TEACHERS STRATEGIES FOR TEACHING MULTIPLICATION AND DIVISION TO GRADE 3 AND 4 LEARNERS IN WESTERN PROVINCE, ZAMBIA

BY

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A Dissertation Submitted In Fulfilment of the Requirement for the Award of the Degree of Master of Education in Mathematics Education

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DECLARATION

I, **Trudy Namoomba** do hereby declare that this piece of work is my own, and that all the work of other persons has been duly acknowledged, and that this work has not been previously submitted at this University and indeed any other University or Institution for similar purposes.

Signed: ....

Date: ...11/12/2017...........................

APPROVAL

This dissertation of **Trudy Namoomba** is approved as full requirement for the award of the degree of Master of Education in Mathematics Education by the University of Zambia.

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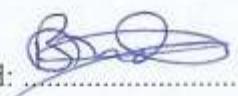
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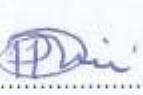
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DEDICATION

This work is dedicated to my husband John Siameja for the financial and emotional support. Secondly, I dedicate this work to my four children, Chilobe Siameja for typing part of my work, Chilombo Siameja, Chintu Siameja and Chabota Siameja for allowing me to leave them without my parental care, guidance, love and encouragement during my studies.

ABSTRACT

The purpose of this study was to interview and observe primary school teachers teaching multiplication and division to grade 3 and 4 learners in Western Province, Zambia. This was done in order to understand the strategies that they employ and to identify the challenges they may be encountering for possible curriculum enrichment in schools. Learning of mathematics is still a challenge to most of the learners in Zambia as evidenced from mathematics continuously recording poor performance over the years Ministry of General Education (MoGE, 2015) indicates that the overall performance in mathematics has remained low over the years and since 1999 the National Mean has remained below 40 percent for grade 5. Five grade 3 and 4 classes were conveniently selected, two class teachers for both grade 3 and 4 from the selected five schools (two schools from Mongu and three from Sioma). The two grades were chosen because this is the time when pupils begin to learn concepts and strategies to solve multiplication and division and assumed that strategies used may be the cause of low performance. The districts were convenient to the researcher. In order to collect in-depth information, interviews and observations were carried out and data was qualitatively analysed. The findings of the study suggested that teachers and learners had challenges in teaching and learning multiplication and division due to strategies used. This is because the strategies used have limited view as such they may have future challenges in learning mathematics because multiplication and division are key topics in mathematics education. The findings further show that most of the teachers introduced multiplication and division as repeated addition, regrouping and multiplication table was also used as a strategy when teaching. This gap created at this level might affect performance in higher grades. Despite the challenges observed, the study argues that there is potential to overcome these challenges and concludes by recommending; that teaching of multiplication and division should be done in a way that could build a strong foundation at grassroots level. For instance helping learners master the multiplication table especially for digits 0-9 is very critical in the learning of multiplication and division. A longitudinal research to prove the claim should be carried out and write books guiding teachers on how to teach for conceptual understanding.

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LIST OF ACRONYMS

ECZ: Examination council of Zambia

MoGE: Ministry of General Education

SACMEQ: Southern and Eastern Africa consortium for Monitoring Educational Quality

MESVTEE: Ministry of Education Science, Vocational Training and Early Education

MOE: Ministry of Education

CDC: Curriculum Development Centre

OMOE: Ontario Ministry of Education

FGD: Focus Group Discussion

CHAPTER ONE: INTRODUCTION

1.1 Overview

This chapter highlights the background and problem statement pertaining to the strategies teachers use to teach and learn multiplication and division in Western Province. It also presents the purpose and objectives of the study and the operational definitions that are used.

1.2 Background of the Study

The teaching of mathematics is an issue that has proved to be challenging globally (Downton, 2008; Stevenson & Stigler, 1992). Researchers have worked around this issue in order for them to find solutions to the challenges faced in the teaching and learning of mathematics at all levels. Children learn mathematics from pre-school or kindergarten level through primary to secondary school and higher levels of education. The concepts taught in the early grades are very critical because learning at this stage forms the foundation on which all the other learning in higher grades will depend. Herolds (2013, p.6) argument that, "If students are failing to learn their facts they will fall behind because they will not be able to complete higher level mathematics skills such as division or fractions". Mwamba (2013) also pointed out that learners who failed in grades 1 to 4 generally were having learning problems in later years. Mwamba (2013) further associated poor achievement of learners to various aspects such as; the specific learning disabilities, poor teaching pedagogy, inadequate teaching and learning resources, ill- trained teachers and overcrowded classes at grades 1 to 4. Hart (2004) points out that, in teaching the purpose is to lay a good foundation of knowledge and to encourage the child to move towards the most efficient way of working. The implication is that the initial educational experiences of pupils before grade 3 and 4 are critical to the learners' advancement in mathematics.

Knowledge of mathematics is a necessary factor for every person to live a useful life and become an effective and productive member of society. As such instructional strategies in multiplication and division may offer a solution to improving learner performance in selected schools of Western Province. For example, Ministry of General Education (MoGE, 2015) indicates that the overall performance in mathematics has remained low over the years and since 1999 the National Mean has remained below 40 percent for grade 5 as shown below
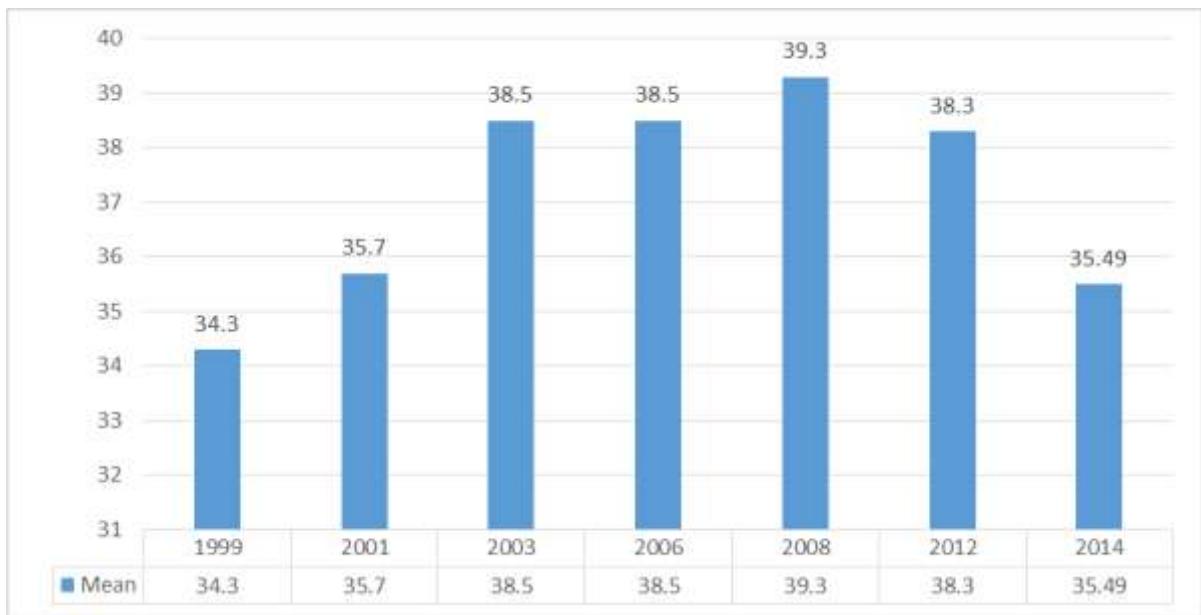
Figure 1 National Mean Performance in Mathematics over the survey years

Additionally Southern and Eastern Africa consortium for Monitoring Educational Quality (SACMEQ)III revealed that the mathematics score of 435.2 for Zambia was the lowest out of 15 Southern African countries that took part in the region as indicated in Table 1. Similarly, at grade 7 level, performance of pupils in national examinations was poor, for example the details in Table 2 were extracted from the 2014 national examinations at grade 7 level showing that most of the learners got division 4 indicating that there is a problem of poor performance. This is what motivated the researcher to carry out the study on "strategies teachers use in teaching and learning of multiplication and division at grade 3 and 4 learners in western province of Zambia.".

Table 1:   **Pupil Performance in Mathematics in the SACMEQ III**

Country		Mathematics Score	
		2000	**2007**
1	Botswana	512.9	520.9
2	Kenya	563.1	557.0
3	Lesotho	Nil	476.9
4	Malawi	432.9	447.0
5	Mauritius	584.6	623.3
6	Mozambique	534.7	483.8
7	Namibia	430.9	471.0
8	Seychelles	554	550.7
9	South Africa	486.1	494.8
10	Swaziland	516.5	540.8
11	Tanzania	522.4	552.7
12	Uganda	506.3	481.9
13	Zambia	435.2	435.2
14	Zanzibar	478.1	486.2
15	Zimbabwe	519.8	519.8

Source: SACMEQ III Report (2007)

Table 2: Grade 7 National Examination Performance in Mathematics for Western Province 2015

	Number of Boys	Number of Girls	Total
Division 1	1472	1574	**3046**
Division 2	2007	2070	**4077**
Division 3	1502	1377	**2879**
Division 4	5336	4727	**10063**
Absent	1518	1520	**3038**
Total		**11269**	**23104**

Source: ECZ Report, (2014)

Nakawa (2013) pointed out that pupils had more difficulties in multiplying and dividing compared to subtraction and addition, and that position may be or may not be different among grade three and four pupils in Western Province. It should be noted that multiplication is a key topic in mathematics education because the syllabus has several of multiplication-related units such as arithmetic, measurement, number patterns, ratio and proportion, equations, average, number bases and fractions as noted by Nakawa (2013). Additionally, Lawson and Rizvi (2007 pp. 377-378) state that, the concept of division is one of the subject areas in mathematics where prospective and practising primary level teachers often seem to have insufficient knowledge. For example, Lawson and Rizvi, claimed that the cause of the problem with division was the models teachers used for teaching division such as fair sharing and repeated subtraction. According to Ministry of Education Science, Vocational Training and Early Education (MESVTEE, 2013), mathematics and science continue to record unsatisfactory results and as such there is something worth thinking about seriously as to why learners performance in mathematics is continuously declining. Ministry of Education (MOE, 1996) also indicated that this unsatisfactory performance requires immediate or urgent attention as well as major intervention. The researcher claims that the poor performance in mathematics is a result of teaching and learning at grassroots (primary school) especially the strategies used to teach and learn multiplication and division.

Mwamba (2013) attributed this poor performance to the fact that teachers had negative or poor attitude towards work as well as school managers having poor management skills. Additionally, he states that, "Despite this, teachers had very good pedagogical skills but they were lazy to help children who had identifiable difficulties. Kazuyuki and Baba (2013) confirm that Zambia's learning achievement was still low and the country was cited to have underperformed in calculation capability. Nakawa (2013, pp. 107-108) points out that "pupils had more difficulties in multiplying and dividing compared to subtraction and addition". Multiplication and division are the key topics in mathematics education because the syllabus has a number of multiplication related units such as arithmetic, measurement, number patterns, ratio and proportion, equations, average, number bases and fractions.

It was this background view that the researcher had to investigate strategies teachers use in teaching and learning of multiplication and division to grade 3 and 4 learners in Western Province with the understanding that; firstly, at these grade levels, learners begin to learn strategies of solving multiplication and division as well as learning of concepts in mathematics. This could mean that if learners were not able to read and write at the end of grade 4, a gap could be created in all the future academic life of a child (the child continues to learn how to read while reading to learn). Secondly, the researcher claims that multiplication and division form a basis for teaching mathematics at higher levels.

1.3 Statement of the Problem

In recent years, there has been growing concern that teaching was not meeting the needs of the society as observed by Choobe, Mulendema and Shumba (2013).For example SACMEQ III revealed that the mathematics score of 435.2 for Zambia was the lowest out of the 15 countries that took part in the assessment. MoGE, (2015) also indicates that the overall performance in mathematics has remained low over the years and since 1999 the National Mean has remained below 40 percent for grade 5 as illustrated in Figure 1.This low performance motivated the researcher to carry out the study under investigation and claims that "strategies used in teaching and learning of multiplication and division" may offer a solution to improving learner performance in selected schools of Western Province, because there is no empirical evidence or little is known about any study on the topic under investigation.

Furthermore, Nakawa (2013) pointed out that pupils had more difficulties in multiplying and dividing compared to subtraction and addition, and that position may be different among grade 3 and 4 pupils in western province. In addition multiplication is a key topic in mathematics education because the syllabus has a number of multiplication-related units such as arithmetic,

measurement, number patterns, ratio and proportion, equations, average, number bases and fractions as noted by Nakawa (2013). Lawson and Rizvi (2007, pp. 377-378) further state that, "The concept of division is one of the subject areas in mathematics where prospective and practising primary level teachers often seem to have insufficient knowledge". For example Lawson and Rizvi, claimed that the cause of the problem with division was the models teachers used for teaching division such as fair sharing and repeated subtraction. This study claim that strategies teachers use to teach and learn multiplication and division may be the cause of the low performance and that, the teaching of multiplication and division may build a strong foundation for pupils while at grassroots such as grade 3 and 4 level as it forms a basis for teaching and learning of mathematics for higher levels. Little is known about such a study in Western Province, hence the gap.

1.4 Purpose of the Study

The purpose of this study is to interview and observe primary school teachers teaching multiplication and division to grade 3 and 4 learners in Western Province, Zambia. This was done in order to understand the strategies that they employ and to identify the challenges they may be encountering.

1.5 Justification of the Study

Most of the studies in Zambia focussed on causes of poor performance in terms of anxiety, attitude, perception, self-concept and self-efficacy, and it appears there is little known about any study of this nature in Western Province and as such the knowledge gap exists on the strategies teachers use for teaching and learning of multiplication and division on performance of grade 3 and 4 learners of Sioma and Mongu districts in western province, Zambia. This will help the researcher to understand the challenges faced and take an immediate action.

1.6 Objectives of the Study

The study was guided by the following objectives:

i To establish strategies teachers use when teaching multiplication and division at grade 3 and 4
ii To establish strategies grade 3 and 4 learners use when solving multiplication and division problems.
iii To explore challenges teachers and learners experience in the teaching and learning of multiplication and division

1.7 Research Questions

The study was guided by the following questions:

i   What strategies do teachers use when teaching multiplication and division?

ii   What strategies do grade 3 and 4 learners use when solving multiplication and division problems?

iii   Why do teachers and learners find teaching and learning of multiplication and division challenging?

1.8 Significance of the Study

It is hoped that the information generated from this study may help the government to put up deliberate measures to enhance the teaching and learning of multiplication and division in mathematics at lower grades in order to improve learner performance since multiplication and division form a strong foundation of teaching and learning of mathematics. It will further contribute to the existing body of knowledge in the learning and teaching of multiplication and division at primary school level and how children learn mathematics. The results could also be used by MoGE in policy making. The Examination Council of Zambia (ECZ) and the Curriculum Development centre (CDC) can also use the results for assessment and evaluation purposes.

1.9 Theoretical Framework

The study was guided by constructivists' theory of learning whose beliefs are that learners construct their own knowledge through activities. The activities are very important to a child because they help a learner to be actively involved in the learning processes. In the classroom, the constructivist view of learning can point towards a variety of teaching practices (Bada, 2015). This is in line with the revised curriculum where team work is encouraged (MESVTEE, 2013). Constructivism states that learners are builders of their own cognitive tools as well as their external realities. Constructivist theory is one of a major referent in education and a philosophical stance on human knowledge (Taber, 2011). The implication here is that knowledge and meaningful realities are constructed by the knower, in this study strategies used by teachers and the challenges may be clear to the researcher after observing and interviewing the teachers and pupils in classrooms.

Additionally Muijs and Reynolds, (2011, P. 88) say "constructivism is a teaching philosophy that has made strong inroads among teachers and teacher educators in recent decades.)".

Researchers have established a number of teaching strategies although varied and often subject - specific including: linking new ideas to previous knowledge, modelling, scaffolding, coaching, reflection, and teamwork (Muijs &Reynolds, 2011). It should be observed that these strategies may be integrated during the learning process in the classroom by the teacher. Taber, (2011, p. 40) says that, "constructivism as an education theory, comprises of ideas about how human learning occurs, and ideas about how curriculum and instruction should be designed to best respond to educational purposes given what is understood about learning".

In order for learners to builder their own cognitive tools as well as their external realities, they should be encouraged to construct their own knowledge (experiments, real-world problem solving), create more knowledge and then to reflect on and talk about what they are doing and how their understanding is changing. The implication is that the learner is at the centre of learning and the learner should search for meaning from learning environment.

The main constructivist theorists were Piaget, Vygotsky and Dewey. The main concepts in the theory are that learning is an active process of constructing rather than acquiring knowledge and instruction is a process of supporting knowledge construction rather than communicating knowledge. An active process allows learners discover and construct new ideas based on their current knowledge. The implication is that teaching creates knowledge awareness to learners. The teacher's role in this case is to ensure that all learners actively participate in the process of learning and any theory of learning which ignores resistances to learning misses the point (Ackermann, 2004).

It is therefore, important to consider that learners actively discover and construct new ideas/concepts based on their prior knowledge. In order to acquire knowledge, two things should be bone to a teachers mind that each pupil construct his or her own knowledge and also each pupil should cooperate with others to fully grasp the new knowledge (Richardson, 2003) Furthermore, learners who have hands on experience during learning might acquire solving skills and improve on their proficiency levels in mathematics at large. The teacher in this case is a key player whose responsibility is to purposively manipulate the learning environment in order for children to learn. The theoretical framework is ideal for this study because a significant portion of middle school mathematics deals with ideas within its framework. Solid understanding of multiplication (and division) in elementary school is essential for learners success (Watanabe, 2003). Socially constructed reality is seen as an ongoing, dynamic process reproduced by individuals acting on their interpretation of knowledge

1.10 Delimitation of the study

Delimitations according to Cresswell (1994) are used to address how the study is narrowed in scope. Western Province was chosen because records from ECZ showed that there was poor performance in the National Examinations at Grade 7 levels, hence there was need to ascertain the effect of teaching and learning multiplication and division on performance of grade 3 and 4 as the foundation in mathematics. There were two districts that participated, namely Sioma and Mongu involving five schools during the study.

1.11 Limitations of the Study

Best and Kahn (2009) explain that limitations are those conditions which are beyond the control of the researcher and may also place restrictions on the conclusion of a particular study. For this study, the major limitation that was failure to generalise the research finding to the whole nation due to the limited sample involved and confinement of the study. Failure to do pre-test and post- test due to high rate of absenteeism in schools

1.12 Organisation of the Study

The study is organised into six chapters. The first chapter comprises the introduction, statement of the problem, purpose of the study, study objective, research questions, Significance of the study, the theoretical framework, delimitation, and definition of operational terms. Chapter two consists of literature review, while chapter three contains methodology. The research findings are presented in chapter four, while chapter five consists of discussion of the findings and chapter six contains the conclusion and the recommendations. The report ends with references and appendices.

1.13 Operational Definitions

Strategies: In this study the term referred to methods teachers choose for the purpose of instruction

Reasoning: By this the researcher meant the process of thinking and drawing conclusion

Repeated subtraction: Subtracting numbers in a group n times where use of the term "take away, "subtract", "minus" is verbalised as distinguishing feature, for example 20 take away 5 is 15 (n) times in this research study meant the number varies depending on the question given.

Repeated addition: In this research study it meant adding the number in a group n times, where use of term "and" is verbalised as a distinguishing feature, for example "five and five are ten and five are fifteen".

Upgrade: In this research referred to knowledge added to teachers existing knowledge through school based continuous professional development/further training

Best lessons: For the researcher referred to delivering a planned lesson where a teacher is able to communicate to his/her learners effectively the planned material.

Unobtrusive manner: The researcher meant having no control over / playing passive and nonintrusive role

Skill acquisition: In the study meant ability to solve multiplication and division using the strategies taught/ learnt

Good foundation: In this study good foundation means use of variety of strategies such as repeated addition, regrouping, multiplication table forward and backward counting to learn multiplication and division.

1.14. Ethical Considerations

Clearance for the study was obtained from the University of Zambia ethics committee. The researcher obtained a letter from the District Education Board Secretary (DEBS) who in turn wrote a letter authorising the researcher to visit the selected schools in the two districts. At school level the Head teachers introduced the researcher to grade 3 and 4 teachers, then arrangements were made to come back to observe and interview the teachers, and give a test to the pupils. During data collection, participants were treated with respect and an explanation was given to them that the information they needed to provide was for academic purpose and that it would remain confidential. The findings were shared with the participants in order for them to react. The class teacher then informed the learners that they were going to write a test at the end of the topic (multiplication and division). Permission for learners was sought from parents, those whose parents did not allow them were not part of the sample.

1.15   Summary

 This chapter covered the introduction to the study. The background to this study emanated from the need to investigate the strategies teachers use to solve multiplication and division and the challenges they faced. It has been shown that Zambia performance in mathematics is still problematic as evidenced by SACMEQ III and the National Assessment results which has been low over the years. In view of this strategies may offer a solution to improving learner performance by means of constructivist approach of learning whose beliefs are that learners construct their own understanding.

<center>**CHAPTER TWO: INTRODUCTION**</center>

2.1 Overview

This chapter presents various related literature to the current study. The chapter included the following; multiplication and division, the views of constructivists approach on learning, learning/teaching strategies, understanding/knowledge, major findings of the reviewed related studies, methodologies used for the studies and finally conclusion of the findings. This study focussed on strategies used in teaching and learning of multiplication and division at grade 3 and 4 because these are basic topics in mathematics which form a foundation in the learning and teaching of mathematics in higher grades. This is because most of the topics are related to multiplication and division such as measurements ratio and proportion, fractions and mensuration.

2.2 Teaching and Learning strategies in Multiplication and Division

Multiplication and division as described by Berdynaj and Vula (2011) are simply fundamental operations and their relations are basic mathematical concepts that are normally taught at primary level. For example the National research Council, (2001) stated that,

> Division arises from the two splitting situations … A collection is split into groups of a specified size or into a specified number of groups. Just as subtraction can be thought of using a part-whole relation, division can be thought of as splitting a number into two factors. Hence division can be approached as finding a missing factor in multiplication. For example, $72 \div 9 = ?$ Can be thought of as $9 \times ? = 72$.

Acquisition of these concepts and their relations may enable pupils to develop the understanding of numbers and calculating strategies as well as associating them with everyday life problems. However depending on how these strategies are introduced to learners, Berdynaj and Vula, (2011) argued that strategies used to introduce multiplication and division presents future challenge of learning mathematical concepts and resulted in pupils negative performances in mathematics. This study intends to observe and interview teachers in order to understand the strategies teachers and learners use during lessons. This may give the researcher an opportunity to compare what happens in class and what the teacher says does in class during interview session. Additionally, Nakawa (2013) revealed that teaching of multiplication was mainly on computational skills without considering the conceptual understanding of multiplication. This study further seeks to find out how the strategies may contribute to low performance especially if not carefully handled. As such instructional

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strategies are very important because they help learners construct their own understanding. However, Lawson and Rizvi (2007) argued that both prospective and practising teachers often seem to have insufficient knowledge in the concept of multiplication and division. If teachers were incompetent in teaching such key topics in mathematics it may have effects on the performance of the learners in higher grades. The cause of the problem may be the models teachers use to teach multiplication and division such as fair sharing and repeated addition/subtraction. Little is known about strategies used in teaching and learning of multiplication and division at grade 3 and 4 in Western Province of Zambia. This gap identified is important because basic understandings of multiplication together with computation skills are essential for children to grow academically (Nakawa, 2013; O'Connell & Sangiovanni, 2011). Therefore, the objective of every teacher of mathematics remains the same, helping learners to understand multiplication and division, and to help them lay a firm foundation rather than simply relying on memory.

Additionally, researchers such as Holdheide, McGraner and VanDerheyden (2011) revealed that a focus on understanding multiplication and division facts provide a strong foundation in learning and teaching of mathematics in further grades and advised that, central to raising students' achievement in mathematics is improving the quality of mathematics teaching. Basing on social constructivist theory of learning learners create own knowledge when they construct own understanding by means of hands on experiences. With regard to this study understanding the strategies teachers use and the challenges they face will help the researcher to come up ways of helping teachers overcome the difficulties they face.

For example, Herold (2013) did a research on coming up with some strategies to improve performance of learners who were struggling with multiplication facts. The students were divided into three groups based on mathematics quarterly assessments. Groups consisted of interactive-based activities, computer-based drill, and paper and pencil-based (Cover, Copy, Compare: CCC) activities. Each group practiced multiplication facts for ten minutes every day for a month in addition to their regularly scheduled mathematics instruction. The interactive group practiced multiplication facts using manipulative, songs, games, and other hands-on materials. The computer-based group completed problems on an internet website where they correctly completed as many quizzes as they could during the allotted time. The CCC group completed problems using a paper and pencil-based strategy. Data revealed that students who learnt multiplication facts through interactive lessons experienced greater increases in their short term and long term recall of multiplication facts compared with students who learned facts through computer and paper and pencil- based strategies. The implication is that learners who used interactive method constructed their own knowledge. This is in agreement with National Research council (2001, p. 193) that "practicing single digit calculations is essential

for developing fluency with them. The practice can occur in many different contexts, including solving word problems." Other researchers confirmed that practice that follow important initial experiences that support understanding and emphases on thinking strategies has been shown to improve student achievement with single-digit calculations. National Research Council (2001). Hence the need for a survey of the strategies teachers use in the selected schools in Western Province, Zambia.

Hideyuki (2014) observed that most of the teachers followed a routine procedure of teaching which ended as a transfer of knowledge from teacher to pupil. The implication here is that constructivist approach of teaching may not be adhered to when teachers follow the routine procedure. Furthermore, knowledge of basic multiplication facts supports pupils in carrying out more complex computations with more than one digit (Ontario Ministry of Education [OMOE], 2006). Therefore, a constructive approach of teaching would enable learners develop skills in multiplying and dividing numbers with more than one digit because:

> Many strategies for multi-digit multiplication depend on decomposing numbers to hundreds, tens, and ones, it is important that students develop skill in multiplying numbers by multiples of 10. For example, students in the junior grades should recognize patterns such as $7 \times 8 = 56$, $7 \times 80 = 560$, $7 \times 800 = 5600$, and $7 \times 8000 = 56\ 000$ (OMOE, 2006.p. 16).

Additionally, OMOE (2006) suggests a number of strategies which can equip the pupils with skills of multiplying and dividing. Traditional approaches teachers use may have a negative effect on learners which begins to form during the elementary school years if teachers focus is on the mastery of standard algorithms rather than on conceptual understanding. Some of the strategies used in OMOE (2006) are worthy trying in our schools. In line with this view, multiplication is difficult to both learners and teachers because of the strategies used to introduce it to the learners. For example Mulligan (2002, p. 25) "children's solution strategies to a variety of multiplication and division word problems were analysed at four interview stages in a 2-year longitudinal study," the results indicated that performance levels generally improved at each interview stage. Mulligan further subscribe to a variety of different viewpoints about how knowledge is acquired including constructivist view of learning which this study also ascribe to.

Harries and Suggate (2006) argued that representations utilising concrete objects such as plates of strawberry would not adequately represent the commutative and distributive nature of multiplications (7×6 or 6×7). Additionally representation of 7×6 on a number line would also look different and it would be extremely difficult to show $(5+2) \times (5+1)$ on a number line

but the arrays show these aspects of multiplication clearly. The conclusion drawn was that the array presentation was better than other presentations because it could support pupils' calculations and show clearly the aspect of multiplication (such as commutative and distributive property), although they pointed out that these same aspects contained within the arrays were not necessarily visible to pupils. They needed to make some links across the presentations hence the need for a variety of presentations to allow learners reflect on and compare them. Similarly (Council, 2001) (2004) informs us that two meanings of multiplication are used, repeated addition and number of equal sized groups the total of which can be written as multiplication. The latter meaning links more closely to division, which is usually introduced as how many groups of certain size can be formed from the given amount. The different strategies allow the learner to have a variety of thinking strategies and to link multiplication to division. The array representation is ideal for teaching multiplication and division because learners can use different strategies to find the solution in a constructive way and build their own knowledge. Interviewing and observing lessons identify the study with constructivist approach of learning because the researcher will get first-hand information. The researcher's analysis of data uses common sense which may link phenomena to the study.

 Contrary to Berdynaj and Vula (2011), Lawson and Rizvi (2007) and Nakawa (2013) who argued that strategies used such as repeated addition/subtraction to introduce multiplication and division presents a future challenge of learning mathematics. McIntosh and Ramagge (2011) is of the view that there were some useful foundations necessary for multiplication and division of whole numbers namely experience with forwards and backwards skip counting, doubling and halving small numbers. Additionally, Mclntosh and Ramagge (2011) maintain that multiplication could be termed as repeated addition for whole numbers and in situations dealing with finding totals of numbers in a collection and later children should see multiplication as much more than repeated addition. In short both teachers and learners should be able to note that multiplication and division are related arithmetic operations which arise from everyday operations. In order to do so teachers could purposively plan different activities and use a variety of strategies to allow each child reflect on the activities used and link them to familiar situations they already know, these activities may help learners build their own understanding.

 Nakawa (2013) noted that when teaching multiplication the emphasis was on computational skills and not on the conceptual understanding of multiplication in the outcome of learning stated in the syllabus and textbooks. The lesson observed was in accordance with the syllabus and textbooks in the teacher-centred approach. The teaching focussed on computation skills without considering the conceptual understanding of multiplication. Nakawa (2013) stressed the need to reconsider the conceptual understanding of multiplication in the early stage of

learning by elaborating multiple presentations such as regrouping and doubling in the combination of concrete, semi concrete and abstract expressions in practice. This issue seems very serious in that poor performance in mathematics may emanate from lack of understanding of multiplication and division because the topics form a basic foundation in the learning of mathematics. Additionally school certificate and general certificate results in Zambia continuously show unsatisfactory performance, however, most of the studies in Zambia focussed on causes of poor performance in terms of anxiety, attitude, perception, self-concept and self-efficacy (Chifwembe, 2010). The study's focus was to interview and observe teachers in the selected schools to see if the strategies used to teach and learn multiplication and division may be contributing to the low performance. For example, primary school is the beginning of formal education. At this level, children formally learn mathematics and when they arrive at school they come with knowledge of counting and simple understanding of addition, subtraction and even sharing and regrouping of objects as they play with their toys and/or with friends. Children then learn multiplication by using concrete objects such as counters and count all. For division situations children may physically share objects. The need for strategies come later, although as we shall see later on that these strategies may be ignored while some of the teachers just remember them but do not remember how to use them.

Mclntosh and Ramagge (2011, p. 4) further said that, "one way of thinking of multiplication is as repeated addition. Multiplicative situations arise when finding a total of a number of collections or measurements of equal size. Arrays are a good way to illustrate this. Some division problems arise when we try to break up a quantity into groups of equal size and when we try to undo multiplications". Hart (2004, p. 9) further states that multiplication is a "number of equal sized groups the total of which can be written as a multiplication". This suggests that multiplication and division may be linked together and taught in a way that could help learners associate the two operations. The implication of this is that multiplication and division should be taught in a meaningful way, relating it to everyday life situations familiar to the pupils. As learners interact with the teaching materials and among/between themselves they begin to build concepts and learn from one another. The activity described here may help learners relate multiplication to division as they break up the quantities into groups of equal sizes. In line with the study the method employed was appropriate because the researcher was able to see the activities during observations and the constructivist approach in play. Learners may build their own understanding through activities of regrouping and grouping sets of equal sizes. For example; If John has 3 sons and buys 4 mangoes for each how many mangoes will buy altogether? The answer to this can be obtained in different ways such as $3 + 3 + 3 + 3 = 12$, or $3 \times 4 = 12$ or $4 \times 3 = 12$

According to O'Connell and Sangiovanni (2011), teachers of mathematics want their students to develop a quick recall of single digit when dealing with the four basic operations in mathematics. These operations (addition, subtraction, multiplication, and division) provide a foundation of mathematics success. Teachers expect that all students will master these basic skills, but that is not a simple goal to achieve. This is because pupils have different abilities; some pupils effortlessly remember the facts and others struggle with the very same task. Additionally, teachers also labour to find the right strategies and activities to help all pupils succeed. Hence the need for teachers to use a variety of strategies in order to help learners learn with ease and address their different abilities of learning. Keirinkan, (2012) the textbooks in entitled Fun with maths 3A, 3B and 4B for Elementary School have a note to parent/teacher explaining how to use the books, probably to ensure that any user receives guidance on how to use it. These books for sure have a variety of strategies and link the previous knowledge to present/ what will be learnt giving the children rich background at elementary level. Although these pupils have different abilities of learning, the goal for each one of them is the same: to master the basic Multiplication and division facts so that they have a strong foundation for more complex mathematics skills and procedure. To achieve this goal, (O'Connell & Sangiovanni 2011) explored numerous strategies and activities that support all students in understanding basic multiplication and division facts and committing those facts to memory. Their work supplies teachers with insight and activities to simplify this complex, but critical, component of mathematics teaching. Should the multiplication and division topics be taught appropriately, then, the primary aims of the curriculum may go a long way in being met, which is to "enable pupils to write clearly, correctly and confidently in Zambian language and in English, and to acquire basic numeracy and problem solving skills," (MOE, 1996, p.34). The focus here was to ensure that those who leave school were able to function effectively in society, while those who continue in school learn without difficulties. In line with the study if learners were exposed to these strategies they could develop thinking skills that may be useful in everyday life. Teaching strategies are ways of organising pupils so that a teacher could instruct them. In most of the schools in Sioma and Mongu districts, pupils are overcrowded. This brings challenges to teachers on how they could meet the educational needs of their learners and on which appropriate strategy to use when teaching such crowded classes. Mwamba, (2013, p.36) revealed that, "the learning difficulties came about as a result of specific learning disabilities, poor teaching pedagogy, inadequate teaching and learning resources, ill-trained teachers and overcrowded classes at grade 1-4". Quist (2000, p.26) observes that, "primary schools normally have classes of 35-45 pupils but there are schools where the class size may double that number." This scenario is true in Sioma and Mongu districts; learners in most of the schools visited by standards officers have classes of 60 pupils in some cases more than 90 pupils.

The study assumes that teachers have challenges in communicating knowledge to learners in multiplication and division lessons due to such overcrowded classes. For example no communication takes place and also if the teacher uses teacher centred strategies, the learner would be cut off and start doing other things hindering communication to take place. If communication does not take place at lower grade a gap or hole may be created which may be difficult to close up until higher grades. Hart (2004, p. 12) states that "leaving a hole in pupils knowledge and understanding just leads to further errors later." As described by Tanya (2011); Quist (2000) that learning is a product of interaction, depending on the epistemology underlying the learners learning design. In this regard, learners might interact with instructors and tutors, with content and/or with other people as such teachers need to understand how, why and when their learners are learning or else it would be impossible to improve their teaching and achieve high levels of learning. The learner may feel safe and comfortable if teachers use a variety of strategies. Little is known about what strategies teachers and learners use when teaching and learning multiplication and division at lower grades in Western Province of Zambia, this is the gap the research identified. In order to communicate effectively a constructivist classroom could give learners an opportunity to think critically and analytically. This can be achieved by organising content which is relevant to them and put in a sequence learners can follow. Do teachers often assume that, because they are "teaching," students must be learning? Quist (2000) pointed out that the ideal learning situation needs to make use of a variety of strategies. This is important because pupils also learn in a variety of ways, some master concepts easily while others struggle to remember simple facts. The role of the teacher, therefore, is to help both the slow and fast learners to master the concepts and enable them build a strong foundation in readiness for difficult/complex mathematics skills and procedures especially when teaching multiplication and division. According to (Bada, 2015, p. 67). "The perceived benefits of constructivist learning may be particularly valuable where the teaching of complex skills ... are concerned". The implication of this is that teachers should create learning environment conducive for learners to use hands on experience. For instance, strategies suggested by (O'connel and Sangiovanni (2011), that starting teaching 0,1,2, 5 and 10 might help the pupils to form a basic foundation for understanding multiplying and dividing numbers, in the sense that they will be able to recall that when multiplying by 0 the result is always zero and when multiplying by 1 the product is that number being multiplied, multiplying by 2 is the same as doubling the number, multiplying by 5 the product is half of the number being multiplied by 5 in the tens place and in one's place the digit is 0 when even and 5 when the number multiplied is old. "Once 0, 1, 2, 5, and 10 are mastered, students have developed a strong foundation on which to build mastery of the remaining facts" O'connel and Sangiovanni (2011, p. 9). This would allow learners to build networks which would assist them learn mathematics in higher grades.

2.3 Constructivists Approach Theorists

Constructivists believe that learners should be actively involved in the learning process in order for them to construct their own knowledge. Woolfolk (2010, p.311) agrees that most constructivists theorists state that, "Learners are active in constructing their own knowledge and that social interactions are important in knowledge construction". For example Taber (2011) says that "every student in class will bring unique conceptual and cognitive resources to bear on a lesson" (p. 54). The implication is that when these resources are combined during social interaction the learners would learn from one another and eventually build their own knowledge. The researcher therefore supports the view that learners construct their own knowledge and fundamentally, constructivism says that people construct their own understanding through experiencing things. Furthermore, learning may occur when individuals integrate new knowledge with existing knowledge and … when learners are actively engaged in the learning process" as advocated by Tracey and Morrow (2006, p. 47). Also Farrant (1980) confirms that, Piagets theories of learning have contributed to the firm establishment of child-centred education in schools. For example, sharing of 33 sweets among three children may not be so easy to them. It therefore requires that the learners do the actual sharing of sweets or a teacher could use counters in place of sweets in order for learners to illustrate the division process by means of concrete objects (grouping them in groups of 11 or 3 illustrating the two factors involved). If a learner divides a packet of 33 sweets into 11 groups, how many sweets will be parked in each group? How could teachers promote active learning in their teaching? The same question of 33 sweets could be given to learners in form of research that if a rectangle has area of 33 square units and its breadth is 3 centimetres, find the width. Similarly the National Research Council (2001, p. 192) state that, "a collection is split into groups of a specified number of groups. …division can also be approached as finding a missing factor in multiplication." A good example could be $81 \div 9 =?$ Can be thought as $9 \times - = 81$. As such a child may have a wide range of ideas and variety of strategies to use. Taber (2011) suggested that a teacher should therefore lay ground work for active learning by determining particular learning activities as well as considering the learner and material to be learnt. Taber further pointed out that the individual has to actively construct a meaningful interpretation of what is seen and heard. Each learner needs to think critically on the information and make some connections to the network of information he/she has already learnt in the past. (Taber, 2011).

2.4 Understanding/Knowledge

Understanding is to make link/connections between different ideas or concepts. Barmby, Harries and Higgins (2009) described understanding of mathematics as involving the building

up of conceptual network in connection with mental presentations. Understanding, therefore, implies that both teachers and learners keep on building on their knowledge through critical thinking or reasoning. Nakawa (2013) observed that teacher's limitation of their subject matter knowledge of mathematics hindered some from expected improvement. This could be a challenge in the sense that the teacher may be aware of his or her own inadequacy in the subject (mathematics) leading to avoiding teaching some topics, which may be difficult for him or her. This might create a knowledge gap in the learners future academic life in this case I refer to teaching using strategies reviewed in this study may be problematic to some teachers. Shulman (1986, p.5) stated that, "The person who presumes to teach subject matter to children must demonstrate knowledge of that subject matter as a prerequisite to teaching". For example table 3 shows what to be taught at grade 3 and 4 curriculum, the content and the objectives to be achieved by learners, so knowledge to be taught is key to learners' progression in higher grades.

Table 3: Outcomes/objectives and skills learners should have at the end of grade 3 and 4

Grade	Specific outcomes	Skills
3	Multiply two and three digit numbers by a single digit number vertically. Apply multiplication in real life situation.	*Multiplication* of two and three digit by single digit numbers *Accuracy* in *computations* *Application* of place values
3	Divide two and three digit numbers by single digit number using Long division (with remainders). Demonstrate multiplication and division skills in real life situations	*Division* of two and three digit by single digit numbers *Accuracy* in *computations* *Identification* of the long division symbol *Application* of division to real life
4	Multiply numbers by 10, 100 and 1000 using short multiplication. Multiply two and three by two digit numbers using vertical multiplication. Apply the properties of zero (0) and one (1) in multiplication Apply multiplication to solve problems in real life.	*Multiplication* of two and three digit by two digit numbers *Accuracy* in *computations* *Application* of place values
4	Divide numbers by 10, 100 and 1000 using short division. Divide two and three digit by two digit numbers using long division (with remainders). Apply division to solve problems in real life	*Division* of two and three digit by two digit numbers *Accuracy* in *computations* *Application* of division to real life

Source: MESVTEE (2013)

Suffice to say that learning of multiplication and division is a process, which requires active involvement in order to develop skill proficiencies in students as they learn mathematics. Teachers, role therefore, is to provide opportunities for learners to get engaged in the learning

process, through activities that allow learners to explore and understand mathematics on their own. The knowledge teachers have therefore, needed to be upgraded so that they could improve on the subject knowledge and build strong representational-reasoning model of understanding. This may improve children's network of understanding and enable them to think in a variety of ways. For example if a child is given to multiply 3×2 and later on the child is given 20×300, the child should make connection of the two problems and find the solution without any difficulties. However, it must be noted that three aspects of teacher knowledge relates to the teaching and learning of multiplication and division; Knowledge of the topic(s), knowledge of students learning and pedagogical content knowledge (Shulman, 1986). The knowledge of teachers' mathematical knowledge affects what is taught and how it is communicated or taught to the learners. Additionally, teachers' knowledge of how pupils come to know and how their existing knowledge may affect their construction of new knowledge. This may also help teachers to be aware of students strengths and weaknesses and also the level at which each learner is at. Pedagogical content knowledge helps teachers to transform the mathematics into means by which its learning can be facilitated which includes "ways of representing and formulating the subject that makes it comprehensible to others" (Shulman, 1986, p.9). Hence the need for variety of strategies of teaching.

2. 5 Summary of Reviewed Literature

The literature revealed that multiplication and division are fundamental operations and their relations are basic mathematical concepts taught at primary level, as such it is important that every student at this level is well grounded so as to help them all the way through higher levels of education. In addition as pupils have different abilities, there is need for the teachers to explore numerous strategies so as to support all students in understanding basic multiplication and division facts and committing them to the memory. Furthermore, as has been advanced by constructivists, learners should be actively involved in the learning process in order to integrate new knowledge with already existing knowledge. The application of constructivist theory of learning would improve learner performance. There is need to reconsider the conceptual understanding of multiplication and division in the early stage of learning. This issue appears very serious in that poor performance in mathematics has remained stagnant over the years. The study argue that poor performance emanate from lack of understanding of multiplication and division by learners due to strategies use to teach multiplication and division. The reason is that multiplication and division topics form a basic foundation in the learning of mathematics. The present study asserts that teaching and learning of multiplication and division at grade 3 and 4 may be one of the causes of poor performance at higher grades, for example the literature review, revealed that there was a gap in strategies teachers and learners use in teaching and learning multiplication and division and seeks to find out some of

the challenges faced by teachers and learners in the selected schools which requires immediate attention by all stakeholders.

CHAPTER THREE: METHODOLOGY

3.1 Overview

This chapter discusses the methodology that was used to carry out this research. Burns and Groves (2005) noted that research methodology is important to help address a research problem in a meaningful way. In addition, Orodho (2003) also explains methodology as the scheme plan used to generate responses to research questions. As such this chapter focuses on research design and setting; study population, study sample and sampling techniques; data collection instruments and techniques and the data obtained, pilot study and description of ethical considerations that were made during data collection; data analysis and dissemination of results and it ends with a chapter summary.

3.2 Research Design

Research design is an overall plan for collecting and analysing data. It includes specification for enhancing the internal and external validity of the study (Burns & Groves, 2005). The design helps to arrive at answers to the research questions or testing research hypothesis, it further spells out in advance basic strategies that the researcher adapts to obtain and present information that is accurate and interpretable during the study (Basavanthappa, 2006).

The study was purely qualitative, and a phenomenological none interventional descriptive design was used because no interventions were done. The study was descriptive in nature because it sought to describe the views, opinions, perceptions and understanding of people (teachers and pupils) on strategies of teaching and learning of multiplication and division (Fraenkel & Wallen, 2006). The study employed qualitative method to collect data through interviews done in a natural setting. Going by Cresswell (2009, p. 4) who stated that "… a qualitative research is a means of exploring and understanding the individual or group attributed to a social human problem." Therefore, this entails that an individual or group becomes the hub of the study.

3.3 Target Population

Kombo and Tromp (2014, p. 76) referred to population as "… a group of individuals objects or items from which samples are taken for measurement." The target population included grade 3 and 4 pupils as well as their class teachers from the selected 5 schools of Sioma and Mongu districts in western province from which a representative sample was drawn.

3.4 Sample Size

Orodho and Kombo (2002) say that a sample is a selected number of individuals or objects from a population. The selected sample contains elements representative of the characteristics found in the entire group. The goal was to select participants in a strategic way and ensure that those sampled were relevant to the research study as advised by Bryman (2012). For this study, the sample comprised of 20 teachers out of which 2 focus group discussions where formed drawn from the target population and 10 participated in lesson observation, and individual interviews for the purpose of triangulation. The teachers were observed first and later interviewed to cross check the results. In some cases teachers were interviewed first then observed. This situation happened if the teacher had lessons in the afternoon session, the researcher had to arrange to meet the teacher an hour before the session began in order to avoid disturbing the lessons. This was ideal because after observation the teacher had to continue with her normal routine. The other 10 were informants drawn from the 5 selected schools. These informants were also teaching grades 3 and 4. There were 86(46 from grade 3 and 40 from grade 4) pupils that participated by taking the test. These were conveniently sampled and out of which10 participated in the interview from one institution based on their performance in the test they were given (below minimum, average and outstanding) (see section 3.4). The children were given assent forms to give their parent to sign and only those whose parents consented participated in the study. The 86 learners signed the assent forms and their parents too assented.

3.5 Sampling Techniques

This study employed convenient sampling to select the 5 schools (2 from Mongu and 3 from Sioma) in Western Province. The teachers and the grade 3 and 4 classes were conveniently sampled. Convenient sample is advocated for by Cohen, Manion and Morrison (2007, p. 114) that the sample depends on "those who happen to be available and accessible". Bryman (2012, p. 201) say that "convenient sample is one that is simply available to the researcher by virtue of its accessibility." In relation to this study grade 3 and 4 classes were sampled both teachers and the learners so whoever was found at the school was interviewed and observed. In case of the learners a consent forms were sent to parents. Those learners whose parents did not allow them or did not respond were not selected. The learners were selected to elicit more information on how learners solve multiplication and division question and assess if they showed understanding. From the 86 learners 10 were selected from one school to answer questions in order to cross check what the teachers said during the interview sessions.

3.6 Research Instruments

The study employed semi-structured interviews, lesson observations, audio-video recordings/voice recording, Focus group discussion and a test. The following data collection procedure was followed

3.5.1. Semi-structured interviews

Semi-structured interviews were used in order to collect in-depth information from the participants. They were semi-structured in design because of different situations encountered in the field. Semi-structured interviews allowed the researcher freedom of probing further on the views of the interviewees. According to Lindlof and Taylor (2000) the advantage of a semi structured interview guide is that it allows for new questions to be brought up during the interview as a result of what the interviewee says.

3.5.2. Focus Group Discussion Guide

The researcher used focus group guide during the focus group discussion where a voice recorder was used to record the interview sessions. Brayman (2008) states that focus group discussion is a type of group interview that embraces several respondents inclusive of the moderator. A topic for discussion is raised for the group to discuss. In this technique, participants hear or modify each other's views so that a collective meaning may be constructed within the session.

3.5.3. Observation Guide

An observation guide was used during lesson observations, this was for the purpose of cross checking the results from the interviews. Lessons were video recorded to allow the researcher view the lessons during data analysis. The researcher used pen and pad to record whatever happened during the lesson for analysis purposes.

3.5.4. A Test

The criterion referenced test which is used by MoGE, was adopted and administered to pupils, the test had four performance benchmarks, namely; Below Minimum Level of Performance (0-39), Minimum Level of Performance (40-60), Desirable Level of Performance (60-80) and Out Standing Level of Performance (80-100). Additionally, past performance mark sheets were

checked and the pupils interviewed completed a set of questions outlined in Appendix C. The pupils who were interviewed were got from the levels of performance outlined above.

3.6. Data Collection procedure

The information to establish how multiplication and division is taught at grade 3 and 4 was collected through face to face interviews, lesson observation, focus group discussion and a test was given to the pupils. This was done for the purpose of triangulation and it allowed the researcher to compare the information obtained from the participants. Additionally the test was given to help the researcher understand the strategies learners were using and identify challenges they had in order to compare them with those of their teachers.

Permission to conduct the research from districts was sought from the Provincial Education Officer (PEO) and at district office from the District Education Board Secretary (DEBS) of Western Province and permission for learners to participate was sought from parents those whose parents did not respond their scripts were automatically left out for the analysis.

Data collection took place in the second term of the Zambian school calendar of the year 2016. The researcher visited the schools at the beginning of the term to arrange for research and collected data from the teachers and written test for the purpose of document analysis of the learners strategies used to solve multiplication and division. The test was again given at the end of the topic to see if learners continued using the same strategies they were using at the beginning of the topic. Data analysis continued up to January, 2017.

3.6.1 One on One interview.

During one-on-one interviews semi-structured questions were used in order to elicit in-depth information from the participants (see section 3.5.1). The respondents were assured of ethical considerations that the information was purely for academic purposes. Additionally, permission to voice record was sought from the respondents. This was to ensure that a correct record was obtained.

3.6.2. Lesson Observation

Lesson observations in grade 3 and 4 took place soon after the interview in some cases observation was done first then interviews followed so as to cross check the results. This was done for the purpose of triangulation. The observation was appropriate because it allowed the researcher have hands on experience, compare the information obtained from the interview

session then create own understanding of the data through codified common sense. Tachipondwa (2013, p.130) pointed that "observation strategies collect qualitative data and are suitable for investigating phenomena that can be observed directly." This helped the researcher to notice things teachers may take for granted. The lessons were video recorded in order to capture factual information on the strategies teachers and learners used when teaching and learning multiplication and division and identify some of the challenges faced.

3.6.3. Focus Group Discussion

Focus group discussion was employed to get views from several respondents at once (see section 3.5.2). The researcher welcomed the participants and assured them that the information was purely for academic purposes. Additionally, before the interview the respondents were put at ease and the purpose of the study was explained to them. They were told that they could ask for clarifications where they did not understand certain information during the interview session. At the end of each interview the respondents were thanked for their participation.

3.6.4 A Test

A test given to learners on multiplication and division was based on the current syllabi for the Zambian curriculum and helped the researcher to verify the claims made by teachers during interviews. Pupils were given a test at the end of multiplication and division topics so as to collect information on the strategies learners used to solve multiplication and division problems. Furthermore, the sampled learners were selected to elicit more information from their written work and the challenges they encountered.

3.7 Data Analysis

Data analysis is a process of making sense of, interpreting and theorising data or it signifies a search for general statements among categories of data (Vosloo, 2014). Data collected from the semi-structured interviews, lesson observations and Focus Group Discussions were qualitatively analysed by systematically putting them into categories and themes that emerged from the data. The qualitative analysis was used for the purpose of getting first-hand information and is closer to codified common sense. Further it allows a researcher to get the information in a constructive approach (Vosloo, 2014). The researcher was the natural thing that brought the ideas together through critical analysis. A test was analysed using SPSS and Microsoft Excel to form descriptive tables, then a conclusion was drawn by means of theoretical proposition

3.8 Pilot Study

 The pilot study was carried out at two nearby schools in Sioma. A test and interview were carried out. This was undertaken to test for reliability and validity of the tools. The purpose of conducting the pilot study was to test the study tools and it gave insight on how the research process would be conducted.

3.9 Chapter Summary

 This chapter presented the methodology that was used in the study; it was purely a qualitative study which employed interviews, lesson observation and learners were given a test in order to cross check the responses teachers were giving. The research used convenient sampling to sample teachers and learners. The total sample was 20 teachers and 86 (10 were interviewed selected from the same 86 using high score medium and the lowest) pupils. Data was thematically analysed and themes were generated from the data which tallied with the literature reviewed. Finally the test results were analysed using Microsoft excel and SPSS. The following chapter give an account of the results obtained from the data.

CHAPTER FOUR: PRESENTATION OF FINDINGS

4.1 Overview.

This chapter presents the study findings on the strategies used by teachers in teaching and learning of multiplication and division at grade 3 and 4 in selected schools of Western Province, Zambia. The research findings are centred on the three objectives namely:

i   To establish strategies teachers use when teaching multiplication and division at grade 3 and 4

ii To establish strategies grade 3 and 4 learners use when solving multiplication and division problems.

iii To explore challenges teachers and learners experience in the teaching and learning of multiplication and division

The aim of the study was to understand the strategies teachers use to teach multiplication and division and identify the challenges they maybe encountering for immediate action. In order to collect factual information, the researcher carried out observations of lessons on multiplication and division for grade 3 and 4 classes. Additionally one-on-one semi-structured interviews were conducted and 2 focus group discussions were carried out. Also the researcher gave a test to the learners and interviewed only 10 learners from one school because these learners were able to answer the question and expressed their views. The test was given in order to analyse the strategies learners used to solve multiplication and division problems. The other reason for giving a test was that during the pilot study most of the learners were not able to express themselves clearly when they were asked to give their views on the subject. The researcher then assumed that the written work by learners may express their views and thinking. Duration of the study lasted for about six months July 2016 to January 2017. This was preceded by a pilot study that lasted 3 weeks. The aim of the pilot study was to perfect the research questions.

4.1.1 What strategies do teachers use when teaching multiplication and division?

Participants (teachers sampled) were asked on the strategies that teachers used when teaching multiplication and division to grade 3 and 4, responses were obtained through one on one interviews, lesson observations and focus group discussions. Lesson observations were done with the same person after each interview (see chapter 3), with teachers. After each interview and lesson observation the researcher had to transcribe the field notes and then all the notes and transcripts were read thoroughly to gain an overview of information from the data

collected. The categories generated from the data were; repeated addition, re-grouping, equal sharing and 100 square charts, multiplication table, skip counting, mental work, repeated subtraction, Semi-concrete objects and equal sharing. Hart, (2004, p. 9), stated that "two meanings of multiplication are used." Repeated addition and a number of equal sized groups (re-grouping) the total which can be written as multiplication.

Table 4: **Strategies used by teachers when teaching multiplication and division grade 3 and 4 learners (drawn from all data sources)**

S/N	CATEGORY	THEME
1	Repeated addition, 100 square chart	Repeated addition
2	Repeated subtraction, Re-grouping Equal sharing	Re-grouping
3	Multiplication tables, Skip counting Mental work	Multiplication tables

Source: Field work

4.1.2 Repeated addition

When teachers were asked what strategies they used to teach multiplication and division, 18 out of 20 respondents interviewed said (one-on-one interview and Focus Group Discussion) and were also using repeated addition. Some of the responses were as follows:

> Multiplication work hand in hand with addition so when you teach multiplication and division pupils understand it, it will not be difficult for them to add because they practice it each and every day. (Children should have the background of addition). Learners should understand the symbols and explain the meaning of addition, multiplication is repeated addition/repetition said (T. Mwinga, Personal communication, July 19, 2016)

> I was teaching regrouping; first of all I started with addition say multiplication is repeated addition. Using concrete objects then when they are in grade 3 I use multiplication table, I even use songs 5 add another 5, 10; 10 add another 5, 15; and so on and so on. They sing a song by doing so they are learning multiplication, which is one of my strategies. (A. Lwiindi, Personal communication, July 19, 2016)

Similarly, during the interview conducted on 19 July 2016 G. Sianda said that. "I use repeated addition and concrete objects, I just collected stones and bottle tops". In another interview conducted at the same school on 19 July 2016 A. Lwindi shared similar sentiments that,

> In multiplication I would say we were teaching regrouping, first of all we started with addition say multiplication is repeated addition. Using concrete objects then when they are in grade 3 we use multiplication table, I even use songs 5 add another 5, 10, 10 add another 5, 15. They sing a song by doing so they are learning multiplication

4.1.3 Re-grouping

The other strategy which teachers use was regrouping. For example (B. sautu 2016, personal communication 19 July) confirmed that "I had to teach them that division is sharing where objects have to be shared equally, from there I had to introduce the concept of borrowing, let's say $21 \div 5$, they can't divide 5 into 2, they had to get 1 so that it becomes 21 then use concrete objects to divide…" and When it comes to division the same we are sharing, but when we are sharing pupils are able to master that concept they are sharing by smaller numbers, when it comes to bigger numbers it becomes 72 divide by 2, they misfire there because they do not know how to carry over, they do not know how to place values, 81 divide by 9, 9×9, instead of multiplying most of the learners were adding instead of multiplying, so I don't know whether it is the words problem which confused them or not …they misfired in the test (referring to the test given to the learners that they did not understand the questions). Maybe they thought it was walk over (K. Mulinga, Personal communication, July 19, 2016)

All the respondents had one common strategy as they introduced multiplication and division in the same way as repeated addition and re grouping and also using concrete object.

4.1.4. Multiplication tables

Data further revealed that teachers said used multiplication table as a strategy when teaching and learning multiplication and division. For example, study participant agreed that,

> "Pupils should be advised to learn the multiplication table if they can. This is a must, yes I think when they learn multiplication table even division will be easy for them. Sometimes you can use mental work, you give them mental work.

The other thing is that others have this new technology they use phones/calculators, they don't trouble themselves when it comes to show, their work they fail because they rely on their calculators (use of calculators hinder pupils from developing their mental capabilities). (A. Lwiindi, Personal communication, July 19, 2016)

Some respondents had mixed feeling about multiplication table strategy. (B. Sautu, 2016, Personal communication, July 19), confirmed that:" I introduce multiplication table, others find it difficult for example 3×6 they go to the table, although it was difficult".

During the interview session the respondent laughed and said,

… for them to know the multiplication table, I even allow them to use multiplication tables and allow them to find answers on the same multiplication table Multiplication using multiplication tables I usually relate it to repeated addition 2+2+2+2+2 translated to 2×5, 2 times 5 you add 2 five times division I just use the chalk board with big explanation hahahahah…so then when this goes into this, I use the chalk board for division. (A. Muwana, Personal communication, June 15, 2016)

Furthermore, the results obtained from lesson observations were characterised by activities like $15 \times 15 =$? Pili lwaeza ncwana (we write like this first) (15×10) + (15×5) mubale ma10 a fifteen (count 15 tens) (Teacher A. Akakubelwa, encouraged learners to count using fingers in order to track the answer by skip counting) alubale (lets count) 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150. Kalabo ki (the answer is) 150 + a lubale (lets count) ma five a fifteen 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, ma five a fifteen kalabo kaluna ki bukai (what is the answer?) The children shouted ki 75. The interesting part was to indicate the use of place values to the learners $150 + 75$ added vertically to get 225 (a good presentation by the teacher).

4.2   What strategies do grade 3 and 4 learners use when solving multiplication and division problems?

 In order to address the second objective, lesson observations and interviews with the learners were carried out in the selected schools and a test was given (see sections 3.5.4; 3.6.4). The information in the graph shows low performance of learners. Tables 5 and 6 show how learners performed per question. Table 8 further illustrates how 32×10 was solved by different learners.

	BELOW MINIMUM	MINI	DESIRABLE	OUTSTANDING	
GRADE 3	20	5	15	13	53
GRADE 4	9	6	8	10	33
	29	11	23	23	86
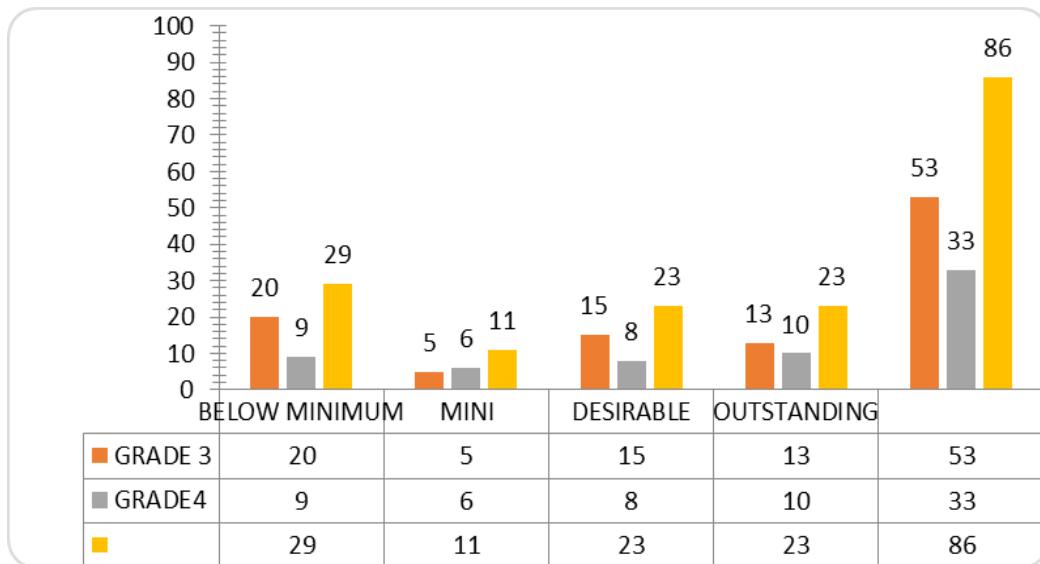
Source from field work

Figure 2: Results showing learner performance in the test showing 86 pupils sampled from grade 3 and 4

The results were consistent with responses from the teachers that they used repeated addition, mental work, semi-concrete objects (bars) and some provided their own strategies.

For example; Table 6 illustrates the findings from the interview with the learners (pupils interviewed were selected from the 86 sample getting top score, medium and lowest marks). The learners were encouraged to ask for clarity during the interview (see appendix B) All respondents wrote their responses on the question papers which were provided to them, only 3 asked for guidance on the questions they were not sure. The questions were read for them by the researcher. The results of the interview and test are shown in Figure 4, Table 5 and 6 illustrates how learners performed per question (see Section 3.7).

Table 5: Illustrations showing grade 3 learners performance in the test

Grade 3 question	Correct	percent	wrong	percent
$7 \times 5 =$	37	80.4	9	19.4
$32 \div 4 =$	34	73.9	12	26.1
$412 \times 2 =$	27	58.7	19	41.3
$53 \times 4 =$	19	41.3	27	58.7
$15 \div 3 =$	36	78.3	10	21.7
$15 \div 5 =$	31	67.4	15	32.6
$36 \div 4 =$	26	56.5	20	43.5
$4 \times 5 =$	24	52.2	22	47.8

Source: field work 1

Table 6: Results showing learner performance at grade 4 in a test including the total number in the sample

Grade 4 question	Correct	percent	Wrong	Percent
$17 \times 3 =$	27	67.5	13	32.5
$9 \times 7 =$	33	82.5	7	17.5
$32 \times 10 =$	15	37.5	25	62.5
$8892 \div 4 =$	16	40	24	60

$4 \times 8 =$	34	85	6	15
$982 \div 2 =$	15	37.5	25	62.5
$24 \div 4 =$	19	47.5	21	52.5
$7 \times 5 =$	29	72.5	11	27.5

Source from field work 2016 1

The information gathered show that learners used the following strategies when solving multiplication and division: Repeated addition, Regrouping and they also provide their own strategies (made errors) and evidence is provided in the sections below:

4.2.1. Repeated addition

Learners when interviewed, observed during lesson observations and through their written work produced similar and consistent results to their teachers. For example Peter said "my teacher said it is repeated addition, you simply do 3×2 you add $3+3 = 6$ and also $3 \times2 = 6$. He also said $3 \times 4 =$? I was counting 4 three times it gave me 12. The results in Table 7 show that 8 out of 10 said multiplication was repeated addition, the other 2 one said "multiplication is like +" while the other one said "multiplication is a revision of addition."

Table 7: Strategies used by learners to solve multiplication and division problems

S/N	CATEGORY/EVIDENCE	THEME
1	Repeated addition, Peter said "my teacher said it is repeated addition, you simply do 3×2 you add $3+3 = 6$ and also $3 \times2 = 6$. $4\times3 = 12$.	Repeated addition
2	semi-concrete objects,	Re-grouping
3	$87 \times 9 = 7263$, $5 \div10$ or 5 into 10, $3+4 =7$(add instead of multiplying)	Provide own strategy (make errors)

Source: Field work 2016

4.2.2 Re-grouping

Nine out of 10 learners who were interviewed used semi-concrete objects/bars to find answers. Figures illustrates how the semi concrete objects/bars were used by learners.
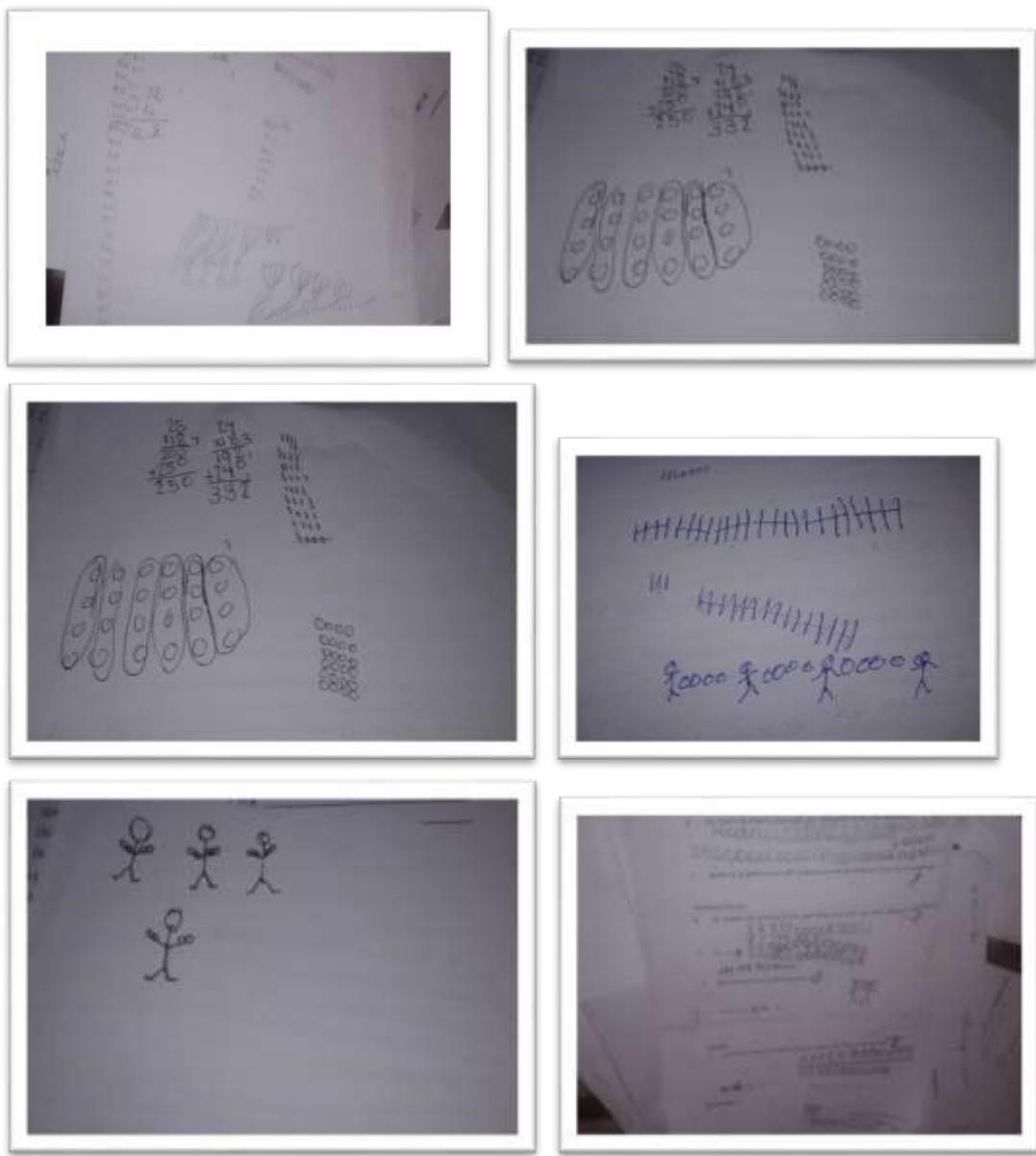
Source: field work

Figure 3: Showing how regrouping strategies learners use to solve multiplication and division

4.2.3   Provide their own strategies

The information gathered further revealed that learners provided their own strategies when solving multiplication and division. For example the learners who were interviewed 8 out of 10 provided their own strategies when multiplying and dividing. To illustrate learners solved some questions this way $87 \times 9 = 7263$, $5 \div 10$ or 5 into 10, 32 divided by 4, the child writes 812 as the answer. Table5 and 6 shows how learners performed in the test for example $36 \div 4$, the results were 26 out of 46 grade 3 learners got the answer correct and 20 out of 46 got the same question wrong. Also the grade 4 learners' performance is displayed in Table 6 showing 15 out of 40 getting the correct answer and 25 out of 40 getting the answer wrong when solving 32×10, simply because of the semi-concrete objects learners were using.

Table 8: Showing number of learners who got 32×10 the answers given are displayed

32×10										
Answer	32	3020	300	380	30	40	120	50	blank	Total
Number	9	3	1	1	5	1	1	1	2	25

Source from field work 2016

4.3 Why do teachers and learners find teaching and learning of multiplication and division challenging?

In order to address the third objective, participants were observed and interviewed in order to identify the challenges they may be facing when teaching and learning multiplication and division to grade 3 and 4 learners from the selected schools in Western Province of Zambia. The total number of 10 teachers was interviewed and 8 said multiplication and division was challenging to pupils compared to the 2 who said they had no challenges the following were identified as challenges including; teacher incompetence, misconceptions (errors), no teaching and learning resources

4.3.1   Misconceptions (errors)

One of the lessons observed produced the information displayed in Figure 4 which was an illustration with errors giving misconception to learners during teaching and learning where a teacher worked out an example $305 \div 6 = 5 \text{ R } 5$, this error may be very difficult to erase from the learners if the teacher does not realise and correct it.

Explanations to learners like "Multiplication work hand in hand with addition so when you teach multiplication and division pupils understand it, it will not be difficult for them to add because they practice it each and every day." Were given during interviews. (Children should have the background of addition). (T. Mwinga, Personal communication, July 19, 2016)
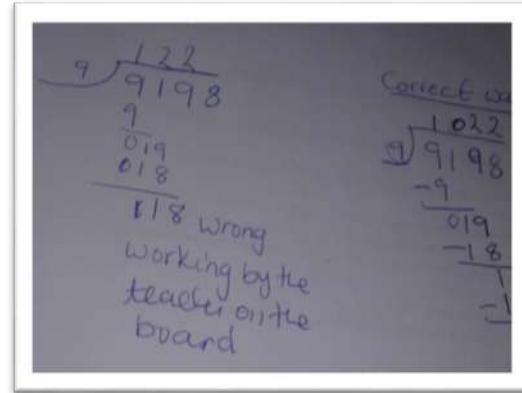
Source: Field work

Figure 4: Illustration from lesson observations showing errors by teachers in different classes
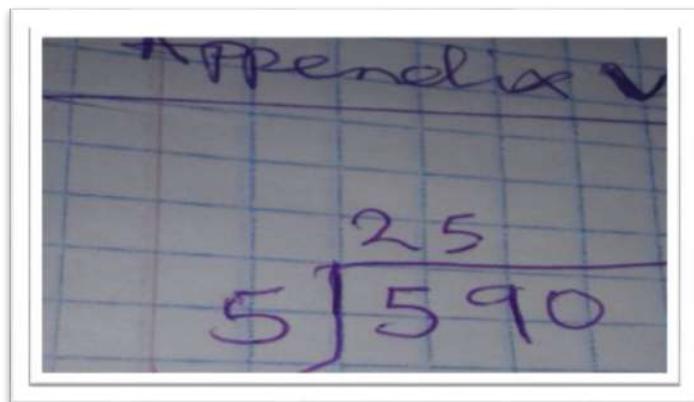
Source: field work

Figure 5: Illustrations showing pupils solving division problems during lesson observation.

4.3.2 Teacher incompetence

Participants tended to feel that teaching lower grades was challenging

> As for me it is a challenge to teach lower grades, very challenging, "I find it very difficult". "It seems like multiplication and division is difficult for those small children to understand. So it is better we improve their performance. They don't easily understand. It takes time for them to understand. .A. Muwana, 2016, Personal communication, 15 June), also said the following:

Further the same respondent uttered the following, "The other issue I have seen is how to multiply two digit numbers, how to multiply vertically 112 multiplied by 12, learners get mixed up… so here it is also challenging, but I have tried my best to explain."

Also another respondent observed that

> …division in word problem becomes difficult for learners to identify the dividend and the divisor. So I had to teach them what a dividend is and divisor as well as identifying them if learners do not know that it becomes difficult for them to perform division itself…" He further pointed out that, "… on multiplication, vertical multiplication there is a part where you add a zero, I was not taught that at school, 10×10 space we used to leave, I told the learners to do that, I'm yet to find out whether it has got effect on the learners or not. (C. Nahana, 2016, Personal communication, 19 July)

B. Sautu, Personal communication, July 19, 2016 revealed that:

> …learners had challenges because of their negative attitude towards learning multiplication and division. "… The teaching of mathematics has been good, although most of the learners have negative attitude towards mathematics. Additionally, most of the learners do not know how to identify place values and they also forget the reminders/ carrying over they forget it, such as $15 \times 3 = 45$ the child will write 315 instead of writing 45. They forget that it has to be added to the next number (next column of the tens because 15 one has 1 ten and 5 ones).

A. Akakubelwa, Personal communication, June 15, 2016 said

> Usually we use the 100 square chart. Do you have the 100 square chart in the school? We prepare in the school, Teacher X has one in her class so we borrow from her, and she is very good at preparing. I do not know about the abacus I have forgotten how to use it, I was scared to use it. I need to research (teacher did not use the abacus because she was not sure of how to use it) the strategy of sets was also used by the teacher when introducing the topic of multiplication as repeated addition.

C. Nahana, Personal communication, July 19, 2016) reported that:

> The whole process of teaching multiplication and division may be simple to the teacher, but to the learners, for them to comprehend what they have been told (taught) becomes difficult unless a teacher becomes so much as to device a system to help the learners, now the problem is how to come up with that simplest way of helping learners to understand the process of multiplication and division (challenges due to teacher incompetence).

Learners also said had some challenges with multiplication and division one interviewee wrote this:
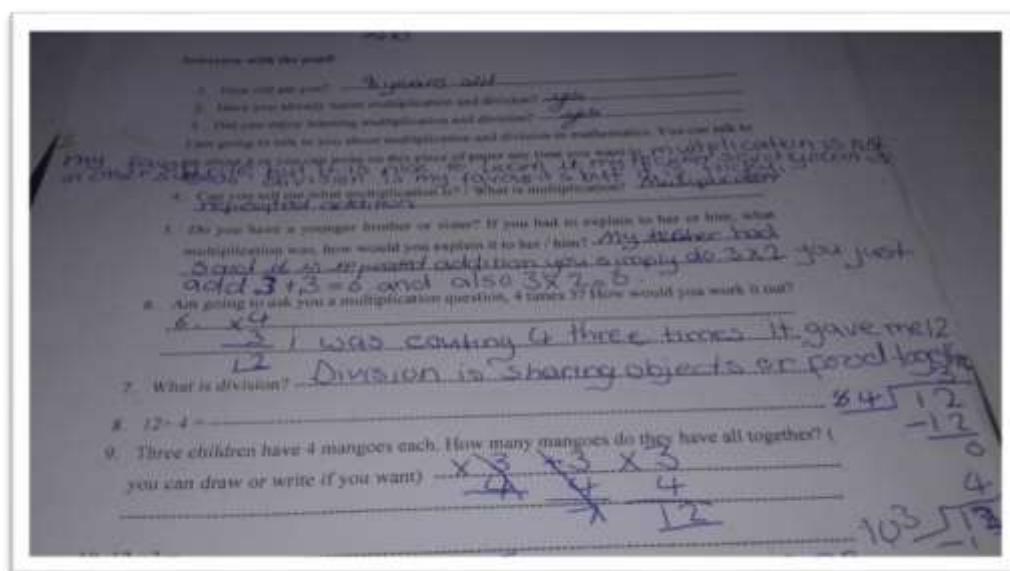
Source: field work

Figure 6: Illustration showing what the learner said on multiplication and division

It can also be said that the bars they use when solving make them get wrong answers in some cases, for example 10×4 the answer given was 39, similarly when dividing they made same errors, 36÷ 4 the answer given by some pupils was 8 others 10 while some wrote 7. Semi-concrete objects (bars) maybe the cause of these errors (see. Table 5 and 6)

4.3.3 Lack of Teaching and Learning Resources

L. Miyanda: No books, books are not enough even lack of teaching and learning aids.

A. Lwiindi: In private schools we are lacking books. Most of the work is centred on teacher because we are sharing books. Sometimes if books were available we could give books to learners.

B. Sautu: Teachers should be conversant with all the information from all the books (teachers do not research or use different text books). All the books available should be brought together and simplified just teach the learners what is expected of them. Bearing in mind that you are not going to set the examination

4.4 Summary of Chapter

The findings highlighted that 18 out of 20 respondents interviewed (10 one-on-one, 10 FGD) said used repeated addition to introduce multiplication. All the 10 respondents during Focus Group Discussions said they used repeated addition. Both methods employed to solicit information from the respondents yielded the same results of repeated addition was frequently used compared to the other strategies teachers used to teach multiplication and division. Division was defined as equal sharing, while only one said used repeated subtraction.

CHAPTER FIVE: DISCUSSION OF THE FINDINGS

5.1 Overview

This chapter discusses and analyses the findings of the study in relation to the research objectives and research questions. The valuable insights emanating from the study have been linked with existing knowledge of other research findings to address the following questions

    i   What strategies do teachers use when teaching multiplication and division?

    ii   What strategies do grade 3 and 4 learners use when solving multiplication and division problems?

    iii Why do teachers and learners find teaching and learning of multiplication and division challenging?

It is argued that teachers need to understand how, why and when their learners are learning or else it would be impossible to improve their teaching and achieve high levels of learning (Quist, 2000). This is the main reason why the research objectives and research questions were raised in order to assess if teaching and learning at grassroots level is addressing the goals of teaching and learning of multiplication and division of grade 3 and 4 learners. This was accomplished by interviewing and observing teachers in the selected schools in Western Province of Zambia as out lined in chapters 3 and 4. The information gathered revealed that the study was timely because to some extent both learners and teachers had challenges in one way or another, meaning that if the gap identified is not addressed learners may have challenges in higher grades because Nakawa (2013, pp. 107-108) points out that "pupils had more difficulties in multiplying and dividing compared to subtraction and addition". However, Multiplication and division are the key topics in mathematics education because the syllabus has a number of multiplication related units such as arithmetic, measurement, number patterns, ratio and proportion, equations, average, number bases and fractions. So if this is not addressed performance of learners may continue being low as highlighted earlier on in the background of the study. The following section attempts to respond to the first objective and question.

5.1.1 What strategies do teachers use when teaching multiplication and division to grade 3 and 4 learners?

In section 4.1 strategies used by teachers were categorised and are in line with Hart 2004 that multiplication is repeated addition and also defined as regrouping. The researcher summed

them into themes namely; repeated addition, re-grouping and multiplication table. This is so because equal sized groups' links closely to division and is usually introduced as how many groups of a certain size can be formed from a certain amount? (Hart, 2004).The findings were that both teachers and learners used similar strategies including repeated addition, regrouping and multiplication tables when teaching multiplication and division. Furthermore, teachers had challenges in teaching multiplication and division and learners had challenges too as such they provided their own strategies (errors). The major findings were that teachers and learners had challenges in teaching and learning of multiplication and division due to the strategies used and teacher incompetence. Finally misconceptions made by teachers may be transferred to pupils if not noticed.

5.1.2. Repeated addition

The finding show that 18 out of 20 interviewed in FGD and one-on-one teachers observed and interviewed used repeated addition. The theoretical framework which guided the study encourages learner participation so that each learner constructs his/her own knowledge. The results show that there was need to revisit the approaches of teaching used to teach multiplication and division. For example during lesson observations, activities were limited to repeated addition, equal sharing, using concrete objects and multiplication table which does not give a variety of reasoning leading to learners not understanding the concepts. In other words these learners may have future challenges in learning mathematics. This is in line with Berdynaj and Vula (2011) argument that strategies used to introduce multiplication and division presents future challenge of learning mathematical concepts and resulted in pupils negative performances in mathematics. This researcher agrees that teaching of multiplication and division requires a variety of strategies which may allow them to explore and compare the strategies. In order to accomplish this learner must be exposed to multiplicative thinking.

It was also observed from the findings that teachers classroom practice and students learning were highly affected by the knowledge which teachers possessed. For example repeated addition and equal sharing strategies commonly used may bring future challenge in higher grades because it can only be used when solving smaller numbers. For example, Akakubelwa, Personal communication, June 16, 2016 said, "Multiplication is repeated addition e.g. 5 times 10, 5 sets of tens or 10 sets of fives". A. Muwana, 2016, Personal communication, June 15, said, "Multiplication using multiplication tables I usually relate it to repeated addition $2+2+2+2+2$ translated to 2×5, 2 times 5 you add 2 five times".

It may be necessary at this point to also bring in the aspect of regrouping as observed by (Hart, 2004) discussed in section 4.1, says that regrouping links division to multiplication. This is very true because when regrouping, the aspect of how many groups gives the idea of a factor

and the objects contained in the group is another factor. When the two factors are multiplied the answer is the same as for the one who added the objects in all the groups.

Furthermore, when introducing multiplication and division, concrete objects were highly used and that may only be practical when solving smaller whole numbers. In order to communicate the concept of repeated addition to the learners, there is need to link multiplication to division in order to develop "thinking strategies for single-digit multiplication" for learners, National Research Council (2001, p. 192). Suffice to say learners and teachers have more than enough combinations they may learn from the 100 multiplication combinations from what they called the 100 square chart (see section 4.3.2) (A. A kakubelwa, 2016, Personal communication, 16June).

5.1.3 Re-Grouping (Equal sharing)

The findings from the study show that the strategy used by teachers to teach division was equal sharing. In this study the researcher opted to use re-grouping because it links it to multiplication. (Hart, 2004, p. 9) say regrouping is normally introduced as a question of how many groups of a certain size can be obtained from a certain amount." During lesson observations the teachers instructed learners to use concrete objects in groups and were able to form equal size amounts, this is a right way to go. But there is more that need to be done, learners should be challenged to link this operation to multiplication. For example National Research Council (2001, p. 192) observed that "division can be approached as finding a missing factor in multiplication. For example$72 \div 9=?$ Can be thought of as $9 \times ? = 72$".

5.1.4 Multiplication table

There was overwhelming evidence from the responses that teachers were using multiplication table as a learning and teaching aid but during observations they were not using it. My view is that instead of using concrete objects and semi concrete objects it may be imperative to use the multiplication table because they can show commutative property, finding missing factors and skip counting. This may broaden learners understanding (see Section 2.2 and 2.3) (Barmby, Harries and Higgins, 2009). This was also an emphases by (A, Lwiindi, 2016, personal communication, 19) who said, "…pupils should be advised to learn the multiplication table if they can. This is a must …I think when they learn the multiplication table even division will be easy for them. Sometimes you can use mental work, you give them mental work".

5.2 What strategies do grade 3 and 4 learners use when solving multiplication and division problems?

This section seeks to answer the second objective. The results revealed that learners employed the following strategies namely: repeated addition, re-grouping and some provided their own.

5.2.1 Repeated addition

Learners who were interviewed verified what the teachers said were doing. The learners' responses are highlighted in section 4.2.1 and Table 5. Learners were able to relate and show what they meant when they said multiplication was repeated addition. For example 3×2, you add $3 + 3 = 6$ and also $3 \times 2 = 6$ (see Figure 6). The pupil was able to explain that multiplication was repeated addition according to teacher. This study therefore, is of the view that learners can do better with the help of the teachers. Teachers therefore, should employ constructivist theory of learning when teaching so that they construct their own understanding.

5.2.2 Re-grouping

Learners did not show skill acquisition when solving multiplication and division in the test because they continued using semi-concrete objects even when solving big numbers. This confirmed what teachers said that learners had challenges in solving multiplication and division problems. This may be a clear indication that the strategies employed by both teachers and learners bring future challenges in the learning of multiplication and division, because it was characterised by errors (Berdynaj & Vula, 2011).

5.2.3 Learners provide own strategies

Figure 5 is another example of an error by a pupil noticed during lesson observations. In most cases such learners are left an attended to because there was no evidence of remedial work given to learners because teachers just mentioned homework policy without any evidence. In other words challenges were not adequately addressed by the teachers observed apart from one school where teachers confirmed that and with evidence. Hart 2004 called this leaving a hole or gap in the learners' knowledge and understanding may lead to further errors.

5.3 Why do teachers and learners find teaching and learning of multiplication and division challenging?

This section seeks to address the third objective and question. The findings revealed that most of the teachers had challenges in teaching of multiplication and division due to strategies used and their incompetence. During lesson observation the teachers followed the prescribed way of teaching and followed the phases of the lesson plan introduction, lesson development and conclusion. Hideyuki (2013) observed that most of the teachers followed a routine procedure of teaching. This may negatively impact on learners' performance in higher grades because the teachers focus was on how to teach the process and not on what to teach (concepts/content).

It was revealed that teaching and learning of multiplication and division was challenging because of the strategies used to teach multiplication and division were only limited to repeated addition, regrouping and multiplication table. For instance there was no multiplicative reasoning employed during teaching. Teaching thinking strategies would be ideal, for example when teaching multiplication table of 9 learners may be helped to discover that for single digits whenever one multiplies a number by 9, the digits of their product, add up to 9.for instance; $2 \times 9 = 18$; $1 + 8 = 9$; $3 \times 9 = 27$; $2 + 7 = 9$…$8 \times 9 = 72$; $7 + 2 = 9$. This is interesting because there is another guide to finding the answer, (O'Connell and Sangiovanni 2011). Additionally in section 2.1 I discussed numbers which may be used to help learners recall their facts faster such as starting teaching multiplication of 0, 1, 2 and 5. The objective of this is that teachers of mathematics want their students to develop a quick recall of single digit when dealing with the four basic operations in mathematics.

In one lesson I observed it was interesting to note that the teacher used skip counting this is another way that should be encouraged among the teachers (see Section 4.1.3)

It was a common trend for teachers not to prepare for lessons yet it is a very important aspect of teaching and it is also one of their job descriptions. The implication is that ill prepared teachers would not be able to guide and support learners during lessons. As a result, examples and class activities given to learners were got straight from the textbooks. In line with this Tabakamulamu, (2010, p 230) observed that "… lesson preparation was a matter of copying directly from the teachers guides with little or no decision making on the part of the teacher". (C. Nahana, Personal communication, July 19, 2016) also indicated that teachers had challenges because they just followed the procedures as they appeared in the text books. He said, "There are teachers who just follow the procedure as it is written in the book but to me I do not feel that way, I'm conceptual". The implication here was that some teachers do not think outside the box, whatever is in the textbook they present it the same way. This is also clear that constructivist approach is not adhered to by most of the teachers who took part in the study. The constructive classroom should include "modelling, scaffolding, coaching, articulating, reflecting, collaborating, exploratory and problem solving as contended by Muijs and Reynolds, (2011, p. 88). It is therefore necessary for teachers to create an environment that encourage learners to construct their own understanding by giving them enough work in order to reflect on the strategies learnt.

5.3.1   Teacher incompetence

There was inadequate lesson planning and work coverage by teachers. This was observed during lesson observations, the researcher asked for the schemes, records of work and lesson

plans which were not available This was a challenge in the sense that no activities were pre planned to help the teacher play a role of a facilitator during teaching, which would help the learners have hands on experience. Out of those interviewed and observed two student teachers who were on teaching practice had all the lesson plans and indicated that teaching of multiplication and division was easy. Additionally, (A. Muyunda, personal communication June 30, 2016) also confirmed that the purpose of Teaching Practice was for students to practice what they learnt in college. So can it be said that these teachers receive proper guidance? Not at all. The effect of not planning was revealed where some of the teachers gave wrong answers due to inadequate planning. This misconception learners copy from the examples worked out by teachers may be very difficult to erase from the learners minds if the teacher does not realise and correct it (see Figure 4)

5.3.2 Misconceptions (Errors)

The findings also revealed that learners had challenges in carrying over when multiplying numbers with more than one digit for example 15×3 the child would write 315 instead of 45. The learners were also having problems because teachers lacked better strategies of helping learners to understand the process of multiplication and division. It is further argued that teachers should teach for understanding which requires a lot of hard work and sacrifices on the part of the teacher (Harries & Suggate, 2006; Nakawa, 2013). Teaching for understanding is necessary because in lower grades, instructions should focus on developing learners understanding of multiplication concepts and meaningful computational strategies rather than on having learners memorize the steps in algorithm (Ontario Ministry of Education, (2006).

5.3.3 Lack of Teaching and learning resources

Another challenge worthy noting was that respondents said, textbooks teachers were using had no illustration linked to everyday life and that the approaches from textbooks were different, the explanation for different views from respondents could be that there are few teachers guidebooks in schools. Some teachers do not even have access to these books, especially newly deployed teachers (teachers who have just been incorporated into the teaching service on first appointment) in schools. For example, Keirinkan, (2012) the textbooks in titled Fun with maths 3A, 3B and 4B for Elementary School has a note to parent/teacher explaining how to use it, probably to ensure that any user receives guidance on how to use it. These books for sure have a variety of strategies and link the previous knowledge to present/ what will be learnt giving the children rich background.

The implication is that some teachers might not fully understand how to use the textbooks unless they have someone to guide them. Contrary to this view is that some teachers said the textbooks had illustrations linked to everyday life. It can then be concluded that to some extent there are some topics that link the content to everyday life. Nakawa (2012) researched on the Linkage between mathematics syllabus and textbooks in Kabwe town of Zambia. The finding was that Zambian textbooks did not adequately link the mathematics content to everyday life because the "descriptions related to daily life were selected in the beginning of the new learning topics or contents and the units of arithmetic…" (Nakawa, 2012, p. 95). My view on the matter in point is that text books do not give clear guidance on the strategies to use to teach multiplication and division. Compared with the textbooks I referred to earlier on Keirinkan, (2012) teachers are guided on how to employ constructivist approach of teaching and also allows learners to solve mathematical problem their own way, giving teachers opportunity to learn from pupils. Additionally the book highlights what to do next and also encourages learners to reflect on what they have learnt helping them to link the previous information to the present.

The other reason for the challenges in teaching and learning of multiplication and division could be linked to none use of learner- centred approach, teaching was not activity-based and teachers did not adequately facilitate learning in order for learners to individually construct their own learning and understanding. The MESVTEE (2013) has put up the expected targets that are captured in Table 3.

Furthermore, lack of teaching resources made it difficult for teachers to teach effectively. This implies that teachers were not using teaching and learning aids when teaching learners. Some of the schools had no textbooks for pupils to learn at their own pace. Learners only relied on the information from the teachers who did not have time to plan. For example the pupil to book ratio at Manongo (name has been changed) primary school was 40 to 1, this scenario might have an effect on learners performance and skills acquisition. This is evident from (A. Lwindi, Personal communication, July 19, 2016) who said, "… if Textbooks were available we could give books to learners…we write on the board in all the subject." The study also confirmed that learners had challenges in learning of multiplication and division as indicated by (A. Lwindi, Personal communication, July 19, 2016) who claimed that the age affected learners' performance, "The pupils we have here look older than their age, and even their Intelligence Quotient (IQ) is still low especially for grade 3 and 4 pupils. Looking at multiplication table it is difficult for them".

This indicates that learners had challenges in learning multiplication and division. A. Lwindi, Personal communication, July 19, 2016 implied that the learners at their school were too

young (learners were still at concrete level stage of development) to learn the multiplication table. (M. Mwiinga, Personal communication, July 19, 2016) reckoned that the program called Read to Succeed (this was a whole school, whole teacher, whole child approach to improve learning in schools) helped teachers to improve their pedagogical skills and that pupils were then able to multiply and divide. However, the same respondent observed that the only challenge they were experiencing was overcrowded classes, she said "… the only challenge is the number of pupils in classes, they go up to 80 or more in some cases, so when you explain some will listen while others do something else…" This confirms what was aforementioned in Section 2.2. Quist (2000, p. 26) observed that, "primary schools normally have classes of 35-45 pupils but there are schools where the class size may double that number".

From the schools sampled two out of five schools were not overcrowded the rest (three out of five) were, meaning that teachers had challenges in giving individualised attention to learners. To make matters worse, the findings show that the teachers who were handling these classes were inexperienced implying that learners did not receive adequate guidance during lessons. The recommended number of learners from "grade 1-7 is 40 learners per class" in Zambian situation MESVTEE, (2015, p. 106) but from the sampled schools three out of five schools mentioned earlier, had an average range of 50 - 60. (T. Mwinga, personal communication, July 19, 2016) mentioned earlier said, "It was challenging because you explain to some while the others were busy doing something else". This indicated that not all learners were engaged in overcrowded classrooms pointing to teachers' incompetence in handling such.

Additionally teachers interviewed confirmed that performance was average because not all learners understood the concepts, some required more examples while others required remedial work. This was evident from (L. Miyanda, Personal communication, June 14, 2016) who admitted that there was need to "improve learners performance because it was not good". Poor performance was also linked to lack of good foundation (in this study good foundation means use of variety of strategies), less time and lack of better strategies to use to help learners understand the process of multiplication and division.

They also strived to make the lessons learner-centred, but teachers did more talking than pupils and some of the pupils were not allowed to express their own ideas when solving questions. Like the pupil mentioned earlier on who was assigned to solve 24 ÷ 2; the learner was not allowed to express her ideas by completing solving the question, so that the misconception is identified and addressed there and then. It is good that teachers were able to use other learners to solve questions on the board for other learners to learn from their fellows. However, if learners were not allowed to express their ideas to the end, it would be difficult to address and meet their individual and different education needs.

Additionally, strategies used were teacher-centred, giving learners less practice. During the process of learning each individual has to actively construct a meaningful interpretation of what is seen and heard as illustrated in a diagram showing different interpretation of the information taught. Furthermore, learners were not familiar with the multiplication table and application of place values making it difficult to compute multiplication and division problems. In some cases, it was evident that learners mixed the operations as illustrated in Figure 6 or forgot to use other digits "like $112 \times 12 = 224$ as their answer and in a class exercise learners worked 78×9 as 6372 forgetting to carryover," this required that a teacher finds out why that particular error was committed by the learner, then correct the misconception.

The test which learners were given further proved that the way the topics were introduced had a bearing on their performance. The test was criterion referenced. Four performance benchmarks were adopted used by MoGE, namely Below Minimum Level of Performance (0-39), Minimum Level of Performance (40-60), Desirable Level of Performance (60-80) and Out Standing Level of Performance (80-100) (MESVTEE, 2013). This was used to assess skill acquisition after learning multiplication and division. Figure 2 shows how the learners performed; below minimum was the highest with 29, desirable 23 and outstanding were at the same level 23 and the least was minimum with 11. The picture is not good because at every level learners are expected to understand the concepts. If they do not do so the teacher is expected to urgently take a measure or an action of giving learners extra work/homework or remedial work. This picture is not good enough. This is so because, Herold (2013, p.6) argues that, "If students are failing to learn their facts they will fall behind because they will not be able to complete higher level mathematics skills such as division or fractions". Mwamba (2013) also pointed out that learners who failed in grades 1-4 generally were having learning problems in later years.

In spite of the challenges discussed no measures were put in place to help learners who had challenges in learning multiplication and division such as remedial work on the previous work. There was no evidence of remedial work given to learners because teachers just mentioned homework policy without any evidence. In other words challenges were not adequately addressed by the schools visited apart from one school. The school had domesticated homework policy which is given on a weekly basis and parents were required to sign and comment on the child performance. Although teachers confirmed that not all parents were helping teachers supervise homework given to their children. Some parents were doing the work for learners instead of teaching them. There was no evidence to show that homework policy was domesticated in most (4 out of 5) of the schools. There were no charts in the classes to show that they were being prepared or used when teaching.

5.4 Summary of the Discussion

The chapter highlighted that both teachers and learners use similar strategies to solve multiplication and division namely repeated addition, regrouping and multiplication table. It was also further shown that the way these strategies were used gave a limited view of solving multiplication and division because learners do not master the concepts, this was evidenced by learners continuing using semi-concrete objects which make them get wrong answers. It was also clear that learners were not given an opportunity to construct their own understanding because the strategies used were teacher centred. The foregoing therefore indicate that teachers and learners had challenges in teaching and learning of multiplication and division at grade 3 and 4 due to strategies used, teacher incompetence and lack of teaching and learning resources which require an immediate intervention in these selected schools in Western province by carrying out a longitudinal study.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Overview

This chapter highlights the conclusion and recommendations of the study based on the findings. The purpose of the study was to interview and observe teachers on the strategies they use to teach and learn multiplication and division to grade 3 and 4 learners in selected schools in Western province. This was done in order to understand the strategies teachers and learners had in teaching and learning multiplication and division for the purpose of curriculum enrichment in schools. Mongu and Sioma districts were sampled and two grades were chosen because this is the time when pupils begin to learn concepts and strategies to solve multiplication and division. In order to collect in-depth information, interviews, questionnaires and focus group discussion were used. A test was given to pupils in order to assess skills acquisition.

6.2 Conclusion of the study

The following strategies were mainly used by teachers to teach and learn multiplication and division to grade 3 and 4 learners, including; repeated addition, regrouping and multiplication tables. The study revealed that these strategies were used by both teachers and learners. Furthermore, it was shown that both teachers and learners had challenges in teaching and learning multiplication and division due to strategies used. This is because the strategies used have limited view as such they may have future challenges in learning mathematics because multiplication and division are key topics in mathematics education. This is consistent with the literature reviewed for example Mclnatosh and Ramagge (2011) maintain multiplication and division should be seen as much more than repeated addition and regrouping. Date collected outlined challenges emanating from the strategies used such as semi-concrete objects used by learners when regrouping. Therefore, learners did not display proficiency in computational skills and they did not display conceptual understanding. The strategies used such as repeated addition and repeated subtraction by teachers to introduce multiplication and division bring future challenges in learning of mathematical concepts. Despite the challenges observed, the study argues that there is potential to overcome these challenges and measures may include:

- Teachers should link multiplication and division to everyday life situations because learning of multiplication and division requires active involvement in order to develop skill proficiencies in students as they learn mathematics.
- Teaching of multiplication and division should be done in a way that could build a strong foundation at grassroots level. For instance helping learners master the

multiplication table especially for digits 0-9 is very critical in the learning of multiplication and division.

- Teachers should therefore purposefully lay ground work for active learning by determining "particular learning activities by considering the learner and material to be learnt.

- Recommendation for a longitudinal research to prove the claim and write books guiding teachers on how to teach for conceptual understanding.

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APPENDICES

Appendix A: Interview guide for Teachers

Introduction

Thank you for being willing to take part in an interview today. Can I take this opportunity to assure you that, if you so wish will remain completely anonymous and no records of the interview will be kept in your name on them and the school will also not be recorded? In addition, I would like to voice record this interview with your permission of course to help me capture all the minor details of this interview in order to have an accurate record of the data-your responses and opinions. If you have no questions I would like to introduce you to the interview. Generally mathematics is viewed as one of the most challenging subjects to both learners and teachers. I would like to hear from you whether you share a similar view. Allow me to find out from you information on your background (demographic), knowledge, experience (behaviour), opinion or values, feelings and sensory if any concerning mathematics in particular multiplication and division.

1. How long have you been teaching grade 3 and/or 4?
2. What do you think about teaching multiplication and division at grade 3 and/or 4?
3. How do you evaluate performance of the learners in multiplication and division? / What is their performance like in multiplication and division?
4. What key concept/s are taught to grade 3 and 4 when teaching multiplication and division?
5. How is multiplication and division introduced to grades 3 and 4 learners?
6. What strategies do you use to teach multiplication and division to your class?
7. Do illustrations and exercises in the textbooks adequately link multiplication and division to local situations familiar to pupils? Explain.
8. What challenges do you face when teaching multiplication and division?
9. What measures have you put in place to help learners who fail to catch up with your pace of teaching in multiplication and division?

Thank you very much for your time. Once more may I assure you that this information will only be used for academic purposes any comment? A summary of the research findings will be sent to you.

Appendix B: Interview with the Pupils

1.   How old are you?   --

2.   Have you already learnt multiplication and division? ----------------------------------

3.   Did you enjoy learning multiplication and division? ----------------------------------

 I am going to talk to you about multiplication and division in mathematics. You can talk to me about it or you can write on this piece of paper any time you want to

   4. Can you tell me what multiplication is? / What is multiplication? --------------------

   5. Do you have a younger brother or sister? If you had to explain to her or him, what multiplication was, how would you explain it to her / him? -----------------

6.   Am going to ask you a multiplication question, 4 times 3? How would you work it out? ---

7.   What is division? --

8. $12 \div 4 =$ --

9.   Three children have 4 mangoes each. How many mangoes do they have all together? (you can draw or write if you want) --

10. $12 \div 3 =$ ---

11.   Which one is greater 25 x 18 or 24 x 18? --

   12. Mweembe has 24 balls and some boxes. How many boxes did Mweembe fill if she puts 4 balls in each box? --

   13. Mr. Akatama has 15 pencils to give 5 best pupils in his class. How many pencils would each pupil get if they shared equally? ---

Appendix C: Grade 4 Test

The tests will be administered to grades 3 and 4 because they are learning the topics in the syllabi. The test will elicit information on methods used when teaching, acquisition of skills for computing multiplication and division. Performance will be measured using the bench marks used at national level for grade 1 to 4 in Numeracy and Literacy assessments.

Proficiency levels are as follows:

PROFFICIENCY LEVEL	RATING
BELOW MINIMUM	0-39%
MINIMUM	40-60%
DESIRABLE	60-80%
OUTSTANDING	80 AND ABOVE

1.   17 times 3 = ----- ---

2.   There are seven days in a week. Find the number of days in 9 weeks ----------------

3.   Mrs. Akatama wants to make 10 curtains, if each curtain will need 32 rings when she hangs it how many rings will she need all together? ----------------------

4.   A church full of people lined up in four rows. There were eight people in each row. How many people were there in the church?

5.   8892 ÷ 4 = -----

6.   If 982 books are to be shared equally between Sioma primary and Nakabunze primary school how many books will each school get?

7.   Four friends share 24 sweets equally. How many sweets does each of them have?

8.	On the table there are 5 plates with 7 biscuits each. How many biscuits are there altogether? Ask the pupil to explain his/her answer

9.	Mweembe has 24 balls and some boxes. How many boxes did Mweembe fill if she puts 4 balls in each box?

Appendix D: Grade 3 Test

Part 1- Demographic variables

Part 2- multiplication questions

1. $7 \times \quad = 35$

2. $412 \times 2 = ----$

3.   How many legs have 53 dogs altogether?

4.   Ten children are holding 4 books each. How many books do they have altogether? Part3 division questions

5.   There are 32 sweets to be shared among 4 children. How many sweets will each child get?

6. $5 \div 3 = ----$

7.   Mr. Akatama has 15 pencils to give 5 best pupils in his class. How many pencils would each pupil get?

8.   Monde has 36 Mangoes in her bag, if she has 4 friends how many will each eat?

Appendix E: Observation Guide

 In order to validate the study, before interviewing the teacher, he /she will be observed to identify the methods mostly used during teaching.

   1. What teaching strategy does the teacher use during the lesson delivery?
   A.   Repeated addition B. Regrouping C. Multiplication table D. Variety of strategies
   2. What strategies does the teacher use? (Repeated addition, repeated subtraction, equal sharing, counters, partitioning, quotient,)
   3. Does the teacher use diagrams to illustrate/representations to explain multiplication and division? Yes/ No
   4. Does the teacher use real objectives to illustrate concepts in multiplication and division? Yes/No
   5. Does the teacher have any challenges with the strategies
   6. Does the teacher give home work on multiplication and division to allow pupils practice at home? Yes / No

Appendix F: Test results analysis

		Grade 3		
Question	**correct**	**percent**	**wrong**	**percent**
7×5=	37	80.4	9	19.4
32÷4=	34	73.9	12	26.1
412×2=	27	58.7	19	41.3
53× 4 =	19	41.3	27	58.7
15÷3 =	36	78.3	10	21.7
15÷ 5 =	31	67.4	15	32.6
36÷ 4 =	26	56.5	20	43.5
4× 5 =	24	52.2	22	47.8

Grade 3 test

|	7×5=	32÷4=	412×2=	53× 4 =	15÷3 =	15÷ 5 =	36÷ 4 =	4× 5 =
Grade 3 correct	37	34	27	19	36	31	26	24
Grade 3 percent	80.4	73.9	58.7	41.3	78.3	67.4	56.5	52.2
Grade 3 wrong	9	12	19	27	10	15	20	22
Grade 3 percent	19.4	26.1	41.3	58.7	21.7	32.6	43.5	47.8

Grade 3 learner's performance is somewhat average; those that got the answers correct were more than those that got wrong answers in all cases. It can also be said that the bars they use when solving make them get wrong answers in some cases, for example 10×4 the answer given was 39, similarly when dividing they made same errors, 36÷ 4 the answer given by some pupils was 8 others 10 while some wrote 7. Semi- concrete objects (bars) maybe the cause of these errors.

Grade 4				
Question	**correct**	**percent**	**wrong**	**percent**
$17 \times 3 =$	27	67.5	13	32.5
$9 \times 7 =$	33	82.5	7	17.5
$32 \times 10 =$	15	37.5	25	62.5
$8892 \div 4 =$	16	40	24	60
$4 \times 8 =$	34	85	6	15
$982 \div 2 =$	15	37.5	25	62.5
$24 \div 4 =$	19	47.5	21	52.5
$7 \times 5 =$	29	72.5	11	27.5

Grade 4 test

Legend: ■ Grade 4 correct ■ Grade 4 percent ■ Grade 4 wrong ■ Grade 4 percent

	17× 3=	9 × 7 =	32 × 10 =	8892 ÷ 4 =	4 × 8 =	982 ÷ 2 =	24 ÷ 4 =	7 × 5 =
■ Grade 4 correct	27	33	15	16	34	15	19	29
■ Grade 4 percent	67.5	82.5	37.5	40	85	37.5	47.5	72.5
■ Grade 4 wrong	13	7	25	24	6	25	21	11
■ Grade 4 percent	32.5	17.5	62.5	60	15	62.5	52.5	27.5