result of what is happening in the classroom but has a lot more. The overall conclusion is that the teaching and learning in primary schools is not inspiring for children to learn numeracy skills. This conclusion is in spite of several efforts by the government through the Ministry of General Education and its operating partners who have been attempting to introduce new ways of teaching mathematics in primary schools. Educational efforts in the country should to shift from ‘Yesterday’ mind to the ‘Tomorrow’ mind in the teaching and learning mathematics. Implying that, teachers should leave old ways of teaching to modern and new technological teaching of mathematics. While this research findings show that there is marginal efforts in teaching strategies of numeracy skills in primary schools, there is still a long way to go for teaching strategies of numeracy skills in primary schools in
Chipata, Eastern Province of Zambia. There is evidence to support the existence of factors affecting teaching strategies of numeracy skills.

6.2 Recommendations

Following the research findings and in response to the conclusions drawn from the study the following recommendations have been made; although the findings are related to three schools, may not be generalized to other schools, they will be indicative of the general outlook of some schools in Zambia. As such

(i) **For practice:**

There is need to emphasize ‘hands-on’ orientation and effectiveness of some strategies more than theoretical and classroom oriented teaching during Continuing Professional Development meetings and activities of the Zambia Association for Mathematics Education (ZAME). This could expose teachers to variety of teaching strategies especially those that allow children to practice authentic learning.

(ii) **For further study:**

Despite several interventions in the Ministry of Education in providing corrective measures of teaching numeracy, there is need for a large scale study on the teaching of numeracy skills at Grade 4 level. There is also need to study a variety of classroom situations where the teacher is not familiar with the local language so as to assist the teacher in adapting to such environment.
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76


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# Appendix A

## LESSON OBSERVATION SHEET

<table>
<thead>
<tr>
<th>STRATEGIES:</th>
<th>PERCEPTION/ATTITUDE:</th>
<th>ENVIRONMENT:</th>
<th>SKILLS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>What approaches, strategies, methods are used?</td>
<td>What is the attitude of the teacher towards pupils who fail to answer?</td>
<td>What does the class look like?</td>
<td>Are pupils engaged in reading, calculating, working out, and writing in every lesson?</td>
</tr>
<tr>
<td>Which ones are common? How eclectic is the teacher? How is the lesson introduced? How is a lesson ended? What does the teacher like doing when pupils are doing an activity? Are pupils engaged in an activity? Does s/he guide pupils? Does the teacher ask follow-up questions to either correct or wrong responses? How free are pupils in the lesson? Do pupils ask questions during the lesson? Does the teacher evaluate his/her lesson accurately? Does s/he criticize him/her self? Does the teacher come with already made TLA in class or involves pupils in making, or coming up with a TLA?</td>
<td>How does the teacher relate to pupils in general? How free are pupils in class? How free do pupils participate in maths lesson? What feeling is seen with most pupils in class? Are pupils willing to answer, do an activity? How prepared is a teacher for the lesson? How is the classroom atmosphere? Are pupils willing to learn? Are they willfully participating in class activities? How do pupils react to teachers’ comments?</td>
<td>How is the classroom atmosphere? Are pupils willing to learn? Are they willfully participating in class activities? How do pupils react to teachers’ comments?</td>
<td>Are pupils engaged in reading, calculating, working out, and writing in every lesson? Do pupils make anything in class? Are pupils involved in making any TLA? Are pupils actively involved in What instrument/s used to assess pupils? How often are pupils assessed? Are results displayed in class? What instruments are used to monitor pupils’ performance? Is the teacher aware of homework policy? How often is homework given to pupils? Is there remedial activity in class? Do pupils sing in class? Are pupils seen doing any traditional games within class work?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>How free are pupils in class? Are pupils free to talk to each other? Do pupils ask questions? Is the class spaced enough? What language is used in class? Do pupils easily interact among themselves or with their teacher? Is the black board good to write on? Are things written on the board visible enough? Is furniture enough for all the pupils? What is the population of the class?</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B

INTERVIEW TRANSCRIPTS

Teacher A

Researcher: Good afternoon madam
Teacher: Good after noon
Researcher: What did you do today differently in your lesson?
Teacher: Used TLA as usual and I encouraged my class to work in groups and in pairs
Researcher: What else could have helped your pupils to do very well today?
Teacher: Access to pupils’ books must have assisted greatly
Researcher: I saw you being positive in your comments do you think that could have played a part?
Teacher: Oh! Yes. I wanted to motivate them to do more especially with your presence
Researcher: What else do you think you did differently in your lesson?
Teacher: I avoided traditional way of teaching like talking too much, but simply provoked pupils to do the thinking on their own.
Researcher: When one child asked you to show the working you asked a fellow pupil to do it why?
Teacher: I wanted to encourage much more interaction among themselves and just to be authentic in teaching.

Teacher B

Researcher: Sir, today you started with a revision of the previous lesson why so?
Teacher: I wanted to show the connection between the two lessons
Researcher: But I saw one child showing you already done work, who helped that child?
Teacher: Yes, I encourage them to do home work as such he may have been helped by his family members especially his elder sister who is in Grade 9
Researcher: What reasons do most pupils give as to why they fail to write their home work?
Teacher: Some say that they do not have anyone to ask from at home, but others are just playful
Researcher: I saw you asking pupils to check each others’ books, how helpful was it to slow ones?
Teacher: Especially when I do not have time, I sometimes ask them to check each others’ work to confirm their solutions

Teacher C
Researcher: Yes, today I saw most pupils hesitant to give answers to your questions why?
Teacher: that is their nature the problem is with language of English
Researcher: But they could have used local language as well?
Teacher: No, I sometimes do not allow them especially that they are about to get to Grade 5
Researcher: Now how helpful is your tactic to your class?
Teacher: Sir, the worst is even with your presence
Researcher: Only one boy was able to work from the board, why not others?
Teacher: That boy is an inspiration to the class. He just came from town and his parents were teachers, so he could be helped at home
Researcher: Have you ever found out what could be affecting performance of your pupils?
Teacher: No, but from my experience I know is just the nature of local pupils they are below average
Appendix C:

FOCUS GROUP DISCUSSION GUIDE FOR PUPILS

1. What is your favorable subject in school?
2. What do you enjoy most about the subject?
3. How do you find learning mathematics, do you enjoy it?
4. What activities do you do in mathematics lessons?
5. What do you enjoy most in mathematics lessons?
6. What do you dislike most in mathematics lessons?
7. Do you do any games in mathematics? What games? How often? How about songs? (If yes, Can you sing one for me?)
8. How often do you work on your own in mathematics lessons? How often do you work in groups? Do you sometimes have competitions in mathematics lessons?
9. When it comes to learning mathematics, what do you like most about your teacher? What is it that you don’t like?
10. What language is mostly used in teaching mathematics in your class – by your teacher, by your classmates? Which other languages are used? Which language should the teacher be using more for you to understand mathematics best?
11. Is there anything else you would like to tell me about your experiences in learning mathematics?
12. What games/songs do you do after mathematics lessons?
Appendix D

INTRODUCTORY LETTER FOR FIELD WORK

TO WHOM IT MAY CONCERN

Dear Sir/Madam

RE: FIELD WORK FOR MASTERS / PhD STUDENTS

The bearer of this letter Mr./Ms.……… is a duly registered student at the University of Zambia, School of Education.

He/She is taking a Masters/PhD programme in Education. The programme has a fieldwork component which he/she has to complete.

We shall greatly appreciate if the necessary assistance is rendered to him/her.

Yours faithfully,

[Signature]

D. Ndlovu (PhD)
ASSISTANT DEAN (PG)- SCHOOL OF EDUCATION
LETTER OF PERMISSION FROM DEBS

3rd September, 2014

The Headteacher
CHIPATA

RE: FIELD WORK FOR MASTERS STUDIES – MR MWANAMOOONGA SAIDI

I write to introduce the above mentioned Lecturer who is a bonafide employee of the Ministry of Education Science Vocational Training and Early Education based at Chipata College of Education in Chipata District.

The bearer is a student at the University of Zambia and taking a Masters programme in Education. The programme has a fieldwork component which he has to complete.

Kindly assist him accordingly.

[Signature]

Linda Zulu Mwaba (Mrs)
Senior Human Resource Management Officer
For/DISTRICT EDUCATION BOARD SECRETARY
CHIPATA DISTRICT