PRACTICES IN TEACHING AND LEARNING MATHEMATICS USING CHINYANJA IN A MULTILINGUAL CLASS: A CASE OF SELECTED PRIMARY SCHOOLS IN LUSAKA DISTRICT, ZAMBIA

BY

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A Dissertation submitted to the School of Education, University of Zambia in partial fulfilment of the requirements for the award of the degree of Master of Education in Mathematics Education.

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DECLARATION

I **Bareford Mambwe**, do hereby declare that this dissertation presents my own work and that to the best of my knowledge, no similar piece of work has been previously submitted for the award of Degree at this University or another University. Where work of another scholar has been used, it has been duly acknowledged.

Signed:……. Date:……

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APPROVAL

This dissertation of **Bareford Mambwe** has been approved as partial fulfilment of the requirements for the award of the degree of Master of Education in Mathematics Education.

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ABSTRACT

The background of this study was anchored on the introduction of the use of local languages as a medium of instruction in primary schools from grade one to four by the Ministry of Education (2013). The study focused on practices in teaching and learning mathematics in multilingual class. The objectives of the study were: to examine the teachers' discourse practices as they teach mathematics in a multilingual classroom using Chinyanja; to describe learners' practices as they learn mathematics in a Chinyanja in a multilingual classroom; to establish mathematics teachers' views on the new language policy direction in Zambia. This research was underpinned by Socio-cultural theory, that consciousness forms in and through socially mediated activity, with language as a key mediational mean. The research was carried out in two primary schools in Lusaka district. The target population comprised of primary school teachers and pupils in grade 4. The study was qualitative in nature and in achieving this task the study employed a descriptive survey research design.

Data were collected through lessons observations, semi-structured interviews and focus group discussions. The sample comprised of 24 participants whose mother- tongue was not the language of instruction. Purposive sampling procedure was used to select 20 pupils and four teachers whose mother tongue was not the language of instruction. Thematic analysis was used to analyse qualitative data. The study established Code-switching, translating, use of gestures and visual aids as among some of the practices teachers used in the teaching of mathematics. It seems, therefore, that for teachers to facilitate learners' access to mathematics and communicating mathematics in a multilingual classroom, teachers relied mainly on code switching and translation as a practice. Also what was noted was that teachers utilized the board more and dominated the classroom activities through talk and board use. The study also established that chanting and chorusing, learner demonstration on the board during lesson, asking peers for clarification and less talk were among the most prominent practices learners engaged in during learning mathematics. It was established that learners were engaging in these practices due to teachers' style of teaching which promoted these attributes. The study further established that teachers' views on the new language policy direction were divided in as far as the use of local language in a multilingual context was concerned. However, what was coming out clearly was the need to respond to multilingual realities. Therefore, the study recommends for teacher training institutions to consider how they can adapt teacher education programmes to support the use of flexible multilingual approaches in classrooms.

Keywords: **Pedagogical practices, language use, multilingualism, mathematical concepts.**

DEDICATION

I dedicate this study to my late uncle Given Kafulo whose interest in my well-being has never ceased to amaze and inspire me, and to my mother Lidah Kafulo and father Alfred Mambwe for their unconditional support in my life and educational endeavours. I also dedicate this work to my dearest wife, Rolana Phiri Mambwe and our beloved child Blessed Chikaila Mambwe for their patience and perseverance during my studies; I dedicate this work to them.

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ACRONYMS AND ABBREVIATIONS

LOLT	Language of Learning and Teaching
SACMEQ	Southern African Consortium for Monitoring Education Quality
L1	First language
L2	Second language
MOE	Ministry of Education
UNESCO	United Nations Educational, Scientific and Cultural Organisation
CDC	Curriculum Development Centre
ZPD	Zonal of Proximal Development
EMI	English Medium Instruction
FL	Foreign Language
ECZ	Examination Council of Zambia
MOI	Medium of Instruction
LEP	Language-in-Education Policy
NAS	National Assessment survey

Operational Definitions

Multilingualism is the use of two or more languages, either by an individual speaker or by a community of speakers.

A **multilingual learner** is one who speaks more than two languages.

A **multilingual classroom** is one in which there is a teacher and many languages to the class, but the teacher and learners themselves are not necessarily multilingual or a classroom where pupils bring a range of main (otherwise referred to as 'first' or mother tongue) languages to class. 'Multilingual' here is a descriptor of the classroom and not necessarily individual learners (Adler, 2001).

Learner - a pupil in a school.

Learning is relatively permanent changes in behavior, skills, knowledge, or attitudes resulting from identifiable psychological or social experiences.

Local language is the language that is familiar to a particular community.

Familiar Zambian Language: A local language that is commonly used by children in a particular locality. It could be a zone or a community language (Zambia Education Curriculum Framework 2013).

Mother tongue language: Mother tongue refers to the language one learns from parents from birth.

Teacher's discourse practices: Involves everything that takes place in the classroom with an intention to communicate during the teaching of mathematics.

classroom discourse: is a resource for facilitating the learning of mathematics.

learners' practice- refers to learners' participatory strategies during learning of mathematics.

Classroom talk: the amount of talking time that the teacher and the students do.

Teacher's use of language: Teachers' use of the language for various classroom practices (e.g. classroom management, explaining the mathematics, and affective purposes).

CHAPTER ONE

INTRODUCTION

1.1 Overview

This chapter provides the background to the study in which the context of the study is given. The chapter also gives the statement of the problem and the purpose of the study together with the research objectives and questions that guided the study. In addition, the chapter gives the significance of the study, conceptual and theoretical framework, limitations and delimitation of the study. It also discusses ethical issues which were considered when collecting and analyzing data.

1.2 Background to the Study

A major social characteristic of Zambia is that it is multiethnic and multicultural as well. There are reportedly 73 languages in Zambia with seven major languages which include Bemba, Nyanja, Luvale, Kaonde, Lozi, Tonga, and Lunda. The diversity of ethnic groups with their related languages has led to the existence of several traditions and cultural practices which have implications on the education of children (Tambulukani, 2015). Banda and Bellononjengele (2010) said that complex multilingualism is an essential part of Zambian identity and communication.

Despite Zambia having complex multilingualism, the Ministry of Education (2013), introduced the use of local languages as a medium of instruction in primary schools (grade 1-4) with the view that the curriculum will equip learners at all levels of education with vital knowledge, skills, and values that are necessary for contributing to the development of society and the economy. Furthermore, the Zambia Education Curriculum Framework (2013), postulated that according to the policy on education, the aim of education is to promote the full and well-rounded development of the physical, intellectual, social, affective, moral and spiritual qualities of all learners so that each can develop into a complete person for his or her own fulfillment and for the good of society (MOE, 2013).

According to Ministry of Education, (2013, p. 19), the policy on education recognizes the use of Zambian local languages as the official languages of instruction in the pre-schools and early Grades (grades 1-4). It spells out that all the teaching and learning in all the learning areas at the lower primary level should be in local Zambian languages which are widely spoken in a particular

community. This is because there is evidence that children learn more easily and successfully through languages that they know and understand well. It further postulates that English should be offered as a subject, beginning at Grade 2 on the basis that after the children have acquired sufficient literacy skills in the Zambian languages, it will be easier for them to transfer these skills quickly and with ease to literacy in English at Grade 2.

In view of this consideration, learners in pre-schools and Lower primary (Grades 1-4) are given an opportunity to learn not only the initial basic skills of literacy and numeracy in local language but also all knowledge, skills and values in the other learning areas. It should also be noted that the use of local language should be extended to learners with special Educational Needs. English will still remain as the official medium of instruction beginning at Grade 5 up to tertiary (MOE, p. 20, 2013). Thus the introduction of the use of local languages as mediums of instruction in the first four years in primary schools has been partly a desire to improve children's learning of new concepts in local language (MOE, 2013). However, the language policy in education may have a far-reaching implication for mathematics education in Zambia due to multilingualism.

According to Ministry of Education (1996), all children should be given equal opportunity to education. This is an inclusive statement which includes all learners regardless of their ability, disability or language to be given equal opportunities to education. Therefore, there is need to understand how teachers and learners interact in the classroom which consists of learners with different linguistic backgrounds.

The formulation of language policy in education in general and regarding medium of instruction in particular is quite challenging. It can be emotional, founded usually on the ills of the society (Kaphesi, 2003). In other words, a sound policy on medium of instruction will be based on multiple factors that affect the life of an individual, institution and the community. Specifically, the policy on medium of instruction must reflect sociolinguistic factors, educational theories, values and practices, social goals and aspirations, and transformational and developmental processes (Kaphesi, 2003). It should not be based on societal emotions regarding language inferiority and language deficiencies; instead it should be based on positive values of educational, scientific and cultural development.

It is evident from the overview of language policy in developing countries (Mchazime, 1995) that the language which is used for instruction in schools largely depends on the overall language policy in a country, which in turn may partly influence teachers' knowledge of the language and attitudes towards the use of the language in the teaching of mathematics.

The role of language in mathematics education has occupied the minds of most mathematics educators in recent years. Studies have shown that there is a significant relationship between language used and mathematics learning (Austin & Howson, 1979; Pimm, 1987; Cocking & Mestre, 1988; Durkin, 1991; Clarkson, 1992;). Many problems that learners of mathematics encounter are partly due to inability to cope with the demands of the language of instruction, which is partly due to the overall language policy in education (Adler, 2001).

The role of language in mathematics learning is a critical topic, and it is usually dealt with from a variety of theoretical perspectives. A controversial issue is the relationships between communication processes and the development of thinking. In the opinion of some researchers (Cocking & Mestre, 1988) thinking and communication are closely linked, whereas others regard them as quite independent processes. Therefore, it is important to take account of the local language's vocabulary and language structure available to the teacher. It is important that the teachers become more effective in oral work in mathematics to assist children in the development of general language skills. Teachers must use language to make children not only familiar with the language used in mathematics (Cockroft, 1982) but also able to read in order to comprehend what may be called mathematics vocabulary in local languages.

Today as in the past, many students struggle with mathematics and become affected as they continually encounter obstacles to engagement. Mathematics is generally seen as a difficult subject and how this subject is communicated to pupils will influence how pupils learn the subject. Classroom routines play an important role in developing student's mathematical thinking and reasoning. Language makes it possible for the child to objectify and conceptualize his world and himself and to share the responsibility for his destiny. Language is a prime vehicle of expression and exchange of thought in the classroom (Baiju & Vineesha, 2009).

Language plays a key role in the mathematics classroom. In fact, “fluency in it provides access to the whole world of mathematics” (Esty, 1992, p. 32). Much of the attention to mathematical discourse focuses on students’ ability to communicate by clarifying and justifying their ideas and procedures (National Council of Teachers of Mathematics, 1991). However, the teacher’s role in fostering productive mathematical discourse in the classroom is central. In addition to being responsible for creating the opportunities for students to engage in discussions, exploring, negotiating, and sharing knowledge (Manouchehri & Enderson, 1999), the teacher’s own use of language in the mathematics classroom serves as an important example of effective communication.

Therefore, Raiker’s (2002) claimed that spoken language is in large part responsible for problems in the teaching and learning of mathematics. In fact, the results of Raiker’s study revealed clearly that “above all, teachers must be aware of the language they use when teaching mathematics and that the recommended vocabulary…should be used with caution” (p. 59). Language is a learning resource in the mathematics classroom. Using Lave and Wenger's concept of transparency, language in the classroom must then be both visible and invisible: visible so that it is clearly seen and usable by all as a resource; and invisible in that, when discussing mathematics, this use of language should facilitate mathematical learning (Lave and Wenger, 1991).

The National Assessment surveys (NAS Report, 2012), has shown that learners who speak English and a Zambian language at home perform better than those who speak either English or a Zambian language only. The learners who speak English are presumed to be from high social economic status background and urban schools, but their overall performance is lower than those who speak English and a Zambian language. In the Zambian context, for a learner to develop holistically, she / he needs a blend of the local language and the English language. This therefore entails having a language policy which promotes both languages (NAS, 2012, p.47).

As to whether the language spoken at home was same as the one used at school, the survey revealed that 51 percent of the learners showed that the language spoken in their homes was the same as the one used at school for instruction, while 49 percent indicated that the language of instruction was different from the language they spoke at home. These findings showed that the language policy on the language of instruction in schools must be implemented with caution (NAS, 2012, p.47).

Furthermore, according to Zambia's National Assessment survey report 2014, trends in Mathematics national performance at primary level since 1999 have remained at below 40 percent mark except in 2008 when it reached 40.2 percent. The analysis of the trends in performance reveals that while there was a steady increase between 1999 and 2003, there was generally no improvement in Mathematics performance over the period between 2003 and 2014. Moreover, the 2012 and 2014 survey Reports, have a downward trend in the national performance. This poor performance is further corroborated by the SACMEQ results which showed that Zambia's performance has remained below the minimum desired level in the same subject, suggesting that there may be very little teaching and learning going on in schools (NAS, 2014).

Given the fact that all the seven national assessment surveys conducted so far (1999, 2001, 2003, 2006, 2008, 2012 and 2014) have consistently revealed low levels of achievement, it would seem that time is now ripe to review the policies, strategies, and practices pertaining to assessment of learner achievement and its improvement. These should cover the entire value learning chain from curriculum intentions through: - contents, teacher preparation, classroom instruction, examinations and assessment to standards monitoring and evaluation of performance (NAS, 2014).

Therefore, it is worth noting that in as much as low achievement levels in mathematics or any other subject could be attributed to a lot of factors, to a large extent language of instruction have a bearing on low achievement especially in instances where second (L2) learners and teachers are not competent in the language of instruction.

Wood (1988) argues that children may fail to solve a problem being set by an adult or misunderstand something being taught or explained to them not because they lack certain intellectual abilities but because they don't understand the language being used. This problem of communication breakdown can be more pronounced where the local languages in mathematics involve simply replacing a refined mathematical language, as Griffiths and Howson (1974) argue, by a crude one without considering that different languages carry to the child different mathematical meanings. The effective use of a language as a medium of instruction in mathematics should take into consideration the differences in knowledge of, attitude to and practice in language between teachers and their pupils (Wood, 1988; Durkin and Shire, 1991).

According to Edwards and Westgate (1987), during a mathematics lesson, a teacher engages in asking questions, responding to pupils' questions, giving instructions and commands, giving explanations, reading and writing symbols, providing concepts, and so on. Pupils too have their role of assuring the teacher that they are learning. Classroom talk calls for not only the teacher's knowledge of the subject but also most importantly a high command of the language of instruction.

For the teachers what counts as mathematical conversation and how this is facilitated and developed in their classrooms is central to their mathematics classroom practice, constituted as it is by multilingualism. Teachers are likely to give communication a great deal of thought. Moreover, they share an acute awareness of linguistic differences in their classrooms and that they need to consider how their language practices enable or constrain not only the class as a whole, but the diverse learners within it (Kaphesi, 2002). The point here is that it is precisely the challenge of establishing effective mathematical communication - of understanding the significance of the teacher's voice and learning how this is done in classrooms where there is diverse communicative competence in the medium of instruction more especially in multilingual classrooms. Here communication skills simply cannot be taken for granted.

According to UNESCO (1953), it is a common practice in multilingual countries that mathematics be taught in the local language especially in the first school years, yet teachers may not have enough vocabulary in the local language to transfer the knowledge between first (Ll) and second language (L2).

Therefore, this research aimed at assessing practices in teaching and learning mathematics using local language (chinyanja) in a multilingual context.

1.3 Statement of the Problem

Zambia has been trying to address the problem of providing high quality education through, among other things, emphasizing the use of local languages as medium of instruction from grade 1 to 4 and English thereafter (Ministry of Education, 2013). Consequently, there are usually no clear strategies for implementing language policy in education especially that Zambia is a multilingual country. Furthermore, the 2014 National Assessment Survey further revealed that teachers possess the knowledge content of the various subject areas but transmission of the knowledge to their learners shows a problem which could be attributed to the classroom pedagogy (NAS, p. 47, 2014).

Consequently, this research aimed at assessing practices in teaching and learning mathematics using Chinyanja in a multilingual classroom.

1.4 Purpose of the Study

The purpose of this study was to assess practices in the teaching and learning of primary school mathematics using Chinyanja in a multilingual classroom.

1.5 Objectives of the study

1.5.1 General objectives

To assess practices in teaching and learning mathematics using Chinyanja in a multilingual class: a case of selected primary schools in Lusaka district, Zambia.

1.5.2 Specific Objectives of the Study

The study was guided by the following objectives:

i. To examine teachers', discourse practices as they teach mathematics in a multilingual classroom using Chinyanja.
ii. To describe learners' experiences as they learn mathematics using Chinyanja in a multilingual classroom.
iii. To establish mathematics teachers' views on the new language policy direction in Zambia.

1.6 Research Questions

The following were the research questions for the study

i. What are the teachers' discourse practices as they teach mathematics in a multilingual classroom using Chinyanja?
ii. What are learners' experiences as they learn mathematics using chinyanja in a multilingual classroom?
iii. What are mathematics teachers' views on the new policy direction in Zambia?

1.7 Significance of the Study

The findings from this study might help education stakeholders like the Ministry of General Education, teachers, parents and pupils on how to address issues related to the teaching and learning of mathematics using local languages in a multilingual society. Also the study might increase opportunity for other researchers to go beyond this research related aspect of language.

Furthermore, the findings may contribute to the already existing body of knowledge in the area of Mathematics Education.

1.8 Delimitation of the study

The study targeted teachers of mathematics whose mother tongue was not chinyanja, and grade 4 pupils in selected primary schools of Lusaka District. Despite the study making emphasis on practices in the teaching and learning mathematics using chinyanja, it did not investigate teachers' and learners' attitude in the teaching and learning mathematics using chinyanja.

1.9 Limitation of the study

There was panic and anxiety in my participants arising from my classroom observations. This might have hindered the participants from acting in the natural setting. However, the rapport was established. Time factor was a limitation as qualitative researches requires enough time for deep understanding of a phenomenon under investigation.

1.10 Theoretical Framework

The theory that underpinned this study is the Socio-cultural theory as espoused by levy Vygotsky (1978). Vygotsky's theory stresses the fundamental role of social interaction in the development of cognition (Wertsch, 1985; Vygotsky, 1978), as he believed strongly that social interaction plays a central role in the process of making meaning. Vygotsky focuses on the connections between people and the socio-cultural context in which they act and interact in shared experiences.

Socio-cultural theory places the social environment at the very Centre of learning, and without which, the "development of the mind is impossible" (Cole & Wertsch, 2001 p 4). This is because learning is mediated. Vygotsky proposed that in the learning process, experts use tools to mediate learning. Cognitive development is not a direct result of activity, but it is indirect; other people must interact with the learner, use mediatory tools to facilitate the learning process, and then cognitive development may occur. These tools are "psychological" (Vygotsky, 1978 p 53) in nature, in that they are used to express thinking, and include language, signs, symbols, texts and mnemonic techniques. The most significant socio-cultural tool is language, as it is used to teach and is vital in the process of developing higher psychological functions (Karpov, 2003; Rogoff, 1990; Sutherland, Armstrong, Barnes, Brawn, Breeze, Gall et al, 2004). Mediator tools are first seen externally as the expert teaches the learner how to use the tool, then internally as the learner

begins to use the tool in performing other activities. In the internalization process, the tools modify and transform the learners' thought processes as they begin to use these new tools to express their thinking. Thus, the impact of the social environment on learning can be seen in that the experts select and teach tool use and this affects the way that the learners express their thinking (Cole & Wertsch, 2001; John-Steiner & Mahn, 1996).

As socio-cultural theory proposes a mediatory function in learning, the role of the teacher can be described in the way they promote learning, and this can be achieved with Vygotsky's concept of the Zone of Proximal Development (ZPD). This concept describes the type of environment that enables the learner to develop cognitively. When faced with a new situation, the learner needs new or more mature psychological tools and mental structures for this particular activity (Chaiklin, 2003). If the learning environment has the right amount of support from others, then the learner can gain maturity in their new tools as they learn to use them in this environment, and the learner is said to be "learning in the ZPD".

It is not just the presence of other more mature people that is necessary, but that these people must be able to help the learners develop and enrich the particular psychological tools that are needed, and only when these learners are ready for this next stage of development. If these factors are all present, then the learners' interaction in the social environment can be able to help them achieve success in the learning activity, in a way that they could not have done without the social support (Chaiklin, 2003; Karpov, 2003; Kozulin, 2003).

The context needed for learning is that where the learners can interact with each other and use the new tools. This means that the learning environment must be authentic, that is, it must contain the type of people who would use these types of tools such as concepts, language, symbols in a natural way. The activity that is part of this environment would also need to be an authentic one, as the type of language used by the people in the environment would be determined by the type of tasks they would be doing. Here the learners will be able to learn how to use domain knowledge in the same way practitioners would, as they would discuss and interact using the domain knowledge that learners require competence in (Brown, Collins & Duguid, 1989). Therefore, the type of situation that is required for this interaction is tasks or problems that would normally be done by those in the field. These tasks may be simple or complex, depending on the learners' levels, but

must be authentic. In a socio-cultural learning design, Vygotsky's themes of mediation, the social environment, the use of tools, scaffolding, collaboration and the development of cognition in the ZPD are all inter-related concepts and these should be applied to the design of Socio-cultural learning environments.

Mediation

Mediation is central to Vygotsky's socio-cultural theory (Williams and Burden 1997). Mediation according to Vygotsky refers to the part played by other significant people in the learners' lives, people who enhance their learning by selecting and shaping the learning experiences presented to them. Vygotsky (1978) (as cited in O'Neil, 2011) claims that the secret of effective learning lies in the nature of the social interaction between two or more people with different levels of skills and knowledge. This involves helping the learner to move into and through the next layer of knowledge or understanding. Brodie (1996, p. 12) posited that mediation is the process of closer teacher direction and guidance. Vygotsky also regards tools as mediators and one of the important tools is language. The use of language to help learners move into and through their ZPD is of great significance to socio-cultural theory. According to Kozulin (2002), human mediation usually tries to answer the question concerning what kind of involvement on the part of the adult is effective in enhancing the child's performance, while symbolic mediation deals with what changes in the child's performance can be brought about by the introduction of the child to symbolic tools such as language and learning media. Therefore, it is important to understand how learners and teachers whose mother tongue is not Chinyanja interact during learning and teaching of mathematics. This is because key to the concept of mediation is that both the learners and the teacher should have competence in the language of instruction, for the learners to be able to provide necessary feedback to the teacher in areas where they would need closer assistance.

Scaffolding in the zone of proximal development

Scaffolding is another fundamental concept of the ZPD theory. The term scaffolding was introduced by Wood, Bruner and Ross (2001) in an attempt to operationalize the concept of teaching in the ZPD (Wells, 2000). In the context of the ZPD, scaffolding is used to explain the social and participatory nature of teaching and learning which occurs in the ZPD. According to Vygotsky, in a social interaction, a knowledgeable participant can create by means of speech and supportive conditions in which the student (novice) can participate in and extend current skills and

knowledge to a high level of competence (Donato 1994). Educationally, scaffolding is an instructional structure whereby the teacher models the desired learning strategy or task, then gradually shifts responsibility to the students.

According to Rogoff (1990) in Donato, (1994), scaffolding implies the expert's active stance towards continual revisions of the scaffolding in response to the emerging capabilities of the learner and a learner's error or limited capabilities can be a signal for the adult to upgrade the scaffolding. As the learner begins to take on more responsibility for the task, the adult dismantles the scaffold indicating that the child has benefited from the assisted performance and internalized the problem-solving processes provided by the previous scaffolded episode. Therefore, in this study, the concept of scaffolding guided the study in understanding the teacher's use of Chinyanja as they interact with learners in socially created learning environment in the teaching and learning of mathematics in a multilingual classroom.

The teacher's role within the ZPD in teaching Mathematics

The teacher's role in teaching Mathematics in the ZPD becomes one of purposeful instruction, a mediator of activities and substantial experiences allowing the learner to attain his or her zone of proximal development (Blanton, 1998; Rueda et al., 1992). The implications are that the teacher's task is to push the student's ZPD toward higher and higher levels of competence and complexity. To add to what teachers do, teachers provide a model to show the learner how something is done, or they can demonstrate a process or skill both physically and by talking aloud about how an expert thinks then the learners are given the opportunity to imitate the process. Lastly, teachers are expected to simplify complex matter. Perhaps the most important form of assistance is well-timed questioning, which can guide and scaffold the learning process. Questions can also serve to extend students' thinking further and provide opportunities for them to articulate and reflect on their thoughts.

Vygotsky's theory focuses on the mechanism of developing skills and strategies, and the Zone of Proximal Development (ZDP) is the concept that explains this mechanism: "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in

collaboration with more capable peers" (Vygotsky, 1978, p. 86). With the scaffolding of the teacher (Bruner, 1960), students can widen and deepen their knowledge within their ZPD, but they are assumed to be active and to construct their knowledge themselves.

Brousseau's theory also regards the learning environment, with teachers scaffolding students and offering valid conditions for learning, as important for students' own construction of their knowledge. The teacher has, in line with Brousseau's theory, the responsibility for creating a-didactical learning situations in which the teacher does not make known to the students his/her intention regarding the knowledge students have to construct. Nevertheless, the teacher is still responsible for scaffolding students through the a-didactical situations. Teachers cannot be said to have the power to make the students learn, which is the students' responsibility, but they have the responsibility for scaffolding students in their own learning processes and for offering conditions for students to access the knowledge. The institutionalization of knowledge (Brousseau, 1997) also aims to make knowledge socially and culturally acceptable, which means that it not only is individual, but that it also can be used in other situations outside the school context. Therefore, the concept of mediation, scaffolding and ZPD guided this study, in understanding teachers' and learner' practices in the teaching and learning of mathematics using local language (Chinyanja) in a multilingual classroom.

1.10.1 Conceptual Framework

Below is the conceptual framework that guided this study. In the conceptual framework it is assumed that when both the teacher and pupils are competent in the language of instruction, the teacher will be able to mediate and scaffold the learners during the learning process while the learners will actively participate and negotiate mathematical meaning with the teacher and amongst themselves in classroom discourse thereby enabling the pupils to construct mathematical knowledge.

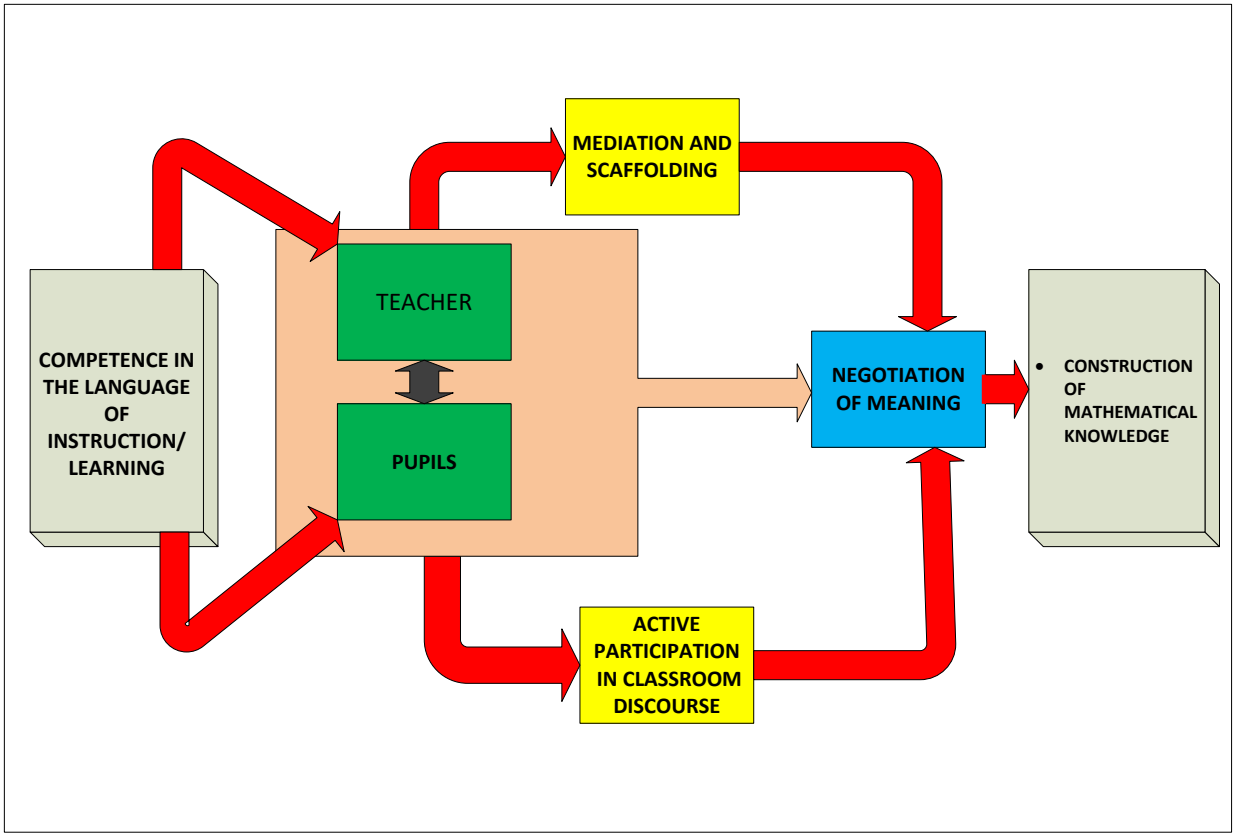

Figure 1.1 Conceptual Framework

1.11 Organisation of the Dissertation

The dissertation is organized into six chapters.

Chapter One: Chapter one provided some detailed accounts of the background of the study. It also outlined some key items such as the statement of the problem, purpose of the study, objectives with their research questions, and the significance of the study, scope (delimitation and limitation), the theoretical and conceptual framework and finally the operational definitions.

Chapter Two: Chapter two reviewed literature that relates to the use of local language as a medium of instruction and also the teaching and learning of mathematics in a multilingual setting. In an attempt to do this, literature related to this study were reviewed under the following sub-heading: mother tongue as a language of instruction, familiar or second language as a language of

instruction, Language Issues in teaching and learning of mathematics, teaching mathematics in multilingual classrooms**,** mathematics learning in a multicultural society, challenges in the teaching and learning of mathematics in a multilingual classroom and pedagogies and practices in multilingual classrooms.

Chapter Three: Chapter three discusses the research methodology that I applied to assess teachers' and learners' practices in the teaching and learning of mathematics using Chinyanja in a multilingual classroom. The chapter presents the type of research design that was used, study area, study population, sampling techniques, instruments for data collection, procedure for Data collection and data analysis that was employed in the study. Also taking into account the ethical issues that surrounded the study.

Chapter Four: Chapter four presents the findings of the study in relation to the research objectives. These findings are presented in form of themes supported by lesson excerpts and verbatim which were recorded during semi-structured interviews and focus group discussions.

Chapter Five: Chapter five provides the discussion of the findings presented in chapter four in line with the research objectives. The findings are further discussed in view of the literature reviewed and the theoretical framework underpinning the study.

Chapter Six: Chapter six is the conclusion of the study together with the recommendations that were drawn from the study.

1.12 Chapter Summary

In this chapter, the researcher has presented the background of the study and the statement of the problem. Furthermore, the researcher explained the aim of the study, objectives, research questions, theoretical framework and conceptual framework of this study, significance of the

study, delimitations and operational definition of terms. The chapter that follows focused on reviewing of related literature that provided gaps and background to this study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

In this chapter, the researcher presented a review of related literature, which provided a basis for analysis. In an attempt to do this, literature related to this study were reviewed under the following sub-heading: mother tongue as a language of instruction, familiar or second language as a language of instruction, Language Issues in teaching and learning of mathematics, teaching mathematics in multilingual classrooms**,** mathematics learning in a multicultural society, challenges in the teaching and learning of mathematics in a multilingual classroom and pedagogies and practices in multilingual classrooms.

2.2 Mother Tongue as a Language of Instruction.

To show the importance of using home language as medium of instruction in teaching and learning process, numerous studies have been conducted. Prah (2000) and Phillipson (2000), argued that children learn better when the language used for instruction in the teaching and learning process is a familiar language which later facilitates the acquisition of other languages easily. They argued that local languages are the best basis for literacy, since they are already understood by local populations and young children in particular can easily learn academic content in languages they already understand. In their further analysis, they stated that such learners who attain initial literacy in their familiar language will find it easier to grasp concepts in the second language.

UNESCO (2013) showed that in Ethiopia, for example, primary school children learning in their mother tongue performed better in grade 8 in mathematics, biology, chemistry and physics than pupils in English-only schools. The same report also indicates that in the Islamic Republic of Iran in 2011, 74% of learners who spoke Farsi, the local language, performed better in schools than those who used English language. Thus in as much as local language is better for learners to attain initial literacy, there is need to find out how teachers and learners engage with each other in the teaching and learning of mathematics in multilingual classrooms.

Benson (2005) and Effiong (2013), highlights that when children's home language is used to teach them, they understand concepts better. Matang (2003), states that in order to gain interest in mathematics and make meaning out of what children are learning, their culture needs to be

embedded in mathematics. He emphasizes that materials from children's cultural background needs to be used as teaching aids to make more meaning to mathematics concepts and ideas taught. He also highlights that contextual meaning to abstract ideas needs to be provided in mathematics through culturally inclusive curriculum. In addition, mathematics teaching and learning at primary school level should be made user friendly to the students through incorporating children's home language.

According to Israel and Thomas (2013), children understand mathematics better when they are taught using their mother tongue. Learning using mother tongue also helps to develop mathematical vocabularies that could be easily used and remembered by students. Furthermore, Vygotsky's Cultural Historic theory highlights that knowledge from children's culture and cultural background should form basis of teaching and learning process. The importance is given to children's mother tongue which helps children to develop mentally and use the ideas learnt from culture to enhance their performance.

Niesche (2009), sees the need to embed children's culture in teaching mathematics. From his research in Western Australia, he found out that children performed better when the native language (Kriol) was used instead of English to teach mathematics to the children. He realized that using children's mother tongue in teaching mathematics can become a powerful tool for learning mathematics. I also support the ideas of the respective authors that using home language and materials from children's culture can enhance the teaching and learning of mathematics at primary school level especially in monolingual societies. However, the use of mother tongue or local language in a multilingual setting where learners come into classroom with different linguistic background is likely to yield different results.

Banda and Kabubi (2016), did a study on the positive impact of using local language as a medium of instruction in selected primary schools in Chipata District, Eastern province of Zambia". The findings of study showed a number of positive impacts of teaching in local language on pupils' academic performance which included among others; easy understanding, participation increasing by learners, high level of concentration, easy teaching, good performance, higher academic standards, and learner's confidence increasing. Among the recommendations put forward by the researchers were that the government through the Ministry of General Education should retrain

teachers in local languages so that they can teach effectively and that the teachers should be able to speak three to four languages so as to help implement local languages in schools. This recommendation is a clear indication of the multilingual nature of most of the classrooms in Zambia. Therefore, despite the positive impact of teaching in local language on pupils' academic performance, there is little research on how teaching and learning mathematics using Chinyanja is done in multilingual classrooms in Zambia.

2.3 Familiar or second language as a language of instruction

It is worth noting that there are a number of studies done in Zambia in relation to the use of local language as a medium of instruction, even though they focused mainly on the teaching of literacy. However, these studies provide necessary insights in relation to the selection of a local language perceived to be familiar in a certain locality and used as a language of instruction in a multilingual setting.

Kumwenda (2010) carried out a study on the reading performance levels of grade one learners. These learners were instructed using chichewa which was not their first language. The study was carried out in Chipata urban, in the eastern region of Zambia. It was established from this study that learners whose first language were other languages other than Chichewa performed poorly compared to pupils whom chichewa was their first language in the same target area. It is worth noting that, this study was only limited to reading skills and was also meant to compare the reading skills of children whose native language was Chichewa and those who were not. The point here is that teaching learners in a language which is not their mother tongue will have challenges in comprehending what is being taught. From the foregoing it becomes necessary to assess teachers' and learners' practices in teaching and learning mathematics using Chinyanja in a multi-ethnic society.

Bunyi's (2005, p.140-147) ethnographic study of Kenyan lessons showed that classroom interactions in an L2-dominant school are dominated by safe talk – where the teacher makes little demand on learners, encourages choral answers, repetition of phrases and copying of notes from chalkboards or textbooks, undermining efforts to bring up a new generation of teachers (Capper 2000, p.18).When teaching becomes mechanical and stifling, learners are likely to want to distance themselves from primary school as soon as possible. Thus, without adequate support for an L1-

based language policy, as a result primary schools end up encouraging an orientation towards error-free regurgitation of curriculum content rather than the expression of ideas and interaction with new information (Stenhouse 1971).

Tambulakani and Bus (2011) conducted a study on testing the degree of fitness between learners' home language and the language of teaching, on the reading skills on students. The findings showed that learners who were taught using the L1 had better reading skills than those who's teaching were in L2. Therefore, this is an indication that in a multilingual setting like Zambia selecting a language of instruction might be challenging on the ground that they will always be learners who will be sidelined in the learning process a result of the language. Therefore, there is need to consider education aspirations of the minority learners.

Another study conducted by Tambulukani and Bus (2012), the findings showed that children in Lusaka were not familiar with the language in which they were being taught to read in (Chicewa). They preferred to use words in "town Nyanja", which they commonly spoke at home and at play. This discrepancy could be hampering the learning and teaching process. The study explained that it was difficult and confusing for the learners because some items they knew in Chicewa had different meaning.

Tambulukani (2015), did another study to find out whether first language teaching of initial reading is a blessing or curse for the Zambian children under primary reading programme. The study was quantitative in approach and used a quasi-experimental design and a total of 240 children were chosen from 12 schools, covering 4 schools from each of the three districts of Chipata, Lusaka and Mongu. It was assumed that the three districts would differ in degree of language fit. It was expected that Mongu would have the best language fit between the language of teaching and the language spoken by the children as their home language because of the homogenous nature of the language community and strong unified cultural setting.

The second best fit would be in Chipata district which lies only 80 kilometers away from Katete which has a much deeper Chewa language which is similar to the Chinyanja used on the course. Lusaka would have the worst fit because of its cosmopolitan linguistic community and has a

dominance of a variety of Chinyanja which is commonly referred to as street Nyanja. The study aimed at finding out whether children from the three districts with different levels of fit between the language of teaching and the language children used at home and in the play grounds would perform equally on the tests, compare the performance of low achieving children with that of high achieving children, and establish whether literacy achievement in the first language assisted literacy development in English in grade 2.

The findings of the study showed that in Mongu district, children scored highly on the language of teaching and this result indicated that in Mongu the language of instruction was the children's familiar language and therefore the language fit was high with the scores ranging between 90% and 100%. Chipata district results on the test came second to Mongu indicating that the majority of the children in Chipata schools responded in the other language (L2) and not in the language of teaching. Children used the street variety of Nyanja and not the textbook chinyanja which is referred to as Chichewa in the nearby districts of Katete and Chadiza. Therefore, for Chipata, the language fit was low with the range falling between 14% and 55%.

Lusaka scored the lowest on the familiar language test. Almost all the children in Lusaka schools preferred to use the other language, L2, and not the language of teaching literacy in class. Children used the street Nyanja L2 to discuss the test (on a picture). This result indicated that for Lusaka district the language fit was the lowest with scores ranging between 6% and 9%. The findings of the study confirmed that oral-language plays major roles in initial reading especially when beginning readers have acquired a minimum of alphabetic understanding that enables word reading and writing. The results also confirmed that transfer of skills from the first language to the second language was evident for the learners who had acquired initial reading ability in the first language.

The results from Tambulukani's study clearly show that Zambia is a multilingual country and selection of a local language as language of learning and teaching can have implications to the learners and teachers whose mother tongue is not the language of instruction. However, the question on the effectiveness of local languages as mediums of instruction in a multilingual classroom remains unanswered in his study. Therefore, the current study takes another angle from Tambulukani's study in that while his study is based on reading levels, the current study looks at

teachers' practices in the use of Chinyanja in the teaching of mathematics as medium of instruction in multilingual classroom.

It is again worth noting that various studies have also been conducted within Zambia that looked at the challenges faced when using a familiar local language as medium of teaching (Banda, Mostert & Wikan 2012, Mwanza 2012, Simfukwe 2010). The studies have indicated various challenges teachers encounter as they implement the curriculum at classroom level in a muitilingual country. Banda, Mostert, Gerd and Wikan (2012), as cited in Mbewe (2015) carried out a pilot study on the language of education policy implementation, practice and learning outcomes in Lusaka district at White primary school. One of the findings of the study was that although chinyanja still remained a lingua franca and recognised as the familiar local language for Lusaka province, the prominent languages spoken by the majority of pupils in this school once they got to their homes were chinyanja, Bemba, Tonga, Soli, Lenje, Lozi, Kaonde and several other Zambian languages.

Therefore, the conclusion is that even if chinyanja is considered the language of play for some learners while at the same time being used as a medium of teaching, it is not the mother tongue for many other learners. Thus, it becomes a necessary undertaking to find out how Chinyanja play out in the teaching and learning of mathematics in a multilingual classroom. In the same year, a similar study was carried out by Mwanza (2012) in Lusaka. The study was on the language of initial literacy in an environment that was more cosmopolitan but where chinyanja was being used as a medium of teaching. From the study, it was established that chinyanja was not a language of play in certain parts of Lusaka district. Another result realised was that the chinyanja spoken in the district was not equal to the standard one recognized in schools. The study further revealed that there was lack of materials that could enhance the teaching and learning of initial literacy and also that both teachers' and learners' levels of proficiency in standard chinyanja were very low.

It was further established in the study that teachers lacked fluency and enough vocabulary in chinyanja. Equally, as observed, the standard chinyanja recognized for use in schools was different from what both teachers and pupils knew. As established in the study, it was noted that chinyanja was the dominant language of play in high and medium density areas whereas English was

established as the dominant language of play in low density areas. It was also established that local languages such as Bemba, Tonga, Lozi and Nsenga were among the languages of play used in the district.

Simfukwe (2010) also carried out a study that sought to ascertain the effectiveness of teaching indigenous languages under the team teaching arrangement in colleges that offer primary teaching education in Zambia. It was established that indigenous languages were not being taught effectively under this team teaching arrangement in these colleges. It was also at the same time revealed that teachers lacked sufficient training in the local languages. This study is different from simfukwe's study in that, this study's main focus is to assess teachers' and learners' practices in the teaching and learning of mathematics using Chinyanja in a multilingual classroom.

Additionally, Mubanga (2012) cited in Mbewe (2015) conducted a study in Chongwe district that sought to investigate the effects of the use of chinyanja in teaching initial literacy in an area that is predominantly Soli speaking. The study revealed that the use of chinyanja as a medium of instruction in teaching initial literacy skills only made the school to look more alien and hostile in some parts of Lusaka province because it made some learners feel as if they were not part of the classroom especially in terms of discussions due to language barrier. This means that a learner who learns using local language as a second language will still experience challenges just as when English is used. Therefore, even though the ministry of Education (2013) introduced the use of local languages as medium of instructions from grade 1 to 4, more research is needed to find out how teachers and learners in multilingual settings engage in classroom discourse. Hence, the need to find out how teachers and learners whose mother tongue is not Chinyanja teach and learn mathematics in multilingual classroom.

Benson (2004) argued basing on factors involved in delivering quality education. Of all the factors mentioned, language stood out as a key factor to communication and understanding in the classroom. Regarding teacher preparation, Benson (2004) stated that compounded by chronic difficulties such as low levels of teacher education, poorly designed, inappropriate curricular and lack of adequate school facilities, submersion makes both learning and teaching extremely difficult, particularly when the language of instruction is foreign to the teacher. In his argument he

stated that teacher education must be addressed no matter what the innovation and serious consideration should be made for in-service (in the short-term) and pre-service (in the long-term). Thus, this study attempts to understand how teachers and learners whose mother tongue is not Chinyanja cope with the demands of chinyanja in the learning and teaching of mathematics. McCarty (2003) argued that the only strategy for languages is through teacher education. He further argued that being a fluent speaker does not automatically make a skilled teacher because a first language teacher is often unaware of the difficulties of learning that language. It is for this reason that this study aimed at assessing teachers' practices in teaching and learning mathematics using Chinyanja grade 4 in a multilingual classroom in Lusaka district, of Zambia.

Finally, an extensive project conducted in 1975 by de Lemos using 641 randomly selected primary school children is relevant to this review. De lemos set out to assess the educational achievement of migrant children in grades 2, 4 and 6 in Melbourne (Australia) primary schools, and therefore was considering the effect of a second language on pupil achievement. The pupils were divided into 4 categories, namely (1) Australian; (2) English speaking migrants of English origin; (3) English speaking migrants of non-English origin; and (4) non-English Speaking migrants where English was not the major language spoken at home. The children were assessed on a selection of tests of school achievement, English vocabulary, conceptual development and non-verbal ability. On all tests at all grade levels, the mean scores of the non-English speaking group were consistently lower than the Australian pupils and the English speaking migrants (Newman, p.42, 1983).

Importantly the differences were far more marked on the language tests than on non-verbal and arithmetic tests. The differences between the Australian pupils and the non-English speaking pupils on the non-verbal and arithmetic tests decreased from grade 2 to 6. On the language based comprehension and word knowledge tests there were still significant differences between the Australian and the non-English speaking groups at the grade 6 level. One could extrapolate from these results to suggest that where second language children are concerned it is on those mathematical items involving a large degree of verbal language that these children experienced difficulties. On straight arithmetic items involving only symbolic language, second language children achieve as well as monolingual English speaking children (Newman, p. 42, 1983).

Thus the context of this research is different from that of De Lemos and other than the differences identified some aspects such as how learners and teachers from different linguistic background learn and teach mathematics in a language which is not the mother tongue could be checked in the current study.

2.4 Language Issues in Teaching and Learning of Mathematics

The teacher-student and student-student interactions in mathematics classrooms have been studied for many decades, but in recent years, the analyses of classroom interactions have had a different focus. Today, there is great interest in whether children are permitted to contribute constructively and actively to their own learning process during class discussions. Voigt's (1985 quoted in Ellerton, 1989) carried a microanalysis of the sequence of 24 lessons in which a teacher routinely introduced new mathematics tasks by asking open-ended questions and then, directing a whole class discussion with the students. The findings revealed that although the teacher thought his questions were encouraging constructivist learning, unknowingly he funneled the students towards the solution he had in mind all along by means of implicit markers and non-verbal cues. As a result, there was hardly any genuine negotiation of meaning (Cobb, Yackel and Wood 1988, p. 85).

In his seminal work on psycholinguistics, Miller (1965) suggested that there are two aspects of language; physical representation and meaning, and commented that 'the gulf between the two is wide. This need to be counterbalanced with Clark's (1973) observation that early meanings given to words by young children are often determined by the context in which they occurred. Various studies have indicated that the language problem is one of the major factors contributing towards the poor performance of many students in mathematics (Secada 1992, Barton, and Barton 2003). The results all point to the fact that linguistic factors have significant effect on learning of mathematics.

Rastogi (1991) conducted a study on the weakness in mathematics as related to academic achievement considering the deficiencies due to lack of language ability. It has been found out that retardation in further stage of learning mathematical skills is incumbent upon the weakness in basic arithmetic skills. According to Secada (1991), performance of students in mathematics is below expectations and the mathematical background, seems to be shaky and concluded that the language factor might be perhaps one of the causes of the low performance of students.

According to IAE (1986), students need to be taught how to communicate mathematically, give sound mathematical explanations, and justify their solutions. Effective teachers encourage their students to communicate their ideas orally, in writing, and by using a variety of representations. Allen (1988) found out that appropriate language is the key to making Mathematics intelligible. According to Brodie (1989), language is a necessary condition for understanding and a pre-requisite for thoughts. Furthermore, Gawland (1990) asserted that the language of the classroom has a formative effect on the learner's understanding of mathematics.

Pimm (1991) remarked that most of the tasks involved in the teaching and learning of mathematics involves some form of communication between teacher and pupils and between pupils. Being able to make good use of language is an essential skill for a mathematics teacher. Thus while Pimm is right in his own thinking, his view does not extend in situations where the teacher and the pupils are both struggling to learn the language of instruction. According to Cline and Fredrickson (1996), linguistic factors have a significant effect on student learning in mathematics. Ellerton and Clarkson (1996) stated that communicating mathematical ideas are essentials for any successful mathematics teaching and learning process. According to Bell and Woo (1998), language of the student influences how he will interpret and builds understandings. Stard, (1998) emphasized that it is the responsibility of a mathematics teacher to ensure that the classroom discussion does not damage mathematical learning.

Brown *et al.* (2000), identified language as some sort of a medium for creating, preserving, and communicating mathematical thinking. Language is essential if teachers and students are to communicate and share mathematical ideas and beliefs. According to Silby (2000), communicating mathematics to students in a classroom is mediated by language. Therefore, language has a crucial role to play in communicating and developing mathematics education. National Council of teachers of Mathematics (NCTM) (2000) stressed the importance role of language in mathematics teaching and learning. In the study, communication has been emphasized as an essential part of Mathematics and Mathematics education. Khisty and Chval (2002) established the role of language and teacher talk in Mathematics learning. According to them, understanding how students solve problems, how their thinking develops and how language

impacts learning can foster teacher understanding of how instruction can promote mathematical learning. However, it should be stated that little is known on how all these projections stated above can be utilized in a multicultural society like Zambia.

According to Perry (2002), without sufficient language to communicate the ideas being developed, children will have their Mathematical development seriously curtailed. According to Barton and Barton (2003), language problem is one of the major factors contributing to the poor performance of many students in mathematics especially those who are bilingual and multilingual. Ongstad (2006) pointed out the explicit role of language and communication in Mathematics and found out that teaching mathematics needs to be seen as communication. According to Khalid (2007), a teacher plays a big role in encouraging and determining the success of communication in any class. The foregoing presupposes teachers to be competent in the language of instruction, contrary to the Zambian situation where at times teachers are deployed or posted to areas where they have to learn the language of instruction. Thus, there is need to assess how such teachers handle classroom discourses.

Clarkson's (1991) paper sets out the latest stage in his long-standing work in the area of multilingualism in mathematics classrooms. The research reported in Clarkson and Dawe's (1997) paper was conducted in two cities in Australia with large multilingual populations. A key theoretical background to their work is Cummins' threshold hypothesis (Cummins and Swain, 1986; Cummins, 2000) that relates linguistic proficiency of bilingual students to academic achievement. In many ways, the paper challenges linguistic discrimination, demonstrated in the first instance by its focus on multilingual students, as well as by the finding that bilingual students with high competence in two languages outperformed monolingual students. In addition, the authors argued as a result of their work (following Cummins and Swain, 1986) that students' first language plays a role in their learning of mathematics and it is therefore important that bilingual students maintain and develop competence in their first language. They conclude by contending that both teachers and curriculum writers need to be more aware of the role of first language in mathematics teaching and learning (p. 160), thus placing the onus on the education system to respond to the needs of bilingual students rather than the other way round.

Clarkson and Dawe (1997) argued from their results that students need support in their first language in studying mathematics, and that this is the responsibility of the education system, their characterization of students as having low competence in two languages could have potentially negative consequences for students of Vietnamese background.

The students reported using Vietnamese in solving some problems, particularly if they found them difficult. To explain this finding, Clarkson suggests that switching between languages has a metacognitive function, in effect giving students access to additional or alternative meanings and relationships. Interestingly, interviews with the same students two years' later found that there was much less use of Vietnamese reported. Cummins' work has long suggested that students' use of their home languages can be advantageous in schooling in settings like Australia's. What is particularly important about Clarkson's paper is its specific indication of how and why home language can be used to facilitate mathematical thinking but little is mentioned on how the same local language can be a resource in a multilingual society.

2.5 Teaching Mathematics in Multilingual Classrooms

The language practices that learners bring to school inevitably affect how and what they learn (Nieto, 1999). The students' level of mastery of the language of instruction is a crucial factor for the teacher's interpretation of their difficulties (Clements and Jones, 1983). When minority language students join a mathematics class, they often find different norms, regulating both the social dynamics of the mathematics classroom and the mathematical practices. Discontinuities in understanding new words and new meanings can turn into a wide variety of cultural conflicts and disruptions of the learning process. In order to overcome these drawbacks, many teachers try to be more transparent in their use of language (Núria Gorgorió and Núria Planas, 2001).

Ellerton and Clarkson (1996) suggested a multidimensional framework for interpreting language factors in mathematics learning which portrays the centrality of teachers, the mathematics classroom, and curriculum in addressing these issues. Following Ellerton's idea, it is crucial to know more about the teacher's knowledge of the linguistic situation and how to link it with the curriculum. In particular, it is also important to take into account the relationships between the educational aspirations of minority language students and their teachers (Coughlan, 1995). This

provokes the aspirations to analyze how teachers whose language of instruction is not their mother tongue interacts with curriculum materials in the teaching of mathematics.

Teachers in multilingual settings usually address their students using a simplified language register (Fillmore Wong, 1982). Teaching in a simplified form of the official language does not guarantee that learners have better access to the mathematical content, but may add an obstacle because it interferes with the acquisition of rich mathematical concepts, by obscuring them (Adler, 1997; Valdes, 1999). Thus, it is necessary to reach a point where the language of learning helps the acquisition of school mathematics and vice versa. Even if learners have difficulties in verbalizing a mathematical process, the teacher can promote the mathematical thinking by distinguishing the talk from the thinking (Adler, 1999).

In Grosjean's (1982) terms, language practices in multilingual classrooms should not necessarily be the same as those language practices in monolingual classrooms i.e. classrooms where the language of learning and teaching (LOLT) is the main language of all the learners and the teacher. For example, an important aspect of multilingualism, that which makes the multilingual person an integrated whole, is code-switching (CS). Code-switching, or switching from one language to another in the course of a conversation, can be expected to occur in multilingual setting. One of the significant findings in this area relates to the benefits that result from using CS in teaching and learning mathematics (Setati, 1996). Other studies have shown that use of the learners' first language in teaching and learning provides the Il support needed while the learners continue to develop proficiency in the second language (Khisty, 1995; Adler et. al., 1997). Other practices that have been observed in multilingual mathematics classrooms include chanting and chorusing. Chanting and chorusing can be used in mathematics as classrooms as linguistic, pedagogic and mathematical devices (Adler et. al.; 1996 Setati, 1998).

In multilingual primary mathematics classrooms, negotiating across languages is intertwined with negotiating across discourses **(**Núria Gorgorió and Núria Planas, 2001). The suggested relationship between codes switching, mathematical discourses and whether and how they enable learners to communicate mathematics is indeed a fruitful area to be researched in mathematics education in Zambia.

On the basis of their ethnographic observation of classroom interaction in three primary schools in Kenya, Merrit, Cleghorn, Abagi, & Bunyi (1992) argue that code-switching provides an additional resource for meeting classroom needs. Poplack cited in Grosjean (1982) argues that codeswitching is a verbal skill requiring a large degree of competence in more than one language, rather than a defect arising from insufficient knowledge of one or the other. In most classrooms code-switching seems to be motivated by cognitive and classroom management factors (Adendorff, 1993; Merritt, et al., 1992): Usually it helps to focus or regain the learners' attention, or to clarify, enhance, or reinforce lesson material. Determinants of code-switching in the mathematics classroom are only partially dictated by formal language policy. Even if official policy exists, teachers make individual moment-to-moment decisions about language choice that are mostly determined by the need to communicate effectively: Multilingual teachers do not only teach lessons and inculcate values having to do with conservation of resources. They, perhaps unconsciously, are socializing pupils into the prevailing accepted patterns of multilingualism (Merritt, et al., p. 118).

Most bi/multilingual persons switch when they cannot find an appropriate word or expression or when the language being used does not have the necessary vocabulary item or appropriate translation (Grosjean, 1982). This kind of switching would occur in a bi/multilingual mathematics conversation. For instance, if learners can hold a mathematical conversation in Setswana, it is possible that the mathematical terms will be in English, because mathematics has a well-developed register in English but not in Setswana.

Code-switching as a learning and teaching resource in multilingual mathematics classrooms has been the focus of research in the recent past (e.g., Addendorff, 1993; Adler, 1996, 1998, 2001; Arthur, 1994; Khisty, 1995; Merritt, et al., 1992; Moschkovich, 1996, 1999; Ncedo, Peires, & Morar, 2002; Setati, 1996, 1998; Setati & Adler, 2001). These studies have presented the learners' main languages as resources for learning mathematics. They have argued for the use of the learners' main languages in teaching and learning mathematics as a support needed while learners continue to develop proficiency in the LoLT while learning mathematics. All of these studies have been framed by a conception of mediated learning, where language is seen as a tool for thinking

and communicating. In other words, language is understood as a social thinking tool (Mercer, 1995).

Therefore, it is not surprising that problems arise when learners' main languages are not drawn on for teaching and learning. Arthur (1994) conducted her study in Botswana primary schools where the main language of the learners is Setswana. English as the LoLT starts from standard six. Her study of the use of English in standard six mathematics classrooms revealed that the absence of learners' main language (Setswana) diminished the opportunities for exploratory talk, and thus for meaning-making. The form and purposes of the teaching and learning interaction in these classrooms were constrained by the use of English only. As Arthur explains, communication was restricted to what she referred to as "final draft" utterances in English, which were seemingly devoid of meaning. It can be assumed that even in situations where local language is used a language of instruction, learners and teachers whose mother tongue is not the language of instruction are likely to have diminished opportunities for exploratory talk in the classroom. Consequently, there is need to assess teachers' and learners' use of Chinyanja in mathematics teaching and learning following the introduction of local languages as medium of instruction by the Ministry of Education (2013).

Code-switching has been observed as a "main linguistic feature in classrooms where the teacher and the learners share a common language, but have to use an additional language for learning…the learners' language is used as a form of scaffolding" (National Centre for Curriculum and Research Development, 2000, p. 68). Adler (1996, 1998, 2001) identified codeswitching as one of the dilemmas of teaching and learning mathematics in multilingual classrooms. Adler (1996, 1998, 2001) observed that in classrooms where the main language of the teacher and learners is different from the LoLT, there are ongoing dilemmas for the teacher as to whether or not she should switch between the LoLT and the learners' main language, particularly in the public domain. Another issue is whether or not she should encourage learners to use their main language(s) in group discussions or whole-class discussion. These dilemmas are a result of the learners' need to access the LoLT, as critical assessment will occur in this main language. Adler's study suggests that the dilemmas of code-switching in multilingual mathematics classrooms cannot necessarily be resolved. They do, however, have to be managed.

2.6 Mathematics learning in a multicultural society

Research carried out in Brazil in the 1980s (Carraher 1988, Saxe 1988 cited in Ellerton, 1989) has emphasized how children involved in selling in the streets of cities in Brazil are able to use accurate meaningful mathematics procedures, yet the same children at school during the day are not able to find the answers to corresponding formal arithmetic 'sum'. The verbal protocols produced by the researchers demonstrate clearly that the children's language of real-life mathematics is linked powerful with verbal knowledge, skills and imagery in their long-term memories. These cognitive links are in place because the mathematics is part of the cultural heritage of the children. This link between mathematics language and culture has been explored in cross-cultural mathematical studies by Bishop (1988) and Harris (1988).

According to Newman, (1983 cited in Ellerton, 1989), it is hardly surprising that children, who learn mathematics in classrooms where the language of instruction is not their first language often struggle to comprehend the language of mathematics teachers, textbooks, and examinations. In the past, this has been interpreted as suggesting that the children concerned were, in some way, deficient mathematically. It is only recently that the cultural component of mathematics and mathematics education has begun to receive its due recognition. It can be argued further that Newman concentrated much on pupils whose language of instruction was not their first language. However, what is not known is how teaching and learning can be facilitated in situations where the language of instruction is neither the teacher nor pupils' first language.

Adler (2001) contends that research in multilingual mathematics education reported in the 1980s and early 1990s did not focus on classroom practice. She draws examples from Cocking & Mestre (1988), Durkin & Shire (1991) and Clarkson (1992), who all took up the issue of bilingualism and mathematics learning and argued that bilingualism per se does not impede mathematical learning. Their focus was on cognitive functioning of learners in bilingual settings, and particularly learners whose mother tongue was different from the language of instruction. Some of this research explored the relationship between levels of bilingualism and mathematics performance, building on Cummins's notion of the 'threshold hypothesis' (Baker, 1993, p. 135). Some explored particular aspects of the mathematics register, like word problems, or logical connectives and reading in mathematics.

Adler (2001) supports Rubagumya's (1994) observation that there is little known about how things are done in multilingual classrooms. Rubagumya's observation reflects my own experiences and concerns that have inspired me to embark on a study in understanding teachers' use of local language in multilingual mathematics classrooms.

2.7 Challenges in the teaching and learning of mathematics in a Multilingual Classroom

Learning and teaching mathematics in a bi-/multilingual classroom where the Language of learning and teaching (LOLT) is not the learners' main language is complicated. Learning mathematics has elements that are similar to learning a language since, mathematics, with its conceptual and abstracted forms, has a specific register and set of discourses. Mathematics teachers face different kinds of challenges in their bi-/multilingual classrooms from English Language teachers. The latter have as their goal, fluency and accuracy in the new language - English. Mathematics teachers, in contrast, have a dual task. They face the major demand of continuously needing to teach both mathematics and English (or local language) at the same time (Adler, Slonimsky and Lelliott et al., 1997, p. 17).

Learners, on the other hand, have to cope with the new language of mathematics as well as the new language in which mathematics is taught (e.g Chinyanja). They are also attempting to acquire communicative competence in mathematical language where learning to articulate the meaning of certain concepts involves the development of a language that can best describe the concepts involved. This is especially pertinent to mathematics because mathematical talk is known for involving both specialized terms and different meanings attached to everyday words i.e. a specific register.

It can also be understood that mathematical language, particularly as it is used in the school context, as comprising both informal and formal components. Informal language is the kind that learners use in everyday life to express their mathematical understanding. Formal mathematical language refers to the standard use of terminology (mathematics register) which is usually developed within formal settings like schools. In most mathematics classrooms both forms of language are used and these can be either in written or spoken form. Pimm illuminates the challenges this poses for mathematics teachers: *One difficulty facing all teachers, however, is how to encourage movement in their learners from the predominantly informal spoken language with*

which they are all pretty fluent, to the formal language that is frequently perceived to be the landmark of mathematical activity (Pimm, 199 1, p. 21).

According to Mphunyane (1996, p. 19), "linking informal and formal mathematical languages forms one dimension for paving a way towards development of 'true' mathematical concepts, the merging of spontaneous and scientific concepts; hence mathematical knowledge".

In bi-/multilingual settings, the challenge becomes a three dimensional dynamic (Adler, 1996, 1998). It simultaneously entails access to the language of learning (Chinyanja in the Lusaka context), access to mathematical discourses, and access to classroom discourses. There are ways of speaking Chinyanja for instance, of talking within and about mathematics, and of talking in school. The dynamic is given interesting illumination by Moschovich (1999) in her study of discourses in a primary mathematics classroom in the USA where most learners were Spanish-speakers. Through her analysis of classroom transcripts, Moschkovich (1999) was able to show the significant effects of practices like 'revoicing' by the teacher.

Here, in the whole class setting, the teacher is able to listen to and work with learners' informal or incomplete mathematical language productions and revoice and so frame them towards appropriate or more formal mathematical discourses. In this way, the teacher enables access to English, mathematical English, and ways of talking mathematics in school. The teacher understands her role as including the modelling of mathematical talk for learners who are struggling simultaneously with concepts and their appropriate naming in English, the language of learning and teaching. This however, is only possible if the teacher is competent in the LOLT. Thus, more research need to be done in multicultural society where teachers are not competent with the LOLT.

In addition, mathematics in school is itself carried by distinctive discourses. Cobb (1998), for example, distinguished calculational from conceptual discourses in the mathematics classroom. He defined calculational discourse as discussions in which the primary topic of conversation is any type of calculational process, and conceptual discourse as discussions in which reasons for calculating in particular ways also become explicit topics of conversations (Cobb, 1998, p. 46).

In conceptual discourse, the learners articulate, share, discuss, reflect upon, and refine their understanding of the mathematics that is the focus of the interaction or discussion. It is the responsibility of the teacher to arrange classroom situations in which these kinds of interactions

are possible—classroom situations where conceptual discourse is not just encouraged but is also valued. The teacher, as a "discourse guide" (Mercer, 1995), conveniently acts to a considerable extent as an intermediary and mediator between the learners and mathematics, in part determining the patterns of communication in the classroom, but also serving as a role model of a "native speaker" of mathematics (Pimm, 1987). As a consequence, from their interactions with the teacher, students learn the range of accepted ways in which mathematics is to be communicated and discussed. The teacher models the accepted ways of acting-interacting-thinking-valuing-speaking-reading-writing mathematically. Teachers can encourage conceptual discourse by allowing learners to speak informally about mathematics—exploring, explaining, and arguing their interpretations and ideas.

In an in-depth analysis of one of the lessons observed, English emerged as a legitimate language of communication during teaching, and thus was the language of mathematics, of learning and teaching and of assessment. However, this dominance of English produced a dominance of procedural discourse, mainly because the learners were not fluent in conceptual discourse in English. Thus whenever the teacher asked a conceptual question, they responded in procedural discourse in English, or remained silent until she changed the question into a procedural one. This dynamic is mainly due to the differing linguistic and mathematical demands of procedural discourse and conceptual discourse (Setati, 2002).

In conceptual discourse learners are not only expected to know the procedure that needs to be followed to solve a problem, but also why, when, and how that procedure works. Procedural discourse, on the other hand, focuses on the procedural steps that should be followed in the solution of a problem. These steps can be memorized without understanding. Unlike conceptual discourse, procedural discourse does not require justification. It is therefore not surprising that in an additional language learning environment like the multilingual classrooms in the study, procedural discourse would dominate when mathematical conversation was in English (Setati, 2002).

The challenge that teachers face is to encourage movement in their learners from the predominantly informal spoken language to formal written mathematical language, and this includes both conceptual and calculational discourses. In mathematics, informal language can be referred to as the kind that learners use in their everyday lives to express their mathematical thinking. For example, learners, in their everyday life, may refer to a half as any fraction of a whole and hence

can talk about dividing a loaf of bread into 'three halves'. This is inappropriate in formal mathematical talk. In addition to initiating learners into the formal mathematical meanings and use of 'half', and the conceptual discourse of fractions as equal parts of a whole, learners also need to learn how to use calculational discourses that enable operations on and manipulations of fractions. Thus, more complex scenario arises in a multilingual classroom where almost all the pupils come with different misconceptions (Setati, 2002).

The horns of this dilemma are, on the one side, that explicit mathematics language teaching, in which teachers attend to pupils' verbal expressions as a public resource for class teaching, appears to be a primary condition for access to mathematics, particularly for pupils whose main language is not the language of instruction. On the other side, however, there is always the possibility in explicit language teaching of focusing too much on what is said and how it is said (Setati, 2002).

Setati & Adler (2001) and Setati (2002), have argued that in multilingual mathematics classrooms where learners learn mathematics in an additional language, the movement from informal spoken language to formal written language is complicated by the fact that the learners' informal spoken language is typically not the LoLT.

The meeting point in multilingual classrooms in all the settings represented in the above collections, suggests that teaching students mathematics in a language that they are still learning has negative implications in the acquisition of mathematics skills by students. These students have to cope with learning mathematical concepts, how the concepts are applied and the language in which they are embedded. Their teachers have to deal with teaching mathematics in a language that students are not fluent in. These teachers end up with a dual task of teaching both mathematics and an additional language at the same time. The danger is that mathematics students learn very little mathematics because the teachers are focusing more on developing their fluency in the language of learning and teaching (Adler, Slonimsky and Lelliott et al., 1997, p. 17). As a result, many children enter secondary school without the required background knowledge in mathematics, thus making it difficult for them to succeed in mathematics at higher level.

The variety of dissonances minority language students experience during their transition process often result in a wide range of failure manifestations: disruptive behaviours, 'silent autism'

behaviours, absenteeism or cognitive and emotional blockages. This often leads to failure within the school system. When having difficulties in structuring the new meanings in the new context, the learners may experience a gap in the coherence and the continuity of their living experiences, appearing as cultural discontinuities (Nieto, 1999) and hence as cultural conflict (Bishop 1988). Moschkovich (1996, p. 27) refers to different types of discontinuities in language minority classrooms, "from first language to second language, from social talk to academic talk, and from the everyday to the mathematics register". While these are useful, of greater importance are the linguistic barriers that create obstacles to mathematical learning. The mathematics register is not the same as the everyday language register; the main language is not the same as the official language in the classroom. The mixture arising from this double discontinuity results in code switching being difficult for the learners in many different ways.

It can be asserted that the Zambian education system has had consistently recorded poor performance in mathematics both at grades 7, 9 and 12 final examinations (ECZ Report, 2016). It should be stated that the impact of language factors and how they affect mathematics teaching and learning has not been researched in the Zambian education systems especially in multicultural communities. The argument however, is that school performance (and by implication, mathematics achievement) is determined by a complex or inter-related factors. Poor performance of multilingual learners thus cannot be wholly attributed to the learner's language proficiencies in isolation of wider social, cultural and political factors that infuse schooling. Clearly language is not the only factor, but it is at least a necessary condition of success in many situations, even if not a sufficient condition. Hence there is need to analyze the teaching and learning of mathematics in a multilingual class in Zambia.

As Secada (1991) has argued, bi-or multilingualism is becoming the norm in urban classrooms, rather than the exception. Hence the need in mathematics education research to examine classroom practices where the bi/multilingual speaker (as opposed to the monolingual speaker) is not only treated as the norm, but his or her facility across languages is viewed as a resource rather than a problem (Baker, 1993).

Managing the multilingual classroom consists of balancing double-focused expectations (subject knowledge and language development), as well as dealing with individual learner characteristics,

as found in changing classrooms where learners' linguistic and cultural backgrounds are becoming more and more heterogeneous. Some authors maintain that multilingualism has negative effects on language development, educational attainment, cognitive growth and intelligence (Reynold, 1928; Saer, 1963 both in Grosjean, 1982).

Martin-Jones' (1995) review of research on code-switching in the multilingual classroom reveals the shifting emphases and growing understanding of the complexity of this language practice. Code-switching as learning and teaching resource has been the focus of a range of studies in mathematics education (e.g. Adler, 1996, 1998; Arthur, 1994; Khisty, 1995; Moschovich, 1996, 1999; Setati, 1996, 1998). These studies have either demonstrated and/or argued for use of the learners' main language in teaching and learning mathematics as a support needed while the learners continue to develop proficiency in the language of learning and teaching (LOLT), at the same time as learning mathematics.

All of these studies have been framed by a conception of mediated learning, and of the communicative and cognitive functions of speech. Learners need to talk to learn, and such talking to learn is a function of fluency and ease in the language of communication. In other words, talk is understood as a social thinking tool (Mercer, 1995). It is thus not surprising that problems arise when learners' main languages are not drawn on for talking to learn. Arthur's study in Botswana schools revealed that the absence of appropriate use of learners' main language, and a delivery of instruction through English only, subtracted out opportunities for exploratory talk, and thus for meaning-making. Arthur argued that this effect was a function of both the teacher and the learners not having the opportunity for talking to learn (through a main language) and hence for conceptual exploration through more informal language forms.

Thus, the greater the distance between the nature and the patterns of discourse at home and at school, the more demanding the process of learning would be for students. Many of the differences between home and school are cultural, and are often expressed in the language of the students. The difficulties that students experience when learning school disciplines can possibly be linked to the distance between their social and cultural frames of reference and those valued by the schools they attend (George,1995; Gorgorió & Planas, 2001; Herbert, 2003, 2008).

2.8 Pedagogies and Practices in Multilingual Classrooms

The concept of singularization of plurality - that is, a focus on the individual differences in the discursive regimes that is "languages." The result, then, is the facilitation of communication to improve the lives of speakers of language, instead of promoting a specific language or languages. In the same way, teaching in today's multilingual/multicultural classrooms should focus on communicating with all students and negotiating challenging academic content with all of them by building on their different language practices, rather than simply promoting and teaching one or more standard languages (Ofelia, Claire and Daria, 2011). In this, singularities in pluralities refer to the increased plurality of practices - linguistic, educational, and cultural - that characterize students in the multilingual/multicultural classrooms of today. Additionally, the concept of singularities in pluralities to discuss how teachers' pedagogies and practices that facilitate learning in these complex contexts must build on students' singular language practices as part of the classrooms' pluralities (Ofelia, Claire and Daria, 2011**)**.

However, models of bilingual or multilingual education that impose norms of language use in one or the other language without any flexibility will also privilege those whose language practices follow monolingual norms in two or more languages. This may have been appropriate in the 20th century without the speed and simultaneity of movement of people, goods, and services that technology has made possible today. However, the 21st century is characterized by the concurrent means of communication in many media and languages and, thus, conceptions of bilingualism and multilingualism must also become more flexible, more dynamic (Ofelia, Claire and Daria, 2011**)**

As Mercer (1995) has argued, (mathematical) knowledge produced in the context of schooling is quite specific and is different from knowledge produced in everyday contexts. Within the context of schooling he distinguished between educational discourse-the discourse of teaching and learning in the classroom (e.g., ways of asking and answering questions in class) and educated discourse-new ways of using language (e.g., in algebra 'let x be any number'), "ways with words" (p. 82) that would enable pupils to become active members of wider Society, in relation to mathematical discourse, the teacher's role is to translate what is being said into mathematical discourse to help frame discussion, to pose questions, to suggest real-life connections, to probe arguments, and to ask for evidence. The language practices of the classroom (educational discourse) must 'scaffold students' entry into mathematical (educated) discourse.

Mercer's (1995) argument suggests a mediational role for teachers when they assist learners in crossing the bridge between talk as the invisible window through which mathematics can be seen and more explicit, visible mathematical language teaching. From this sociocultural perspective, the teaching and learning of mathematics in multilingual contexts needs to be understood as three-dimensional. It is not simply about access to the language of learning (in this case English or Chinyanja). It is also about access to the language of mathematics (educated discourse) and access to classroom cultural processes (educational discourse).

The research reported by Adler (1995) contrasts in many respects with that of Clarkson and Dawe (1997). Her research is qualitative in nature and comes from a wider project, one that: seeks a critical understanding of the complexities of teaching mathematics in multilingual classrooms through teachers' knowledge of their practice, (p. 208). Many questions here concern the nature of communicative competence, explanation, thinking and engagement. From Whorfian perspective, all these practices may be influenced by the different linguistic practices within the students' experience, including their experience of other languages with which they are more familiar. Their different languages have associated with them different modes of explaining, of communicating or engaging. Students' diverse linguistic and cultural backgrounds also imply different meanings for the words that are used by all participants. They argue that this elaborated framework enables researchers to examine, in an integrated manner, the mathematics content, the interactional context and the discourses in multilingual pre-service teacher education in multilingual classrooms.

Nkambule's (2013) work was also with immigrant learners but in multilingual classrooms in South African schools. She explores discourse practices with immigrant and local learners during the teaching of linear programming in an urban school in South Africa. Through empirical data collected from immigrant learners from the Democratic Republic of Congo, she found that the teacher supported immigrant learners by switching to two additional languages, French and English during the teaching of linear programming. She concludes that the teacher's support for the immigrant learners by resorting to their additional language paradoxically raised questions about the extent to which local learners were marginalized in the process of learning.

Ghana and India provide an interesting comparison in terms of the models of education that have been put forward to serve their diverse and multilingual societies, and to promote the use of the mother tongue in early primary education. Ghana promotes an early exit, transitional bilingual education model, in which children are required to switch from learning through a government-supported Ghanaian language at the lower primary level, to learning through English at the upper primary level (Erling, Adinolfi, & Hultgren, 2017).

India recommends that the state language be used as the medium of instruction (MOI) in government schools, with another modern Indian language and English being taught as curricular subjects. However, in response to dissatisfaction with the quality of government educational provision, low-cost private schools, which do not follow the government language policy and instead use English medium instruction (EMI), are growing in popularity. These two models represent two rather typical contexts in which EMI is used in primary education – those, often in contexts in Sub-Saharan Africa where there is often a transition to EMI in government schools at the upper primary level, and those in contexts in South Asia and beyond where EMI is increasingly being used in low cost private schools, often against national language-in-education policy (LEP) recommendations (Erling, Adinolfi, & Hultgren, 2017).

The LEPs in both contexts have been fraught with difficulties in implementation, and evidence suggests that there continues to be difficulties in improving educational quality despite them. Since the formulation of the Millennium Development Goals, there has been increasing attention paid to the quality of teaching and learning in schools, with the result being that Goal 4 of the Sustainable Development Goals ensures inclusive and equitable quality education, and promotes lifelong learning opportunities for all. It is increasingly recognized that medium of instruction is a key aspect of improving the quality of education. Findings from this study suggest that the LEP and its enactment can present a range of challenges to realizing improvement in educational quality, and this might be contributing to the rise of low-cost private schools outside the government sector (Erling, Adinolfi, & Hultgren, 2017).

The classroom observations undertaken in Ghana and Bihar revealed similar practices in terms of the teacher-dominated pedagogy observed. In both contexts, despite evidence of low learning

outcomes and insufficient levels of English among students, there was a low occurrence of student-centred, active learning practices that supported the development of content and language learning. Lessons in both contexts were highly teacher dominant and textbook focused, with the teacher being the only one to speak for the majority of the lesson time. The most striking factor in both contexts was that students had very limited opportunities to speak. In both contexts, the focus was on students' memorization of content knowledge and the majority of questions addressed to students were 'closed' and sought a 'correct' answer (Erling, Adinolfi, & Hultgren, 2017).

In Ghana, the teachers' competence in English was reasonably high, where in India it was quite low. In Ghana, the teachers spoke almost exclusively in English, whether to discuss the curriculum, to explain, for affective purposes or for classroom management. Teachers only offered brief explanations or translations of single words or phrases in the local languages. This is despite research that shows that judicious and strategic use of codeswitching can enable students to understand concepts in both languages and to participate actively during lessons (Erling, Adinolfi, & Hultgren, 2017).

In India, however, the facilitative use of codeswitching between English and Hindi – to translate and occasionally explain or give an example – was common among all teachers, and classroom codeswitching was openly recognized as a legitimate and necessary pedagogic strategy, since the students' English-language competence was developing. The labelling of these schools as 'EMI' could therefore be seen as a misnomer. Classroom codeswitching was also a commonly observed teacher practice in the English classes in the Hindi-medium government school. While it was recognized that students required the extra support of Hindi, there was no use of other local languages in the classes observed. In both contexts, it was overwhelmingly the case that the students spoke very little in the lessons, and when they did, it was almost always limited to choral responses or reading aloud (Erling, Adinolfi, & Hultgren, 2017).

2.9 Chapter Summary

The literature discussed in this chapter no doubt has indicated that teaching in early grades in a child home language enhances learning achievements. The reviewed literature also has shown that using local language as a medium of instruction in multilingual settings creates certain challenges

to both teachers and learners who are not proficient in the language used. Thus, the literature has further revealed a number of practices teachers and learners engage in multilingual settings to access mathematical concepts. It should be noted however, that a large body of research bases its findings and arguments on the benefits of using local languages for initial literacy and numeracy in government schools. Thus, there is need to assess teachers' and learners' practices in the teaching and learning of mathematics using a selected local language in a multilingual setting. It is for this reason that the current study was a necessary endeavour. The next chapter gives a detailed discussion of the methodology that was employed during the research process.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research design, data collection methods, and procedures that were used during the whole process of the research.

3.2 Research Design

Research designs are plans and the procedures for research that span the decisions from broad assumptions to detailed methods of data collection and analysis (Cresswell, 2009). Research designs are the specific procedures involved in the research process (Cresswell, 2012). Similarly, Gosh (2011, p.7) states that research design is not a highly specific plan to be followed without deviation, but rather a series of guide posts to keep one headed in the right direction.

This research adopted a descriptive survey research design. Unlike any other designs, a descriptive survey research design is selected owing to its attribute of describing the state of affairs as they exist (Gay 1987, p.189). He further argued that descriptive method is useful for investigating a variety of educational problems. Typical descriptive studies are concerned with assessment of attitudes, opinions, demographic information, conditions, and procedures (Gay 1987).

According to Paggarwal (2012, p. 231), "descriptive or normal survey is that method of investigation which attempt to describe and interpret what exists at present in the form of conditions, practices, processes, trends, effects, attitudes, beliefs, etc… it is an organized attempt to analyze, interpret, and report the present status of social institutions, groups or area." It is concerned with the phenomena that are typical of the normal conditions. It explores into the conditions or relationships that exist, practices that prevail, beliefs, points of view or attitudes that are held, processes that are going on, influences that are being felt and trends that are developing (Paggarwal, 2012). Since I sought to understand practices in teaching and learning mathematics using Chinyanja in a multilingual classroom in its natural setting, hence this design.

Qualitative research methodologies were employed in this study. This places emphasis on exploring the richness, depth and complexity of phenomena. Broadly defined, it means, "A research strategy that usually emphasizes words rather than quantification in the collection and analysis of data" (Bryman, 2008, p.366). Qualitative methodologies help to bring out the meaning

of informants experiences without subjecting them to rigid pre-set categories. In this study, the qualitative methodology is deemed appropriate for collecting the desired data on the grounds that it seeks to understand human and social behavior from the perspective of those living in the environment, that is, "As it is lived by participants in a particular setting, for example a culture, school, community, group or institution" (Aryl 1996, p.476). Furthermore, Denzin & Lincoln, (2005, p. 3), purported that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them. The approach was employed so as to precisely capture the participants' 'views and giving a deeper understanding of lessons observed.

3.3 Study Site

The study was undertaken in two (2) primary schools of Lusaka District in the Lusaka Province of Zambia. Lusaka is the capital city of Zambia and as such it is a province where one is likely to find most of Zambian local languages. The two schools were purposively picked and where both coeducational schools. Lusaka was chosen because the researcher deemed it to be the best fit because of its cosmopolitan linguistic community and has a dominance of a variety of Chinyanja. Below is a map of Zambia showing the research site (Lusaka District)**.**

Figure 3.1: Study site (map of Zambia showing the location Lusaka)

3.4 Study Population

Cresswell (2012) describes population as a group of individuals from which samples are taken for measurement. The target study population comprised of primary school teachers and grade four (4) pupils in Lusaka district.

3.5 Study Sample

A sample refers to a subset of the population that is selected for a particular study, (Cohen, Manion and Morrison, 2006). For the purpose of conducting interviews and focus group discussions, the sample comprised of 24 participants, four (4) teachers and twenty (20) pupils whose mother tongue was neither the language of learning and teaching from two selected primary schools in Lusaka district. However, classroom observations were conducted in the four (4) selected classes, two from each school. Patton, (2002) contended that there are no rules for sample size in qualitative inquiry. Sample size depends on what you want to know, the purpose of the inquiry, what's at stake, what will be useful, what will have credibility, and what can be done with available time and resource.

3.6 Sampling Techniques

The study being qualitative used a non-probability sampling techniques to come up with the sample size. Purposive sampling was used to select four (4) teachers of mathematics from two selected primary schools in Lusaka district whose mother tongue was neither the language of learning and teaching as well as 20 pupils for the purpose of focus group discussions. From each school, two classes were observed and five (5) pupils were selected from each class, in order to get rich information on the teaching and learning of mathematics using Chinyanja. Owing to different types of purposeful sampling, this study employed intensity purposive sampling (Patton, 2002). Intensity sample consist of information-rich cases that manifest the phenomenon of interest (language of instruction in multilingual). Using the logic of intensity sampling, one seeks excellent or rich examples of the phenomenon of interest, but not highly unusual cases (Patton, 2002).

3.7 Data Collection Methods

The data collected were mostly teachers' and pupils' words and actions, which 'requires methods that allow the researcher to capture language and behaviour' (Maykut & Morehouse, 1994, p. 46). To collect this data, I used focus-group discussions, observations and semi-structured interviews.

3.7.1 Lesson Observations

The study used lesson observations to collect data as the researcher used lesson observation guide (Appendix 4). Observations are commonly used in education as a tool to support understanding and development. It is one of the common way of getting information which can help to make sense of educational situations, gauge the effectiveness of educational practices, and plan attempts for improvements **(**Malderez, 2002). There is little doubt that classroom observation can be a valuable tool in giving a more comprehensive picture of what actually happens in class, and help attain a higher standard of teaching and more effective teaching methods. Classroom observations is a method of directly observing teaching practice as it unfolds in real time, with the observer or analyst taking notes and/or coding instructional behaviors in the classroom or from videoed lessons (Hora & Ferrare, 2013). Therefore, I observed the lessons on 'addition and subtraction' of numbers so as to understand what exactly happens in teaching and learning mathematics using chinyanja. During observations, I sat in the participants 'class of their regular mathematics time and used the audio-recorder to record the lessons during the teaching sessions.

3.7.2 Focus group discussions

Focus Group discussions are type of in-depth interviews accomplished in a group, whose meetings present characteristics defined with respect to the proposal, size, composition, and interview procedures. The focus or object of analysis is the interaction inside the group. The participants influence each other through their answers to the ideas and contributions during the discussion. The moderator stimulates discussion with comments or subjects. The fundamental data produced by this technique are the transcripts of the group discussions and the moderator's reflections and annotations. The general characteristics of the focus Group discussion are people's involvement, a series of meetings, the homogeneity of participants with respect to research interests, the generation of qualitative data, and discussion focused on a topic, which is determined by the purpose of the research (Morgan 1989). Focus Group Discussions were used with pupils as key informants (see appendix 3) and had two (2) focus group discussions consisting of 10 pupils each. The focus group discussions were used in order to get the learners' views on their experiences in the learning of Mathematics using chinyanja. It helped me in knowing some of the advantages and challenges they face in the learning of Mathematics.

3.7.3 Semi- structured interviews

Data was also collected using semi-structured interviews (Appendix 2). A semi-structured interview is a method of research used most often in the social sciences. While a structured interview has a rigorous set of questions which does not allow one to divert, a semi-structured interview is open, allowing new ideas to be brought up during the interview as a result of what the interviewee says. The interviewer in a semi-structured interview generally has a framework of themes to be explored. However, the specific topic or topics that the interviewer wants to explore during the interview should usually be thought about well in advance (especially during interviews for research projects). It is generally beneficial for interviewers to have an interview guide prepared, which is an informal grouping of topics and questions that the interviewer can ask in different ways for different participants. Interview guides help researchers to focus an interview on the topics at hand without constraining them to a particular format. This freedom can help interviewers to tailor their questions to the interview context/situation, and to the people they are interviewing (Denzin & Lincoln, 2005).

Thus, by conducting interviews it helped me to have a better understanding of teachers 'use of chinyanja in teaching mathematics and also to establish their views on the new policy of teaching in local languages from grade 1-4. In order for me to capture data in its totality, the interviews were conducted after the lesson and audio-recorded and each teacher was interviewed individually. All group discussions, interviews and teaching that were audio-taped were transcribed into verbatim transcripts.

3.8 Data Collection Procedures.

The research methods that were used when collecting data are the semi-structured interviews, lesson observations and focus group discussions. To collect data on how teachers and pupils' used language in mathematics teaching and learning, observation techniques was used. The researcher entered the classroom simply to observe as a non-participant and note how the teacher and pupils were interacting while teaching and learning mathematics. Foster (1996) notes limitations to observational research methods. The environment, event or behaviour of interest may be inaccessible and observation may simply be impossible. People may consciously or unconsciously change the way they behave because they are being observed and therefore observational accounts

of the behaviour may be an inaccurate representation of how they behave naturally. Observations are inevitably filtered through the interpretative lens of the observer.

Immediately after lesson observations, interviews were conducted with the teachers. The semi-structured interview guide was administered by the researcher to the teachers. All the questions were read to the participants by the researcher which made it easier to clarify any misinterpretation with the participant regarding the meaning of the questions right away (Edwards and Holland 2013). This instrument comprised of open ended questions which were used to collect data from the participants from selected primary schools. Open ended questions helped the researcher to collect information and data on participants' views regarding the practices in teaching and learning mathematics using selected local language in multilingual classroom. Focus-group discussions were used to interpret and verify pupils' practices in mathematics teaching and learning. Focus-group discussions were used because they have 'often presented the unexpected interactions, insights, ideas, and information' (Maykut & Morehouse, 1994, p. 103).

The researcher physically went to the selected schools to administer the semi-structured interviews to the participants as well as conducting lesson observations and focus group discussions.

3.9 Data Analysis

A distinctive characteristic of qualitative research is the on-going analysis during the process of data collection (Neuman, 2003). According to Bogdan & Biklen (1992): Analysis involves working with data, organizing them, breaking them into manageable units, and synthesizing them, searching for patterns, discovering what is important and what is to be learned, and deciding what you will tell others. (p. 153). Cresswell (2012) asserted that thematic analysis categorizes related topics and major themes to provide rich deep description of the phenomena under study. An early and ongoing data analysis technique was employed to ensure that data analysis helps to fine-tune and make the research design more focused at all stages. Analyzing qualitative data in this study meant systematically searching through and arranging the data I had accumulated to increase my understanding and to enable me to present my findings to others as well generating themes.

The constant comparative methods were used to analyze qualitative data through two techniques: *intuitive* and *procedural* (Kaphesi, 2003). Intuitive inquiry is a hermeneutical research method that joins intuition to intellectual precision. As a method, intuitive inquiry seeks to both describe what

is and envision new possibilities for the future through an in-depth, reflection process of interpretation (Anderson, 2000). Intuitive depends on the researchers thorough immersion in the field setting and contemplation of the situation. Procedural approaches tend to restrict the effects of individual judgment; in their ideal state they involve the establishment of research procedures that are followed through in their entirety before analysis of the results is attempted (Firestone & Dawson, 1982). The researcher used the intuitive techniques to analyze the data available to verify what was happening in the classroom in terms of the practices in teaching and learning mathematics using chinyanja.

The researcher used the procedural technique to transcribe the audio recorded interviews and lesson observations before interpretation. Thus, from the words, phrases and sentences I derived codes. Cresswell (2004) highlighted that thematic analysis categorizes related topics and major themes to provide rich deep description of the phenomena under study. Therefore, the transcripts from teachers' and pupils' focus-group discussions, interviews and lesson observation transcripts, where analyzed, interpreted and generated into themes.

3.10 Credibility and Trustworthiness

Neuman (2003) and Silverman (2005), highlighted the importance of validity and reliability in qualitative research. In Naturalistic Inquiry, Lincoln and Guba (1985) used the term "trustworthiness" to cover credibility, transferability, dependability and conformability for the validity and reliability of qualitative data. Creswell (2008) pointed out that the background of the researcher has some influence and significance on the findings deduced. For this reason, various measures were undertaken to reduce such threats as credibility and trustworthiness of the researcher was of utmost importance in research. Hence, the following steps were undertaken by the researcher: long-term observation, member check and triangulation of methods and data.

Merriam (1998) refers to member check as, "taking data and tentative interpretations back to the people from whom they were derived and asking them if the results are plausible." (p. 204). After the interviews were transcribed into textual forms by the researcher, the transcriptions were validated with the participants. This step allowed the researcher to seek clarity with the participants and verify whether the researcher's construction of the findings resembled the views of the participants. This step was undertaken to enhance the credibility of the data collected.

Triangulation is vastly employed in qualitative research data analysis to enhance the trustworthiness of the study (Lincoln & Guba, 1985). Hence, this study employed two techniques of triangulation: methods and data.

Triangulation of data refers to the data collected from different informants or sources to support the findings deduced. Data were triangulated from interviews with multiple participants. Triangulation of data stretched beyond multiple sources of data collection: interviews with the participants, focus group discussion and lesson observations process at various stages. Thus, triangulation of data sources was done in order to compare the findings from each data source for consistency. This step was undertaken by the researcher to ensure that the process of inquiry was logical and well documented in enhancing the credibility and trustworthiness of the data. Furthermore, data was subjected to expert review to examine evidence that justifies the themes (Creswell, 2003). Consequently, my supervisor cross examined them to ensure their credibility in the study.

3.11 Ethical Considerations

Studies that involve collecting data from participants should consider protecting the participants from possible harm and to secure privacy and confidentiality and make a plan of how to do this (Gallen et al, 2007). In line with the aforesaid, firstly permission from the University of Zambia and the educational authorities (DEBS and the school head teachers) to carry out the research in the district was given (Appendix 5). Informed consent was also sought from all participants. All the participants were made aware of the nature and purpose of the study. Additionally, the respondents' identities and the schools were kept anonymous as a way of enhancing confidentiality and privacy. Participants were further given consent forms which they signed and were allowed to withdraw whenever they felt they could no longer continue to participate in the study.

3. 12 Chapter Summary

The chapter includes discussion on the methodology that was used in this study. The research used the qualitative as a paradigm while the design used was descriptive research design. This design enabled the researcher to collect and analyse qualitative data. The chapter has given detailed steps taken from the research design through data collection, analysis, sampling and sample size, to the

ethical consideration and data validation method. The next chapter is the presentation of findings of the study.

CHAPTER FOUR

PRESENTATION OF FINDINGS

4.1 Overview

This chapter presents the findings of the study. The findings are presented according to the research objectives. The data were collected from primary mathematics teachers and pupils in grade 4. These results are based on the data that were collected through lesson observations, focus group discussion and semi-structured interviews. The purpose of this study was to assess practices in teaching and learning mathematics using Chinyanja in a multilingual classroom. The objectives of the study were: to examine the teachers' practices as they teach mathematics in a multilingual classroom; to determine learners' practices as they learn mathematics in a local language in a multilingual classroom; and to establish mathematics teachers' views on the new policy direction.

4.2. Description of Teachers and classes in the Study

The mother tongue language for Teacher 1(Tr-1) was Lozi. The proposed language of instruction was Chinyanja. However, in class, the teacher and few learners used a mixture of English and Chinyanja, while others used English and others Chinyanja. She had been teaching for 12 years and has a Primary School Diploma Qualification. Teacher 1's grade 4 class that was observed had 60 pupils in total, 26 girls and 34 boys. Teacher 1 taught them all- the curriculum subjects. The pupils had a variety of mother tongue languages in the class ranging from Tumbuka, soli, lenje, Bemba, Chewa, Lozi, English, Tonga and Chinyanja. Two consecutive lessons were observed in the same grade 4 class and they focused on vertical subtraction and problems involving subtraction repectively.

The mother tongue language for Teacher 2 (Tr-2) was Ndebele but had developed Chinyanja in her vocabulary. The proposed language of instruction according to the policy was Chinyanja. However, in class, the teacher and few learners used a mixture of English and Chinyanja while others used English and others Chinyanja only. She had been teaching for 11 years and had a Primary School Diploma Qualification. Teacher 2's grade 4 class that was observed had 51 pupils in total, 29 girls and 22 boys. Teacher 2 taught them all- the curriculum subjects. The pupils had a variety of mother tongue languages in the class ranging from Bemba, Chewa, Lozi, English,

Tonga, Chinyanja. Two consecutive lessons were observed in the same grade 4 class and they focused on addition.

The mother tongue language for Teacher 3 (Tr-3) was Bemba and she had developed a bit of Chinyanja in her vocabulary. The proposed language of instruction in teaching and learning was Chinyanja. However, in class, the teacher used English while some pupils used Chinyanja and others English. However, few pupils managed to use both English and Chinyanja. She had been teaching for 22 years and had a Primary School Diploma Qualification. Teacher 3's grade 4 class that was observed had 61 pupils in total, 36 girls and 25 boys. Teacher 3 taught them all- the curriculum subjects. The pupils had a variety of mother tongue languages ranging from Chewa, Ngoni, Tumbuka, Tonga, lozi, lenje, Bemba, Lunda and Kaonde. Two consecutive lessons were observed in the same grade 4 class and they focused on vertical addition**.**

The mother tongue language for Teacher 4 (Tr-4) was Bemba but had developed a considerable portion of Chinyanja in her vocabulary. The proposed language of instruction in teaching and learning was Chinyanja. However, in class, the teacher used a mixture of English and Chinyanja. She had been teaching for 18 years and had a Primary School Diploma Qualification. Teacher 4's grade 4 class that was observed had 58 pupils in total, 37 girls and 21 boys. Teacher 4 taught them all- the curriculum subjects. The pupils had a variety of mother tongue languages ranging from Bemba, chewa, soli, Tonga, Tumbuka, Kaonde. Two consecutive lessons were observed in the same grade 4 class and they focused on vertical subtraction**.**

In Section 4.2 below I present observations and findings from 8 lessons taught by four (4) primary school mathematics teachers in the study. The mother tongue language for these teachers was not the same with the language of instruction (Chinyanja) but all the four (4) teachers where able to use Chinyanja during lessons. The observations provided a glimpse of how the teachers and learners interacted during two (2) Mathematics lessons and how the teachers explained the lesson content to their students. The topics taught were 'subtraction and addition'. This was so because of the common scheme of work being used in the district.

4.3 Mathematics teachers' discourse practices in the classroom

Research objective number one was on teachers' discourse practices using Chinyanja in the teaching of mathematics. In order to examine teachers' discourse practices used in the teaching of mathematics, lessons were observed and semi- structured interviews of teachers were conducted. The impressions created through the classroom lesson observation and interviews with teachers suggested that teachers' spoken competencies in Chinyanja were reasonably moderate. Only one teacher was considered to have had limited competence in spoken Chinyanja, hence, she used English as a language of communication in her lessons.

Below is Table 1 showing common classroom practices teachers' used in the teaching of mathematics in the multilingual classrooms.

Table 1: Common Classroom Practices

S/N	**Classroom practices**
Teachers	- Use of a mixture of Chinyanja and English languages - Question and answers teaching style and dominating classroom talk - use of black board and gestures to explain mathematical terms - talk focusing on correct answer only - translating for learners during teaching - utilizes group discussions

(Lesson observation and interviews, 2018)

The emerging themes from teachers' common practices in the teaching of mathematics in the multilingual classroom were code-switching, teacher taking lead of the discussion, translating, procedural discourses and use of gestures and visual aids.

4.3.1 Code-switching and translation in the teaching of Mathematics

From the lesson observations and semi-structured interviews, the study revealed that all the four (4) teachers (Tr -1, Tr -2, (Tr -3). and Tr-4), used a mixture of Chinyanja and English (code-switching) in the teaching of mathematics. The classroom lesson observation instrument was designed to capture aspects of teachers' language use that could enhance students' understanding of the mathematics, and also to capture if different languages would be used in various classroom management activities.

Two forms of code-switching were observed during lesson observations. The first form of code-switching occurred when teachers were explaining, checking understanding, for interpersonal relations and creating a conducive classroom climate. Here teachers would code-switch from Chinyanja to English or vice-versa. The second form of code-switching occurred when teachers lacked the needed vocabulary in explaining some mathematical terms in Chinyanja. In such instances teachers would code-switch from Chinyanja to English as a way of bridging the language inadequacies.

With regard to supporting access to the mathematics, in all 8 lessons observed, teachers delivered their explanations of concepts using a mixture of Chinyanja and English. For instance, this was evidenced in the following excerpt below;

5.Tr-1: *Sungapunzile nga suyangana nakuvela. So you have to look and listen.*
6.Pupils: *Yes, madam*
7. Tr-1: *So can you all look at me it's time for mathematics. Today we are concluding our topic on subtraction, tisiliza topic yantu yaa chaani? (here the teacher translates the same statement in local language)*
8.Pupils (in chorus): *Subtraction*
9. Tr-1: *Ok tikalibe kuyamba nifuna tuyanganeko kuli vamene tinapunzila last time aii.*
10.Pupils: *Yes*
11. Tr-1: *We were looking at vertical subtraction. We were looking at what?*
12.Pupils (chanting): *Vertical subtraction*
13. Tr-1: *Yes, we were looking at vertical subtraction, can you look at me you. Nikaamba ati chintu chili vertical nichintu chili bwanji? Kuchoka pamwamba kufika pati? (here the teacher uses gestures and the visual aids to illustrate the meaning of vertical subtraction)*
14.Pupils: *Pansi*
15. Tr-1: *So tinayangana masamu yamene tintatika according to place values kuchoka pamwamba kubwela*
16. Pupils: *Pansi*

The above excerpt shows a typical example of Tr-1 using a mixture of Chinyanja and English to teach mathematics. She was switching from Chinyanja to English and vice-versa as well as translating for students in some instances as evidenced from 7 and 13. The use of a mixture of English and Chinyanja during the process of teaching was one of the practice all the 4 teachers were using to teach mathematics to learners but at the same time, the switch from Chinyanja to

English was occurring in instances where the teachers had insufficient vocabulary to express mathematical terms like vertical subtraction and place values (lines 11,13 and 15) in Chinyanja.

The use of mixture of English and Chinyanja can further be illustrated in the excerpt below where Tr-1 was switching from Chinyanja to English when encountering mathematical terms that she could not explain in Chinyanja (vertical order, place values) and in order to communicate the meaning of these mathematical terms, the teacher demonstrated on the black board using meter ruler and hands. The Teacher was also translating (in line 78 below) mathematical terms in Chinyanja to help pupils understand.

27. Tr-1*: Ni word imonzo naimonzi yamene etantauza vasemu, to subtract. Any other word you still remember?*

28.Pupils: *take away*

29. Tr-1: *take away, take away. Any other, you still remember. Any other, Dorcus*

30.Dorcus: less

31. Tr-1: *less, very good. Any other, yes*

32.One pupil: sum

33. Tr-1: sum? Tinapunzila kuti sum nichaani?

34. Pupils: answer

35. Tr-1*: sum ni answer, tifuna mau aja yamene yakamba chimonzi nachimonzi monga subtraction.*

36. Tr-1: *any other word you still remember?*

37.One pupils: *borrow*

38. Tr-1: *Borrow, kuchita borrow nikubweleka. Yes, you*

39.One pupil: *deduct*

40.Tr-1: *very good Dorcus. please can you clap for Dorcus*

41.Pupils: *clapping*

42. Tr-1: *so aya ndiye mau yamene yatantauza chimonzi nachimonzi nakuchosapo*

43.Pupils: *yes*

44. Tr-1: *Minus Nakuchosapo for example, nili nama books yangati apa?*

45.Pupils: *Yatantu*

46. Tr-1: *Nili nama books yatantu, I have got 3 books in my hand, then that word minus simply means chosapo. So tikachosapo simply means subtract, then subtract ndiye minus futi, then take away nikuchosapo pa vinthu vilipamozi then mwatengapo that is to take away isn't it? (here the teacher also is trying to translate for the pupils)*

47.Pupils: *Yes*

48. Tr-1: *Yes, then the next one ati vichepe aii tikamba ati tifuna aya ma books achepe which means tizachosapo aii*

49.Pupils: *Yes.*

50. Tr-1: *so apa yasala imozi aii*

51.Pupils: *Yes*

52. Tr-1: *good, then the other one ati deduct, deduct ati kuchosapo pa vinthu ok, pali vambili wabwela wachosapo*

53.Pupils: yes

54. Tr-1: *So all these words minus, subtract, take away, less and deduct vonse vitantauza chimonzi which is subtraction. So vamene tizapuzila lelo, if you come across one of those words whether it is minus, subtract, take away, less and deduct bafuna kuti uchite chimonzi nachimonzi. Kuchita bwanji?*

55.Pupils: *kuchosapo*

56. Tr-1: *Yes, kuchosapo, so do not be confused by those five words on the…*

57.Pupils: *board*

58. Tr-1: *Are we together boys and girls?*

.

78. Tr-1: *Very good, if 3106 died how many remained? Yes, Gumbo has 5431 cattle, if 3106 died how many remained? Akuti Gumbo, Gumbo uyu nizena ya munthu aii. Ati Gumbo aze na ng'ombe zili 5431 ndiye ng'ombe zamene aze nanzo pamozi, kunafa zili 3106, ati anasala na ng'ombe zingati? Eyi funso niyolembewa muchiganinzo. So it's not that all the time ma question azayamba kulembewa muma numbers no, venengu vemalembewa muchaani?*

96. Tr-1: *so what you do arrange the numbers in vertical order, yakokane bwino bwino according to their place values. So choyamba ng'ombe zoonse zikale pamwamba which is 5431, so apa tifunika tichosemo zamene zinachita bwanji? (*Here the teacher also translates the same statement in local language so that learners who know Chinyanja can understand and those from low density area using English can also understand but terms like place values and vertical order are always mentioned in English).

136. Dorcus: *Ati pali ma plant yali 6000 yamene yanashokewa yali 2568, yangati yamene yanasalako? (here the teacher uses one pupil to the class to understand the translation and she manages well to translate the mathematical statement to the class).*

It was also observed that teachers would translate either from English to Chinyanja or Vice versa during teaching and giving feedback to an individual student. As a consequence, when Tr-2 was asked how she managed teaching pupils whose mother tongue was not the language of instruction (Chinyanja). Tr-2 who formed part of the sample of the study gave the following response;

> *"For me I do manage by mixing English and the local language because there are some who don't understand this language especially those who are new pupils who are coming into school from different parts of Zambia where this language is not spoken and there these pupils who are coming from these places called kuma yard (low density) they are not used to Chinyanja, they speak English, so if you just switch on to Chinyanja only, some of the learners will be left out, so I do mix. I say a word in English and then translate it in Nyanja"* **(Semi-structured interview with Tr-2, Feb 2018).**

Additionally, Tr-3 indicated the following:

> *"As for me sir I do translate for them to understand better. I translate in English"* (**Semi-structured interview with Tr-3, March 2018).**

Furthermore, one participant from the first focus group discussion had the following to say:

"enne nimapenza kuti chilibwino chifukwa ba teacher bamasebezesa mitundu yosiyana siya, bazakamba muchizungu na muchinyanja and so timavela muchizungu. Nafuti kuli banja bamene sibavela chizunga bamavele ba teacher bakakamba muchinyanja so ba teacher bamasanganiza" (As for me I find it ok because the madam uses different languages when teaching, she will speak in English and then Nyanja so those of us who do know Nyanja we follow when she speaks English and again in our class many pupils don't know English and others don't know Nyanja so the teacher mixes English and Nyanja) **(Focus group discussion-1 with pupils, Feb 2018).**

Therefore, what was coming out clearly from the above verbatim was that, the use of the mixture of languages and translating for learners during teaching was a common practice used when teaching mathematics in a multilingual classroom.

4.3.2 Teacher Taking lead of the Discussion and Procedural Discourse

Teacher taking lead of the discussion and focusing on teaching procedures was another striking practice that was observed from all the four (4) teachers when teaching mathematics in the multilingual classroom. Through lesson observations, teacher talk in mathematics classroom was mainly focusing on finding correct answers in which learners were forced to be chanting and giving chorus answers. It was also observed that during the lessons all the four (4) teachers took lead of the discussion.

Below is a typical example of how Tr-1 took lead of the discussion during mathematics lessons.

17.Tr-1: *So for example we are looking at such kind of problems, look at me and the board all of you, for example*

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    4230
-   1119
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9 will be below 0, 1 below 3 in that order, so we were learning numbers in vertical order. Teaze kufaka ma numbers mumundandanda.

18. Pupils: *Yes, madam*
19. Tr-1: *Kukoka bwino bwino kuchoka pamwamba kufika*
20.Pupils: *Pansi*

21. Tr-1: *Then teaze kuchosapo manje aii?*

22.*Pupils: Yes*

23. Tr-1*: so tiyeni tuyanganepo pali vamene tinapunzila last time, tiyeni tichosepo tiwone, eyes on the board. So what is 0 minus 9*

24. Pupils*: it can't*

25. Tr-1*: 0 kuchosamo 9*

26.Pupils*: it can't*

28. Tr-1*: sitingachosemo aii, why? Chifukwa 0 ning'ono aii, then 9 ni…*

29.Pupils (chanting)*: nikuulu*

30. Tr-1*: 0 is smaller than 9 therefore, you cannot subtract 9 from…*

31.Pupils*: 0*

32. Tr-1*: sitingachose 9 mu 0 chifukwa 0 ning'ono so tichita bwanji? What do we do?*

33.Pupils*: we borrow 1 from 3*

34. Tr-1*; Nikamba kuchita borrow nikubweleka aii*

35.Pupils*: yes*

36. Tr-1*: so what number is this one?*

37.Pupils*: 3*

38. Tr-1*: so if we borrow 1 tipeleka pati?*

39.Pupils (in chorus)*: pa zero*

40. Tr-1*: so yakala zingati?*

41.Pupils (in chorus)*: 10*

42. Tr-1*: ok, now we will be able to subtract chifukwa 10 nikuulu, 9 ni*

43.Pupils (chanting)*: ning'ono*

44. Tr-1*: so apa tabwelekako pasala tungati?*

45.Pupils*: 2*

46. Tr-1*: we are now remaining with 2 because we borrowed. what is 10 kuchomo 9*

47.Pupils*:* 1

48. Tr-1*: what is remaining there?*

49.Pupils*: 2*

50. Tr-1*: 2 take away 1*

51.Pupils*: 1*

52. Tr-1*: What is 2 take away 1*

53.Pupils*: 1*

54. Tr-1*: And 4 take away 1*

55.Pupils*: 3*

56. Tr-1*: So ndiye vamene tinapunzila last time evee aii*

57.Pupils*: Yes*

58. Tr-1*: this is what we were learning, vertical*

59.Pupils*: subtraction*

60. Tr-1: *Yes, ma numbers yofaka mumundandanda bwino bwino kuchoka pamwamba kufika (numbers you put in straight lines nicely from top to down)*

61.Pupils: *Pansi*

Another practice observed by the researcher in line with teachers taking a center stage during mathematics discourse was how they were framing the questions during the teaching process. Teachers were asking questions that required one-word answer and were not asking learners to justify their answers, in turn failing to create opportunity for pupils talk in the class. Though an example of an extract is given below, this practice is also evident in the excerpts provided above.

70.Tr-2: *so apa manje we will add because we can't manage to count using sticks. So when adding tuyambila ku last kuma ones. Ukayambila uku kuma thousands your answer will be wrong. So tiyambila nama ones, tens, hundreds and so on. So let us add we see. (here the teacher is using the black board and gestures to communicate to pupils)*

Th H T O
6 4 2 4
+ 2 4 1

---
4 + 1

71. Pupils*: 5*

72. Tr-2: *2 + 4*

73.Pupils: *6*

74. Tr-2: *4 + 2*

75.Pupils: *6*

76. Tr-2: *6 + apa palibe chilichoonse*

77.Pupils: *6*

78. Tr-2: *so answer yantu nichaani?*

79.Pupils: *six thousand and six hundred and sixty-five.*

80. Tr-2: *boonse pamodzi*

81.Pupils: *six thousand and six hundred and sixty-five.*

82. Tr-2: *manje velani mokambila. Six thousand not kufakapo 'and' apa. Ni six thousand six hundred and sixty-five. Ok, tiyetione enangu aii?*

83.Pupils: *yes*

84. Tr-2: *tell me those numbers. This one on top (the teacher writes on the board)*

85.Pupils: *seven thousand four hundred and eighty-four*

86. Tr-2: *plus*

87.Pupils: *two thousand one hundred and twenty-two*

4.3.3 use of gestures and visual aids in the teaching of Mathematics

Apart from code-switching, translating, taking a lead in the classroom discussion and procedural discourse, all the 4 teachers used blackboard, gestures and visual aids during the process of teaching. Teachers were observed to have been using meter ruler, hands (as already exemplified in the excerpt given above on 4.2.1, line 13) and certain body movement when communicating or illustrating a point during the process of teaching. Gestures were seen also in helping the teachers

to bridge the language inadequacies during the process of teaching. One typical example from **Tr-2** is given below;

Tr-2: *"evee nikuvefakaso not so but so" (this you put them like this not this but like this). (At this point the teacher was teaching on vertical subtraction and she was using hands to illustrate on how numbers need to be arranged in vertical subtraction).*

4.4. Learners' practices in learning mathematics (Addition and Subtraction)

In the section below I present learners' practices observed from 8 lessons taught by four (4) primary school mathematics teachers. The learners had a variety of mother tongue languages in these classes. The mother tongue language for the teachers was not the same with the language of instruction (Chinyanja) but it should be stated that all these teachers had enough Chinyanja vocabulary. Classroom observations and focus group discussion provided a glimpse of how the learners interacted with the teachers during Mathematics lessons and how the teachers explained the lesson content to their learners. The topics taught were 'subtraction and addition'. This was so because of the common scheme of work being used in the district.

This study sought to describe learners' practices as they learnt mathematics using Chinyanja in a multilingual classroom. This was done using lesson observations and focus group discussions. The three major themes which came from the lesson observations and focus group discussions are chanting and chorusing, learner demonstration and asking peers for clarification. It was noted however, that little could be concluded about learners' competences in spoken Chinyanja, nor about their grasping of the content covered, because they had restricted opportunities to talk during the lessons, in all the schools and classes observed.

4.4.1 Chanting and Chorusing

After a series of lesson observations, it was established that most of the learners were passive participants in the classrooms during learning. In all the extracts learners had few utterances all of which were giving choral answers and chanting (when answering questions framed by teachers during mathematical manipulations and learning). This might have been influenced by teachers' teaching strategies in which teachers framed the questions which required answers only. This is substantiated in the excerpt as provided in 4.2.2 with focus on lines 23 to 55. In the stated excerpt the teacher and her class were trying to work out a mathematical problem on vertical subtraction.

All the responses given by the learners were one-word answer. The learners were giving responses to answer the teacher's questions. In all the classes observed there was less pupil talk as most of the talk was done by the teachers.

4.4.2 Learner Demonstration

Learner demonstration was another practice that was observed in all the classes. All the 4 teachers were found to have been engaging learners to demonstrate on the blackboard during the lesson as a way of encouraging learners' participation during the mathematics learning. An example of an excerpt is given below;

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133.Tr-1: Let us look at example number 2. This one goes like this, out of 6000 plants 2568 were burnt by fire. Find how many plants were not burnt? Ndani angatuwuzeko ichi muchinyanja bakamba kuti chani? Yes, Izukanji

134.Izukanji: mwaibalapo 'of" apo after out.

135.Tr-1: ok here is of. Nifuna angatuwuzeko chiganizo ichi muchinyanja bakamba kuti chani? Vinja vamene twalemba muchizungu mu chinyanja tingakambe kuti chani? out of 6000 plants 2568 were burnt by fire. Find how many plants were not burnt? Muchinyanja tingakambe bwanji? Ndani azayeselelako muchitundu chili choonse? Yes, Dorcus

136.Dorcus: Ati pali ma plant yali 6000 yamene yanashokewa yali 2568, niyangati yamene yanasalako?

137.Tr-1: mutoteleni muzanu

138.Pupils: clapping

139.Tr-1: akonza aii. Akamba ati ma plant, muziba ma plants?

140.Pupils: Yes

141.Tr-1: so bakamba ati ma plant yali 6000 kunashokewapo 2568, manje bafunsa ati nitungati twamene situnapye namulilo? I want one to go in front and work out the example. Dalitso, clap for Dalitso as he is going

142.Pupils: clapping

143.Tr-1: Yes, you can go ahead

144.Dalitso: 6 0 0 0

2 5 6 8

---

0 minus 8

145. Pupils: it can't

146.Tr-1: *Dalitso is that subtraction, plus or division palibe sign yamene ewonesa kuti vamene uchita nivichaani. So don't forget the sign that shows what you are doing, ok continue (the teacher is using English and a bit of Chinyanja to communicate to Dalitso).*

147.Dalitso: 6 0 0 0

- 2 5 6 8

---

0 minus 8

148.Pupils: *it can't*

149.Dalitso: *what can we do? (the pupil is using English throughout his explanation)*

150.Pupils: *Borrow 1 from 6*

151.Dalitso: *10 minus 8*

152.Pupils: *2*

153.Dalitso: 9 minus 6

154.Pupils: 3

155.Dalitso: 9 minus 5

156.Pupils: *4*

157.Dalitso: *5 minus 2*

158.Pupils: *3*

159.Tr-1: so that is the number of plants which were not burnt. Clap for Dalitso

160. Pupils: clapping

In the above extract the pupil had been called to work out the solution on the board and the pupil imitating her teacher managed to engage her fellow learners in procedural discourse seeking for correct answers only whilst the rest of the pupils were chanting and giving choral responses as well as some just copying from the board. What was predominantly in all the classes observed, was that as long as the learners where finding correct answers, teachers could not engage the learners further to allow them to dialogue and justify their answers. Once more what was observed was that most of the learners who were called or volunteered to demonstrate on the blackboard either spoke English as evidenced in the above excerpt or a mixture of English and Chinyanja.

4.4.3 Asking Peers for Clarification

Asking peers for clarification was another the practice learners who were not competent in the language of instruction used in learning mathematics in a multilingual classroom. Thus, having asked the learners how they found and managed learning mathematics in the language which was not familiar or their mother tongue, one of the participants had the following to say:

"enne nimafusa bazaanga chifukwa bazaang bakakamba nimavela pamene ba teacher sibanalondolole bwino. Timafunsa bazantu bamene baziba kukamba Chinyanja chifukwa ba teacher bamakamba chinyanja chilimonga chicewa so timafunsa bamene baziba chicewa then batitandidza" (For me I ask my friends and when my friends speak I do understand where the madam has not explained well. We ask our friends who know how to speak Nyanja because our madam speak Nyanja like chewa which we don't understand so we ask those who understand chewa then they help us) (**Focus group discussion-1 with pupils, Feb 2018).**

Another participant in another group disclosed that:

"For me, I have no problem with the use of chinyanja as we learn because Iam able to speak chinyanja. It is only a problem because the teacher at times uses difficult chinyanja and that I fail to understand" (**Focus group discussion-2 with pupils, March 2018).**

In most of these classes what was predominant was that the classes comprised of four types of learners. There were learners coming from low density areas where English was used as a home language. The second group of learners were those who were able to speak both English and Chinyanja. These were type of the learners who participated with courage and confidence during mathematics discourses though with limited verbal expressions. A typical example is the excerpt given in 4.3.2 where the learner was communicating using English when demonstrating an example to his fellow learners in the class and also in line 136 where another learner managed to translate the question from English to Chinyanja.

The third group of learners were those coming from high density areas of Lusaka district were Chinyanja was also used as home language but not English. These learners no doubt were fluent Chinyanja speakers. However, they somehow encountered some challenges in expressing themselves verbally in local language in class because the type of Chinyanja spoken by teachers was slightly different from the street Chinyanja of Lusaka district. For instance, the following statement; *"Yes, ma numbers yofaka mumundandanda bwino bwino kuchoka pamwamba kufika pansi" (numbers you put in straight lines nicely from top to down).*

In the above statement the teacher was trying to explain on vertical subtraction to learners but the type of Chinyanja she used seemed to have been outside learners' vocabulary.

The fourth group of learners were those who were still learning Chinyanya and English. These learners either came from homes where Chinyanja and English were not the home languages or came on transfers from areas where Chinyanja was not used as a language of instruction. These learners' in most instances where active participants in chanting and giving choral responses, just copying and writing from the black board during the lesson and less talk or silence during the lesson. For instances when Tr-2 was asked how she found teaching learner in local language in Lusaka, she had this to say;

"Like for me in my class, most of the pupils come from the compounds, so they don't have any problem with the local language but I do struggle with few pupils who come from the English speaking homes, they don't understand the local language, for them it's a challenge but children are fast learner they are getting there" **(Semi-structured interview with Tr-2, Feb 2018).**

Therefore, what is clear from the foregoing is that learners especially those who were not competent in the language of instruction had to rely on asking peers for clarification in certain instances where they were not understanding teachers' explanations in Chinyanja. The implication is that those learners who do not take the courage and initiative to ask peers for clarifications, are indeed passive participants during mathematical discourses. The other implication is that if the peers who are asked do not relay the same meaning from what was being said by the teacher, then the process of meaning making is curtailed.

4.5 Teachers' Views on the New Language of instruction Policy Direction

To address this issue, teachers were asked during interviews to indicate their views on the future of the new language of instruction policy which dictates that the language of instruction from grade 1-4 shall be Zambian local languages. The views of the teachers showed that they were divided as far as the use of local language as medium of instruction in schools was concerned. Two (2) out of four (4) teachers, supported the use of local languages in schools. Therefore, from the analysis of all the views of the four teachers what emerged was that local language had both advantages and challenges.

4.5.1 Advantages of using Chinyanja as a Medium of Instruction

After analysing teachers' views on the new language of instruction policy, two (2) out of four (4) teachers said that it was okay that Chinyanja was used as medium of teaching in lower primary schools in Lusaka. They argued that Chinyanja for instance in Lusaka was the language of play for most learners, so it was the most appropriate language that learners knew. In particular, **Tr-2** said the following in supporting the use of Chinyanja as a medium of instruction:

"For me I would say that yes challenges are there but the policy is just ok because from the time the policy was introduced I have seen a change in the learners. For me my request is that if only the books are in English then we can be using simple Chinyanja. I tell you it's not easy, you find so big words such that as a teacher you can't even understand so if the books are in English then we can use simple Chinyanja, because in Nyanja it's difficult to teach exactly what is intended and it becomes difficult if you are transferred to another province especially for now I'm getting used to Chinyanja now if for example I'm transferred to southern province where there is Tonga it's can be hell because I have to learn the language first before I can begin teaching well" **(Semi-structured interview with Tr-2, Feb 2018)**. .

Furthermore, the other participant **Tr-4** valued the use of local language (Chinyanja) at the lower primary level, as she perceived it as helping to sustain Zambian languages and cultures. In perceiving the policy of learners using local language, she had the following to say:

"So far we have welcomed that because it has really helped us, yes we need to appreciate ourselves as Zambian we need also to appreciate our languages we have in this country. We have welcomed this and how I wish it could even go to grade 7 so that our children can understand well because these things that we teach them they know them even where they are coming from its only that the language that we use English makes these things to be difficult" **(Semi-structured interviews with Tr-4, March 2018)**.

4.5.2 Challenges of Using Chinyanja as A Medium of Instruction.

Although it was recognized that teaching and learning using Chinyanja was good for learners in Lusaka province, two (2) out of four (4) teachers opposed the use of Chinyanja as a medium of instruction and indicated that they faced some challenges in teaching mathematics using Chinyanja in multilingual classrooms, **Tr-1** had the following to say:

"For me I would say it's not easy in terms of the language because "yaaaa", this Chinyanja thing is a bit difficult and at certain times say when we started teaching this mathematics in local language (Chinyanja) you find that I end up switching to lozi, I end up realizing that I'm now speaking Lozi and I have to look for words I will use to replace the lozi words. So it's a bit difficult but for now I think I'm used. You know I'm from western, I was born in western province, I grew up and educated in western province. For now, there are not so many challenges actually the only challenge is that the pupils' books are in chewa and some of the words are difficult for me to understand such that I have to search for the meaning of those words but if they are in English I can use simple Nyanja" **(semi-structured interview with Tr-1, Feb 2018).**

Additionally, **Tr-3** who opposed the use of familiar but supported English had the following words to say:

"For me teaching mathematics in local language is a big challenge, an example which I can give is that I'm Bemba I was brought up and trained in Northern province I just came here because of marriage, now teaching in Chinyanja "aweeea" it's difficult because there are some words which I can't explain, there are some words which I can't translate in English" **(Semi-structured interview with Tr-3, March 2018).**

Furthermore, **Tr-3** with a similar view of opposing the use of local language as medium of instruction went on to say;

It is not a good idea to use Chinyanja in other subjects like mathematics may be just as a subject. I think English can be better because some learners are Bemba, lozi, Tonga and soli so at least English caters for everyone. And as a teacher I can explain effectively in English. Also I am so sure that the majority of the people here are not from Eastern Province. So I feel it is a bit tricky to use Chinyanja in such a place. For me Lusaka was supposed be using English as a language because this is the province where you find almost all the languages found in Zambia and so it is not fair to use chinyanja when teaching at the school level.

What could be said about teachers' views on the new language policy in Education, was that teachers in this study were divided in as far as the use of local language (Chinyanja) in a multilingual context was concerned. Two (2) out of four (4) teachers argued that while it was evident that teaching in local or familiar language has certain advantages on the learners, provinces like Lusaka, it's difficult to select a single language as a medium of instruction due to the cosmopolitan nature of the province. They further, argued that teaching using local language was important only in monolingual societies in which the language of instruction was both the familiar language of the teacher and learners. In situations where learners were coming into the classroom with different familiar languages or mother tongue and the teacher was not competent in the language of instruction, English needed to be used as the language of instruction in order to communicate fairly to all the pupils.

4.6 Chapter Summary

The chapter presented the findings of the study after being analysed. The findings were based on teachers' and learners' practices in teaching and learning mathematics using Chinyanja in multilingual classroom in grade 4. The findings indicted that both teachers and learners had certain practices that they were using in teaching and learning mathematics in a multilingual classroom. The chapter also brought out various advantages and challenges experienced by the teachers due to the use of local language (Chinyanja) in the teaching and learning of mathematics in multilingual context. The next chapter is the discussion of findings of the study.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.1 Overview

The previous chapter presented the findings of the study on practices in teaching and learning mathematics using Chinyanja in a multilingual class: a case of selected primary schools in Lusaka district, Zambia. This chapter focuses on the discussion of findings under the sub-themes that emerged in line with the objectives of the study. Reference is also made to the literature reviewed in chapter 2 and the theoretical framework so as to substantiate the findings.

In order to attain the goals of the study, the following guiding objectives were formulated:

i. To examine teachers', discourse practices as they teach mathematics in a multilingual classroom using Chinyanja.
ii. To describe learners' experiences as they learn mathematics using Chinyanja in a multilingual classroom.
iii. To establish mathematics teachers' views on the new language policy direction in Zambia.

5.2 Teachers' Practices as they teach Mathematics in a Multilingual Classroom.

In order to examine teachers', discourse practices, the study focused on how teachers used Chinyanja in teaching mathematics in a multilingual classroom. The practices that the study identified include: code-switching and translating, teacher-dominance, procedural discourse and use of gestures and visual aids.

5.2.1 Code-switching and translating in the teaching of mathematics

The classroom lesson observation instrument was designed to capture aspects of teachers' language use that could enhance students' understanding of the mathematics, and also to capture if different languages would be used in various classroom management activities.

It was established that code-switching and translation were among the practices teachers used in the teaching of mathematics in multilingual classrooms. The teachers used a mixture of Chinyanja and English when teaching mathematics to the learners. The findings indicated two types of code-switching that were being exhibited by the teachers during the process of teaching. The first type of code-switching occurred when teachers were explaining, checking understanding, for

interpersonal relations, when emphasizing a point to the learners and when creating a conducive classroom climate or rather wanting to make learners concentrate and stopping them from making noise. Teachers would also code-switch when trying to make sure that learners who only knew chinyanja or English could benefit from the lesson. Here teachers would code-switch from Chinyanja to English or vice-versa. This observation aligns with Merritt, et al., (1992) who argued that code-switching provides an additional resource for meeting classroom needs.

Hoffman (1991) viewed code-switching as a communication strategy and it is the situation in which two languages are used in the same utterance. It can be assumed, therefore, that the language choices of mathematics teachers in multilingual classrooms did not only depend on what policy stipulates, but also on what teachers perceived to be in the interests of their learners. As Baker has argued,

"decisions about how to teach [second language learners] ... does not just reflect curriculum decisions... they are surrounded and underpinned by basic beliefs about ... [the learners' first languages] and equality of opportunity" (1993, p.247).

The use of a mixture of languages in multilingual classrooms enforces Ferguson (2003)'s findings who noted that classroom code-switching seems to arise naturally, perhaps inevitably, not only because it is ubiquitous in multilingual societies, but also as a response to the difficulties of teaching in a language in which students do not have full proficiency. However, the point of departure with Ferguson (2003)'s findings is that unlike code-switching acting only as a response to the difficulties of teaching in a language in which students do not have full proficiency, this research has revealed that code-switching could also be used by teachers, teaching in a language where they are not competent as a way of bridging the language inadequacies.

The use of a mixture of languages in teaching is also consistent with the study done by Erling, et al., (2017) in India, where they found that the facilitative use of code-switching between English and Hindi to translate and occasionally explain or give an example was common among all teachers, and classroom code-switching was openly recognized as a legitimate and necessary pedagogic strategy, since the students' English-language competence was developing. Nuria Gorgorio and Nuria Planas (2001), argued that code-switching, or switching from one language to another in the course of a conversation, can be expected to occur in multilingual setting.

However, what need to be appreciated is that no doubt code-switching is a necessary pedagogic strategy in multilingual setting where both the learners and the teacher are competent in the languages being used. In situations where learners come to the classroom with different linguistic backgrounds and learners and the teacher are not necessarily multilingual, code-switching creates communication break downs thereby making it impossible for the teacher to scaffold and mediate the learners along the continuum of zone of proximal development. Poplack cited in Grosjean (1982) argues that code-switching is a verbal skill requiring a large degree of competence in more than one language, rather than a defect arising from insufficient knowledge of one or the other.

Vygotsky (1962) placed great emphasis on social and linguistic influences on learning and in particular on the role of the teacher in the educative process. He introduced a concept to provide a measure of a learner's development related to instruction. Known as 'the zone of proximal development', this is an account of how the more competent assist the young and the less competent to reach that higher ground from which to reflect more abstractly about the nature of reality. Vygotsky (1962) believed that with appropriate instruction, there may be potential for a child to reach higher conceptual levels than s/he would be able to achieve naturally.

Key to the zone of proximal development is the appropriateness of instruction given by the teacher to the learners. Therefore, in a country like Zambia where there are so many languages and education language policy dictates the use of selected languages on an assumption that they a widely spoken in certain localities. Teachers and learners who are not competent in the selected language of instruction either coming from the minority languages or other localities where the language of instruction is not spoken, cannot be expected to observe the academic sign post of zone of proximal development in the classroom discourse. According to National Centre for Curriculum and Research Development (2000, p. 68), code-switching works well in classrooms where the teacher and the learners share a common language, but have to use an additional language for learning…the learners' language is used as a form of scaffolding". Adler (1996, 1998, 2001) observed that in classrooms where the main language of the teacher and learners is different from the LoLT, there are ongoing dilemmas for the teacher as to whether or not she should switch between the LoLT and the learners' main language, particularly in the public domain.

For instance, this research has revealed that the other type of code-switching occurred when teachers lacked the needed vocabulary in explaining some mathematical terms (place values,

vertical subtraction, vertical order) in local language. In such instances, teachers code-switched from Chinyanja to English as a way of bridging the language inadequacies. This finding resonate with Grosjean, (1982), who observed that most bi/multilingual persons switch when they cannot find an appropriate word or expression or when the language being used does not have the necessary vocabulary item or appropriate translation.

This finding is similar with Adler (1998), who reported on a South African classroom where the teacher ‘‘runs out of words’’ when trying to explain advanced math in Tswana. The only different was that this research has revealed that teachers can code-switch to other languages as a way of overcoming the local language inadequacy. Therefore, teachers whose mother tongue is not the language of instruction cannot teacher effective. For example, teachers may not be able to give alternative terms to describe mathematical concepts when a learner has problems with the language being used. Mathematics has technical terms or vocabulary to describe precisely mathematical concepts. My concern here is that teachers may not teach mathematics effectively in multilingual classrooms because they may be unable to explain the mathematical concepts in Chinyanja due to inadequate mathematical vocabulary.

Other than code-switching, teachers were also translating for learners as a way of making them understand the mathematics that were being taught. This research has revealed that translation was an important practice in teaching classrooms which constituted learners of different linguistic background as way of offering educational equality to the learners but at the same time translation depended on the rich vocabulary of the teacher. In a case where the teacher was not competent in the language he or she was trying to translate, translation could be of a disadvantage as there could be a likelihood of distorting the original meaning of the statement.

One implication drawn here is that translation could be a good practice in multilingual classroom because it can give an opportunity to learners to understand what the teacher is teaching especially those who might have difficulties in understanding the language of instruction. However, for this to be fruitful the translator and the listeners must be competent in both the languages being used.

It is observed that the language in which education is conducted is very important as the selected language may enhance or impede the quality of education. Therefore, language is an important issue, especially in multilingual classrooms where we have learners from different linguistic and

socio-cultural backgrounds. The language of instruction can also be a problem, especially when the content or concepts being taught are not in the learners' home language. Learning and teaching certain subjects, such as Mathematics, in Chinyanja may be a problem for learners and teachers whose home language is not Chinyanja.

5.2.2 Teacher Taking Charge of the Discussion and Procedural Discourse

The other teachers' practice that the study established was that teachers were taking the lead in the discussion and also focused on teaching procedures. Teachers led the talk in the classroom during the teaching process. The only talking learners were engaged in was responding to questions asked by the teachers. This resonate well Setati, (2002), who observed that dominance of English produced a dominance of procedural discourse, mainly because the learners were not fluent in conceptual discourse in English.

According to social cultural theory, language mediates both interaction and individual thinking processes. It is therefore not only a tool for thinking but also an essential tool for communication. These two functions of language (communication and thinking) are not separate. They sometimes occur simultaneously. By using language for communication the individual internalizes it for use as a tool for thinking. One of the opportunities that school can offer learners is that of involving other people in their thoughts - to use conversations to develop their own thoughts (Mercer, 1995, p. 4).

In a learning situation a teacher, should create opportunities for learners to involve the teacher and fellow learners in their thoughts and to use talk to develop their own thoughts. Teachers do this by, among other things, asking questions, responding to learners' questions and preparing tasks for learners to work on cooperatively. Mercer, (1995), teachers can encourage conceptual discourse by allowing learners to speak informally about mathematics—exploring, explaining, and arguing their interpretations and ideas.

One of the tasks of a mathematics teacher is to help learners develop ways of talking (about) mathematics which will enable them to understand and be understood by other members of wider communities of educational discourses (Mercer, 1995, p. 83).

This is not an easy task for teachers whose mother tongue is not the language of instruction and teaching classes which constitutes of learners coming from different linguistic backgrounds since

the mathematical talk is not in their first language. Learners therefore need to be initiated into the discourse. This initiation includes: recognition of mathematical terms, knowing how to say them (being able to pronounce them), knowing what they mean and being able to use them in mathematical conversations. The challenge here, for many teachers, is assisting learners to move from a position where they cannot understand the language of learning (Chinyanja) to a point where they use Chinyanja to talk (about) mathematics. I can argue that teaching mathematics would benefit from the philosophy of constructivism by using language to help pupils construct mathematical knowledge. Therefore, any effective communication in mathematics teaching would need to create a two-way communication where teachers and pupils talk to each other as well as talk mathematically. It would hardly be an exaggeration to say that the thinking skills in mathematics are not being developed if the dialogue in the classroom is deficient.

Within this Vygotskian framework the presence of a more experienced other who embodies and models the intended outcome for the learner is crucial. In a mathematics class, the more experienced other can be the teacher and the intended outcome for the learner is mathematical excellence which includes the ability to talk "within and about mathematics" (Adler, 1998). The teacher, therefore needs "to provide a scaffold for the learner via dialogue that includes probing questions and cues that extend talk as well as intellectual range of the learners" (Khisty, 1995). While teaching, mathematics teachers model ways of doing and talking (about) mathematics.

As Moschkovich (1999, p. 11) points out, students need to participate both orally and in writing by ''explaining solution processes, describing conjectures, proving conclusions and presenting arguments.'' One way to encourage students' development of extended ways of talking about math was by having students talk with each other. As putting students into groups to discuss mathematics concepts was also a way of limiting teacher talk, group work in math classrooms had become quite common. But while interaction with peers could achieve some goals of the mathematics teacher, interaction with peers alone would not lead to the development of the mathematics register. Students working in groups were not always able to express their ideas clearly or understand each other's explanations. The findings from the study indicate that teachers were only creating an opportunity for learners to answer questions that required one word answers and were not asking them to justify their answers.

These findings collaborate with Erling, et al., (2017), who undertook classroom observations in multilingual context of Ghana and Bihar and revealed similar practices in terms of the teacher-dominated pedagogy. In both contexts there was a low occurrence of student-centred, active learning practices that supported the development of content and language learning. Lessons in both contexts were highly teacher dominant and textbook focused, with the teacher being the only one to speak for the majority of the lesson time. The most striking factor in both contexts was that students had very limited opportunities to speak. In both contexts, the focus was on students' memorization of content knowledge and the majority of questions addressed to students were 'closed' and sought a 'correct' answer. Therefore, the findings from Ghana and Bihar present a similar situation of what was observed in most of the classrooms, where most of the talk was dominated by the teacher.

However, it can be argued that in situations where both the teacher and the learners are struggling to become proficient speakers in the language of instruction, or where only the teacher or the learners are struggling to become proficient speaker, teacher dominance is expected to occur as a practice in the teaching of mathematics in such classrooms. This is because the teacher is the initiator of classroom discourse and as such the teacher would concentrate the talk in the language he or she is competent and this creates an environment where learners are put outside the talk or silenced as a result of the language barrier. Hence in such an environment low performance in mathematics should not come as a surprise.

This is similar to Alidou et al., 2006' Ankohmah et al., 2012 who explored the relationship between medium of instruction and teachers' classroom practices, finding that using a language that the teacher does not have enough vocabulary in made it difficult for teachers to use active, student-centred strategies. Research conducted in Ghana for instance, found that teachers' practices were more effective when teachers use their mother tongue as Gutierrez (2002) explained, knowing a language means more than knowing technical terms, and having a bilingual translation is not sufficient for scaffolding the development of mathematics language in a second language. A teacher using Chinyanja, for example, would need to have studied mathematics in Chinyanja to be able to teach it in Chinyanja.

It should be noted that procedural teaching in mathematics cannot be avoided because mathematics is made up of formulas and its learning and understanding involves the manipulations of formulas

and certain principles. However, overconcentration on procedural discourse as a teaching strategy is likely to create a fertile ground for a teacher to embrace teacher centered pedagogies thereby blocking the development of mathematical knowledge in learners. This is because procedural discourse focuses on the procedural steps that should be followed in the solution of a problem. These steps can be memorized without understanding and procedural discourse does not require justification. Learners are not only expected to know the procedure that needs to be followed to solve a problem, but also why, when, and how that procedure works. According to Setati (2002), is not surprising that in an additional language learning environment like the multilingual classrooms, procedural discourse would dominate when mathematical conversation was in a second language.

5.2.3 Use of gestures and visual aids in teaching of mathematics

The findings of the research also indicate that teachers used gestures and visual aids in communicating mathematics to the learners. Furthermore, the results suggest that teachers used gesture to serve as a scaffolding function in certain situations. Thus, gesture and visual aids appeared to be one means by which teachers attempted to scaffold student comprehension of mathematics especially in instances where the local language vocabulary was not enough to the teacher. Matang (2003), states that in order to gain interest in mathematics and make meaning out of what children are learning, their culture needs to be embedded in mathematics. He emphasizes that materials from children's cultural background needs to be used as teaching aids to make more meaning to mathematics concepts and ideas taught.

According to Vygotsky's theory, higher mental functions are formed through social interaction (Vygotsky, 1978; 1986; Wertch, 1991). These higher mental functions are mediated by psychological tools and signs that include various systems of counting and mnemonic techniques, with language being the most important (Wertch, 1991).

This research has established that gestures and visual aids could be used in overcoming local language inadequacies by the teachers. It is worth noting that, even if the teacher produced gestures to support her own reasoning processes, those gestures might still have helped students learning by helping the teacher articulate her thoughts more clearly. Because gesture worked in tandem with speech, it could have provided conceptual grounding for new and abstract ideas in a visual and holistic manner. Teachers could use the verbal modality to articulate abstract concepts, while

using gesture to direct students' attention to the referents of their speech, and to ground those abstract concepts to ideas that are concrete and familiar.

Gesture, combined with speech and visual aids, was a communicative tool that was readily available to all teachers. Gestures could be used to support meaningful conversations. In addition to being ubiquitous, gesture was a communicative resource that was shared across cultures and national languages. Thus, the unification of the teacher's gesture, in conjunction with speech and visual aids, helped students grasp and discuss mathematical concepts. The results from lesson observation showed that the teacher's gestures and talk assisted in clarifying, explaining, highlighting, and emphasizing mathematical concepts to his learners. Additionally, gesture and talk resolved multiple meanings, elicited learners' justification of their thinking, and advanced the mathematical lesson.

5.3 **Learners' experiences as they learn mathematics using Chinyanja in a multilingual classroom.**

With regards to the second objective of the study, I sought to describe learners' experiences (practices) as they learn mathematics using Chinyanja in a multilingual classroom in Lusaka District, of Zambia. The learner's experiences in the learning of mathematics were exhumed from the lesson observations and interactions with participants through focus group discussions. The following were the most prominent ones; chanting and chorusing, learner demonstration and asking Peers for Clarification.

5.3.1 Chanting and Chorusing

Chanting and chorusing were more common among the learners during the learning of mathematics. It was observed that chanting and chorusing among the learners' was influenced by teachers' teaching and questioning styles. Most teachers' questions or prompts were directed to the whole class, in anticipation of choral responses or random individual replies. As a result, most of the responses given by the learners were one-word answer. Learners would also chant and give choral responses when teachers were introducing new concepts. The research finding enforces Setati (1998), who concluded that chanting and chorusing were practices most frequently used in primary schools.

According Adler et. al.; (1996) and Setati, (1998), found that chanting and chorusing can be used in multilingual mathematics classrooms as linguistic, pedagogic and mathematical devices. They

further, postulated that chanting and chorusing could therefore be used to introduce learners to mathematics register and the language of instruction. Chanting and chorusing in a multilingual mathematics classroom could be used to teach both mathematical language and the language of instruction. Research shows that during mathematics periods most second language primary school mathematics teachers also teach the language (Adler, et. al., 1996).

Vygotsky (1962) believed that with appropriate instruction, there may be potential for a child to reach higher conceptual levels than she would be able to achieve naturally. Among some of the Vygotskian tenets is that learning occurs during situated activity or in authentic setting such as the classroom setting.

Although chanting and chorusing have advantages which could be utilized during the teaching process, however, when classes are dominated by chanting and chorusing throughout the lesson is a source of concern. This research has revealed that when a teacher dominates classroom talk and concentrates on teaching procedural discourse and when the majority of questions addressed to learners are 'closed' and require a 'correct' answer, chanting and chorusing among learners is likely to occur. Therefore, when a classroom is dominated by chanting and chorusing, the indication is that there is minimal or no dialogue between the teacher and learner during learning process.

5.3.2 Learner Demonstration

The study found that learner demonstration was another practice that was observed. Teachers were found to have been engaging learners to demonstrate on the blackboard during the lesson as a way of encouraging learners' participation during the mathematics learning. According to Vygotsky (1978), for learning to become internalized, mediation must occur during the actual problem solving and joint activity or shared task definition with others. At the heart of constructivist philosophy is the belief that knowledge is not given but gained through real experiences that have purpose and meaning to the learner, and the exchange of perspectives about the experience with others (Piaget & Inhelder, 1969; Vygotsky,1978). The teacher 's role in teaching Mathematics in the ZPD becomes one of purposeful instruction, a mediator of activities and substantial experiences allowing the learners to attain their Zone of Proximal Development (Blanton, 1998; Rueda et al., 1992). The implications are that the teacher's task is to push the student's ZPD toward higher and higher levels of competence and complexity.

The study further observed that the role of the teacher is very paramount in creating an environment in which learners are encouraged to participate fully during the learning process.

The study further observed that most of the learners who were called or volunteered to demonstrate on the blackboard either spoke English or a mixture of English and Chinyanja. This observation is in affirmative with the National Assessment surveys (NAS, p.47, 2012), which postulated that in the Zambian context, for a learner to develop holistically, she / he needs a blend of the local language and the English language. The survey further revealed that learners who speak English or local language only their overall performance is lower than those who speak English and a Zambian language. This therefore entails having a language policy which promotes both languages (NAS, p.47, 2012).

What was predominantly also in all the classes observed, was that as long as the learners where finding correct answers, teachers could not engage the learners further to allow them to dialogue and justify their answers. The study observed that for meaningful learning to occur teachers should to promote a classroom culture that has teacher-pupil, pupil-pupil interaction at its centre. To achieve this, communicative competence - a function of the underlying cognitive approach that assumed talk to be a favourable cognitive tool, and that all learners were equally disposed to talking to learn - should not be taken for granted.

5.3.3 Asking Peers for Clarification.

The study further found that asking peers for clarification was the practice learners who were not competent in the language of instruction used in learning mathematics in a multilingual classroom. According to Vygotsky (1978), cognition is always socially mediated or influenced by others in social interaction. Learning, thinking and knowing arise through collaboration with others. Central to learning in the zone of proximal development is the concept of mediation. Mediation according to Vygotsky (1978) refers to the part played by other significant people in the learners' lives, people who enhance their learning by selecting and shaping the learning experiences presented to them. Vygotsky (1978) citing Wertsch (1985) claims that the secret of effective learning lies in the nature of the social interaction between two or more people with different levels of skills and knowledge. This involves helping the learner to move into and through the next layer of knowledge

or understanding. He also regarded tools as mediators and one of the important tools is language. The use of language to help learners move into and through their ZPD is of great significance.

Jaworski (1994), asserted that construction of knowledge in the classroom should go beyond interaction between the teachers and the learners to include the interaction among the learners and other sources of knowledge. It is crucial for teachers to realise how mathematics learning is linked to language, social interaction and cultural context.

5.4 Teachers' Views on the New Language of instruction Policy in Zambia.

To address this issue, teachers were asked during interviews to indicate their views on the future of the new language of instruction policy which dictates that the language of instruction shall be Zambian local languages from grade 1-4. The views of the teachers showed that they were divided as far as the use of local language as medium of instruction in schools was concerned. Two (2) out of four (4) teachers, supported the use of local languages in schools. Therefore, from the analysis of all the views of the four teachers what emerged was that local language had both advantages and challenges.

5.4.1 Advantages of using Local Language

The research established that teaching in local language has some advantages in that learners are able to express themselves verbally with confidence and participation increases. It further established that using learners home language enables them to interact, investigate, and invent knowledge; thus, maximizing the learners' full potential and allowing them to build up logic at an early age.

These findings reinforce research conducted in other contexts (Effiong (2013), Matang (2003), Benson (2005), Niesche (2009), UNESCO (2013), Israel and Thomas (2013)) which has consistently demonstrated that mother tongue based instruction in early years' education results in higher levels of achievement with regards to subject learning, as well as more rapid and successful mastery of other languages, even if acquired considerably later. Thus, it can be argued further that teaching using learners' home language yields a lot of positives results. However, in a multilingual setting like Zambia, this is true only when both the learners and the teacher have the required vocabulary or proficiency in the language of instruction.

The findings also collaborate with Banda and Kabubi (2016), who did a study on the positive impact of using local language as a medium of instruction in selected primary schools in Chipata District, Eastern province of Zambia". The study revealed a number of positive impacts of teaching in local language on pupils' academic performance which included among others; easy understanding, participation increasing by learners, high level of concentration, easy teaching, good performance, higher academic standards, and learner's confidence increasing.

The findings suggest that there is interplay between pupils and teachers home language on mathematics learning. However, the actual effect of home language on mathematics learning is overshadowed by other equally influential factors such as teacher competencies and pupils' abilities in mathematics and languages used in classroom instruction and others. Therefore, there is need to do further research to determine factors that also play a role in enhancing gains in mathematics learning apart from home languages. However, Vygotsky's Cultural Historic theory highlights that knowledge from children's culture and cultural background should form basis of teaching and learning process. The importance is given to children's mother tongue which helps children to develop mentally and use the ideas learnt from culture to enhance their performance. Thus, if language proficiency is viewed as an index of intellectual competence, it can, therefore, be said that the more a person is proficient in the language of instruction, the more chances he has in achieving academic success.

5.4.2 Challenges of using local language

Although it is widely recognized that teaching and learning in local language is more conducive to learning at an early grade, this research established several challenges in using local language as a language of instruction in a multilingual society. In Lusaka for instance, there had been notable challenges in implementing the use of local languages at the lower primary level. For example, it was established that in some contexts the home language of the majority of learners was not the language of instruction perceived to be familiar or language of play. This resonates well with Banda, Mostert, Gerd and Wikan (2012) who carried out a pilot study on the language of education policy implementation, practice and learning outcomes in Lusaka district at White primary school and found that although chinyanja still remained a lingua franca and recognised as the familiar local language for Lusaka province, the prominent languages spoken by the majority of pupils in

the school once they got to their homes were chinyanja, Bemba, Tonga, Soli, Lenje, Lozi, Kaonde and several other Zambian languages. Another study conducted by Tambulukani and Bus (2012), showed that children in Lusaka were not familiar with the language in which they were being taught.

A similar study was carried out by Mwanza (2012) in Lusaka. The study was on the language of initial literacy in an environment that was more cosmopolitan but where chinyanja was being used as a medium of teaching. From the study, it was established that chinyanja was not a language of play in certain parts of Lusaka district. Another result realised was that the chinyanja spoken in the district was not equal to the standard one recognized in schools.

The concerns that emerged from the analysis of the data reveal that mathematics teachers experience a lot of challenges when it comes to the use of local language in multilingual mathematics classes. Teachers were concerned with achieving equity in mathematics learning through the use of local language in a classroom with learners' coming in school with different linguistic backgrounds. Teachers strongly agreed that when Chinyanja is used for instance in Lusaka a cosmopolitan community, mathematics learning favors learners whose home language is Chinyanja.

The other challenge the findings of the research revealed was that teachers at the lower primary level had to translate or code-switch during the lessons from English to the Chinyanja or vice versa in order to carter for all the learners. Some teachers, however, did not have the competence in the local language especially those whose mother tongue was not the language of instruction and therefore could not do the translation. It is worth noting that even when teachers do speak the local language, they might not have literacy or pedagogic skills to support learners' learning in the local language.

The disparity between the language in instructional materials and teacher/pupils' language competence in the medium of instruction created another challenge in teachers' use of language in mathematics teaching. Teachers were concerned that instructional materials are in deep Chichewa a language which most learners are not conversant with as it is not the language of play for most

learners in Lusaka. Teachers also found it difficult in understanding mathematical concepts because the Pupil's Books are written in Chichewa.

This study makes it clear that teachers and learners whose mother tongue is not the language of instruction have challenges particularly with regard to dialogue during mathematical discourse. In order to enhance the quality of learning amidst language difficulties in multilingual settings on the minority learners, both pre- and in-service teacher education need to be reshaped to consider the multilingual realities. It has also been argued that using a selected local language as a language of learning and teaching in multilingual primary mathematics classrooms in Zambia, disadvantages teachers and learners who might not be competent in the language of instruction. This creates communication blockages in turn failing to utilize the tenets of zone of proximal development during mathematical discourses. Thus, in as much as using local languages in teaching and learning at early grades yields positive results, the education aspirations of minority learners need to be put into consideration.

5.5 Chapter Summary

This chapter discussed the findings of the study by using various literatures. The findings were that teachers uses codeswitching, translation, teacher-dominance and teaching how to find correct answers (procedural calculation). Learners on the other had were found to be chanting and giving choral answers, less talk in the classroom discourse. Teachers also presented different views on use of local language as medium of teaching and learning in multilingual classrooms. In the next chapter, I present the summary of findings, recommendations and suggestions for further research.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Overview

This chapter presents the conclusions and recommendations of the study based on the findings of the study. The purpose of this study was to assess practices in teaching and learning mathematics using local language in a multilingual class.

6.2 Conclusion

The study revealed that code-switching, translation, procedural discourse, use of gestures and visual aids were among some of the practices teachers used in the teaching of mathematics in a multilingual classroom. It seems, therefore, that for teachers to facilitate learners' access to mathematics and communicating mathematics in a multilingual classroom, teachers relied mainly on code-switching and translation as a practice. Also what was noted was that teachers utilized the board more and dominated the classroom activities through talk and board use.

The study has also established that chanting and chorusing, learner demonstration and asking peers for clarification were among the most prominent practices learners engaged in during learning mathematics. It was established that learners were engaging in these practices due to teachers' style of teaching which promoted these attributes.

It has further been established that teachers' views on the new language policy direction were divided in as far as the use of local language in a multilingual context was concerned. However, what was coming out clearly was the need to respond to multilingual realities in Zambia and putting into consideration the education aspirations of the minority learners.

This study makes an important contribution to the field's understanding of the use of chinyanja in the teaching and learning of mathematics to grade four learners. The originality of the study is contextual in that no such study has been conducted in Lusaka Province of Zambia to establish teachers' and learners' practices in the teaching and learning of mathematics using Chinyanja, and informed by social cultural theory.

6.3 Recommendations

The following are the major recommendations of the study:

i. It is important for teacher training to consider how they can adapt teacher education programmes to support the use of flexible multilingual approaches in classrooms. For instance, code-switching be encouraged as a means of bridging the language and knowledge gaps of learners who come with no or little knowledge of the language of instruction. A blend of local language and English need to be encouraged

ii. Primary school teaching of mathematics should not only concentrate on finding correct answers but also encourage the use of problem solving approach in which learners will be given an opportunity to construct mathematical knowledge.

iii. It is important at the level of policy making and educational decision making to consider multilingual realities by formulating language policies that are more flexible toward multilingualism in education.

6.4. Suggestions for further Research

The following suggestions are made for further research:

i. There may be need to investigate how teacher education is conducted in preparing teachers to teach in multilingual society.

ii. It may also be useful to further assess the language use by teachers' whose home language is not Chinyanja in comparison with those whose home language is Chinyanja or teachers whose mother tongue language is not the language of instruction in comparison with those whose mother tongue language is the language of instruction.

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APPENDICES

Appendix 1.: Consent Form

THE UNIVERSITY OF ZAMBIA

DIRECTORATE OF RESEARCH AND GRADUATE STUDIES

DEPARTMENT OF SCIENCE AND MATHEMATICS EDUCATION

Topic: Practices in teaching and learning mathematics using Chinyanja in a multilingual class: a case of selected primary schools in Lusaka district, Zambia

I am a postgraduate student at the University of Zambia pursuing a masters of education in mathematics education. I am conducting a research on Practices in teaching and learning mathematics using Chinyanja in a multilingual class: a case of selected primary schools in Lusaka district, Zambia.

The research is meant for academic purposes. Kindly you are requested to provide answers to these questions as honestly as possible.

You are free to withdraw from the study at any time.

Read the consent of the agreement below and sign.

CONSENT OF THE AGREEMENT SIGNED BY THE RESEARCH PARTICIPANTS.

I have understood the instructions and conditions concerning the study and I agree to participant as he/she asks. I also understand that I am free to withdraw from the study at any given time and that the information collected from the conversation will be confidential.

Signed…….. date: ……

Thank you for your participation.

Appendix 2. Semi-Structured Interview Schedule for Teachers

THE UNIVERSITY OF ZAMBIA

DIRECTORATE OF RESEARCH AND GRADUATE STUDIES

DEPARTMENT OF SCIENCE AND MATHEMATICS EDUCATION

Topic: Practices in teaching and learning mathematics using Chinyanja in a multilingual class: a case of selected primary schools in Lusaka district, Zambia

I would like to have an interview with you on how you find teaching mathematics using local language. Please share your true feelings and opinions with me. The discussion will be kept confidential. Please feel free to participate.

Question

1. What is your professional qualification?
2. How many years have you been teaching mathematic in the Ministry of Education?
3. What do you understand by teaching mathematics using Chinyanja or local language?
4. What is your mother-tongue language?
5. How have you found teaching mathematics using Chinyanja?
6. How do you manage teaching pupils whose mother tongue is not the language of instruction or those who don't Chinyanja?
7. How can you say about your practices in line with the language policy?
8. Any comment(s) or clarifications concerning our discussion?

Thank you for sparing me your precious time.

Appendix 3. Focused Group Discussion Guide for Pupils

THE UNIVERSITY OF ZAMBIA

DIRECTORATE OF RESEARCH AND GRADUATE STUDIES

DEPARTMENT OF SCIENCE AND MATHEMATICS EDUCATION

Topic: Practices in teaching and learning mathematics using Chinyanja in a multilingual class: a case of selected primary schools in Lusaka district, Zambia

The researcher introduces himself and talks about the research being undertaken and its relevance. The researcher requests the participants to introduce themselves and also stating their mother-tongue language.

Questions

1. What language do you use at home?
2. How do you find learning mathematics using Chinyanja or the local language?
3. Do you face any difficulties in learning mathematics using Chinyanja or local language?
4. What are some of the difficulties if any?
5. How do your friends those who know Chinyanja more than you, help you in the learning of mathematics?
6. How does your teacher help you in class?
7. Does your teacher explain everything in Chinyanja?
8. What others language (s) does he or she use when teaching if any?
9. How do you view learning mathematics in local language?
10. What else would you like to add to what we have discussed?

Thank you for sparing me your precious time.

Appendix 4.: Lesson Observation Schedule

THE UNIVERSITY OF ZAMBIA

DIRECTORATE OF RESEARCH AND GRADUATE STUDIES

DEPARTMENT OF SCIENCE AND MATHEMATICS EDUCATION

Topic: Practices in teaching and learning mathematics using Chinyanja in a multilingual class: a case of selected primary schools in Lusaka district, Zambia

The researcher introduces himself and talks about the research being undertaken and its relevance.

item	Elements to check / observe	Observation(s)	Comment(s)
1.	Check if the teacher is competent in the language of instruction by clarifying and justifying ideas and procedures.		
2.	Check if the teacher Provides various opportunities for pupils practice using local language through hands on activities, group work, cooperative learning.		
3.	Monitors pupils comprehension through interactive means (comprehension check, clarification request, scaffolding)		
4.	Check if the pupils are competent in the language of instruction by engaging themselves in concepts negotiation with the teacher		
5.	Check if the pupils are participating in the classroom Discourse by not forced into silence by language limitation		
6.	How does the teacher negotiate the mathematical meanings with pupils?		
7.	What are some of the difficulties experienced?		
8.	What practices does the teacher use during the mathematics lesson?		

Appendix 5.: Approval of Study

THE UNIVERSITY OF ZAMBIA

DIRECTORATE OF RESEARCH AND GRADUATE STUDIES

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Fax: +260-1-290 258/253 952 | **Email:** director@drgs.unza.zm | **Website:** www.unza.zm

Approval of Study

25th February, 2019

REF. NO. HSSREC: 2018-JUN- 016

Mr. Barefored Mambwe
Mukando Secondary School
P. O. Box 850127
Chitambo

Dear Mr. B. Mambwe,

RE: "PRACTICES IN TEACHING AND LEARNING MATHEMATICS USING CHINYANJA IN MULTILINGUAL CLASSROOM: A CASE OF SELECTED PRIMARY SCHOOLS IN LUSAKA DISTRICT, ZAMBIA"

The University of Zambia Humanities and Social Sciences Research Ethics Committee IRB has approved the study noting that there are no ethical concerns.

On behalf of The University of Zambia Humanities and Social Sciences Research Ethics Committee IRB, we would like to wish you all the success as you carry out your study.

In future ensure that you submit an application for ethical approval early enough.

Yours faithfully,

Dr. J. Mwanza
CHAIRPERSON
THE UNIVERSITY OF ZAMBIA HUMANITIES AND SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE IRB

cc: Director Directorate of Research and Graduate Studies
Assistant Director (Research), Directorate of Research and Graduate Studies
Assistant Registrar (Research), Directorate of Research and Graduate Studies
Senior Administrative Officer (Research), Directorate of Research and Graduate Studies

Excellence in Teaching, Research and Community Service

Appendix 6.: Sample of a Lesson Transcript

Teacher: hello hello children

Pupils: hello hello teacher

Teacher: close all your books, close all your exercise books, stop whatever you are doing, pencil and pens down. I said leka vonse vamene uchita, ngati watenga buku yaa masamu valapo sinthawe yolemba ninthawe yopunzila. Ok, ok stand up, sit down, stand up, sit down, ok. Nithawee yaa mathematics, may we be sitted quietly. Ok can you face me. Niyanganeni don't give me your back, ok. Ngatipunzila tifunika kuyangana nakuchita bwanji?

Pupils: Nakuvela

Teacher: sungapunzile nga suyangana nakuvela. So you have to look and listen.

Pupils: yes, madam

Teacher: so can you all look at me it's time for mathematics. Today we are concluding our topic on subtraction, tisiliza topic yantu yaa chaani?

Pupils: subtraction

Teacher: ok tikalimbe kuyamba nifuna tuyanganeko kuli vamene tinapunzila last time aii.

Pupils: yes

Teacher: we were looking at vertical subtraction. We were looking at what?

Pupils: vertical subtraction

Teacher: Yes, we were looking at vertical subtraction, can you look at me you. Nikaamba ati chintu chili vertical nichintu chili bwanji? Kuchoka pamwamba kufika pati?

Pupils: pansi

Teacher: so tinayangana masamu yamene tintatika according to place values kuchoka pamwamba kubwela

Pupils: Pansi

Teacher: so for example we are looking at such kind of problems, look at me and the board all of you, for example 4230 minus 1119, 9 will be below 0, 1 below 3 in that order, so we were learning numbers in vertical order. Teaze kufaka ma numbers mumundandanda.

Pupils: yes, madam

Teacher: kukoka bwino bwino kuchoka pamwamba kufika

Pupils: pansi

Teacher: then teaze kuchosapo manje aii?

Pupils: yes

Teacher: so tiyeni tuyanganepo pali vamene tinapunzila last time, tiyeni tichosepo tiwone, eyes on the board. So what is 0 minus 9

Pupils: it can't

Teacher: 0 kuchomo 9

Pupils (in chorus): it can't

Teacher: sitingachosemo aii, why? Chifukwa 0 ning'ono aii, then 9 ni…

Pupils: nikuulu

Teacher: 0 is smaller than 9 therefore, you cannot subtract 9 from…

Pupils: 0

Teacher: sitingachose 9 mu 0 chifukwa 0 ning'ono so tichita bwanji? What do we do?

Pupils: we borrow 1 from 3

Teacher; Nikamba kuchita borrow nikubweleka aii

Pupils: yes

Teacher: so what number is this one?

Pupils: 3

Teacher: so if we borrow 1 tipeleka pati?

Pupils: pa zero

Teacher: so yakala zingati?

Pupils: 10

Teacher: ok, now we will be able to subtract chifukwa 10 nikuulu, 9 ni

Pupils; ning'ono

Teacher: so apa tabwelekako pasala tungati?

Pupils: 2

Teacher: we are now remaining with 2 because we borrowed. what is 10 kuchomo 9

Pupils; 1

Teacher: what is remaining there?

Pupils: 2

Teacher: 2 take away 1

Pupils: 1

Teacher: What is 2 take away 1

Pupils: 1

Teacher: And 4 take away 1

Pupils: 3

Teacher: So ndiye vamene tinapunzila last time evee aii

Pupils: Yes

Teacher: this is what we were learning vertical

Pupils (chanting): subtraction

Teacher: Yes, ma numbers yofaka mumundandanda bwino bwino kuchoka pamwamba kufika

Pupils: Pansi

Teacher: So lelo tuyangana pali problems involving

Pupils (chanting): subtraction

Teacher: problems involving what?

Pupils: Subtraction

Teacher: Masamu ya subtraction yanja yolembewa muziganinzo, yolembewa mu chaani?

Pupils: muziganinzo

Teacher: ziganinzo nimuma sentences, tuli pamozi

Pupils: Yes

Teacher: Masamu siyonse yolembewa mumanambala No, so iwee ngati bakufunsa question, funso, what you are supposed to do is to understand the question, ufunisisa kuvesensa ngati chiganinzo chikamba chaani. Ukavesensa now you will be able to find what?

Pupils (chanting): The answer

Teacher: Uzapenza answer chifukwa chiganinzo wachivesensa. So lelo we are going to look at problems involving?

Pupils (chanting): subtraction

Teacher: Yes subtraction, masamu yolembewa muziganinzo,batifunsa masamu yolembewa mu sentences, so before we go into details, nifuna tiyanganeko pali anja mau yamene yatantauza subtraction. Yamene yatantauza kuchita bwanji?

Pupils: kuchosamo

Teacher: what sign is this? (here the teacher writes the (sign –) on the black board)

Pupils: minus

Teacher: Minus ok, so zina enangu nichani?

Pupils: subtraction

Teacher: hands up are we in church?

Pupils: No

Teacher: So nikuchita bwanji?

Pupils: Kuyimya manja

Teacher: Yes, Ruth

Ruth: subtraction

Teacher: subtraction aii

Ruth: Yes

Teacher: Ni word imonzo naimonzi yamene etantauza vasemu, to subtract. Any other word you still remember?

Pupils: take away

Teacher: take away, take away. Any other, you still remember. Any other, Dorcus

Dorcus: less

Teacher: less, very good. Any other, yes

One pupil: sum

Teacher: sum? Tinapunzila kuti sum nichani?

Pupils: answer

Teacher: sum ni answer, tifuna mau aja yamene yakamba chimonzi nachimonzi monga subtraction.

Teacher: any other word you still remember?

One pupils: borrow

Teacher; Borrow, kuchita borrow nikubweleka. Yes you

One pupil: deduct

Teacher: very good Dorcus. please can you clap for Dorcus

Pupils: clapping

Teacher: so aya ndiye mau yamene yatantauza chimonzi nachimonzi nakuchosapo

Pupils: yes

Teacher: Minus Nakuchosapo for example, nili nama books yangati apa?

Pupils; yatantu

Teacher: Nili nama books yatantu, I have got 3 books in my hand, then that word minus simply means chosapo. So tikachosapo simply means subtract, then subtract ndiye minus futi, then take away nikuchosapo pa vinthu vilipamozi then mwatengapo that is to take away isn't it?

Pupils: Yes

Teacher: Yes, then the next one ati vichepe aii tikamba ati tifuna aya ma books achepe which means tizachosapo aii

Pupils: Yes.

Teacher: so apa yasala imozi aii

Pupils: yes

Teacher: good, then the other one ati deduct, deduct ati kuchosapo pa vinthu ok, pali vambili wabwela wachosapo

Pupils: yes

Teacher: So all these words minus, subtract, take away, less and deduct vonse vitantauza chimozi which is subtraction. So vamene tizapuzila lelo, if youncome across one of those words whether it is minus, subtract, take away, less and deduct bafuna kuti uchite chimozi nachimozi. Kuchita bwanji?

Pupils: kuchosapo

Teacher: Yes kuchosapo, so do not be confused by those five words on the…

Pupils: board

Teacher: Are we together boys and girls?

Pupils: yes madam

Teacher: tilipamozi

Pupils: yes

Teacher: So look at the following questions, yolembewa muma sentences muchiganinzo. Nifuna uyangane ku board aii.

Pupils: Yes

Teacher: I'm writing a question in sentence form, ok it goes like this, Gumbo, uyangana pa board

Pupils: Yes

Teacher: uwone vamene ni lemba, Gumbo has 5431, nanga wamene abelenga uyo nindani? Nikuvela ukazibelengela mutima pamene nilemba pa board apa aii

Pupils: Yes

Teacher: ubelenga aii, are you reading?

Pupils: Yes

Teacher: quietly no one should talk just look at what I'm writing on the board, ok. So this is a question written in sentence form. Iye nifunso yolembewa muchiganinzo. Ndiye masamu yamene tiyanganapo lelo. So I'm going to read that question.

Pupils: Yes

Teacher: ndani angayense kutibelengelako? Who can read that question for us? Yes you

Pupil: Gumbo has 3431

Teacher: Are you sure its 3000?

Pupil: oooh No.

Teacher: read again

Pupil: Gumbo has 5431 cattle if 3106 died. how many remained?

Teacher: very good, if 3106 died how many remained? Yes Gumbo has 5431 cattle, if 3106 died how many remained? Akuti Gumbo, Gumbo uyu nizena ya munthu aii. Ati Gumbo aze na ng'ombe zili 5431 ndiye ng'ombe zamene aze nanzo pamozi, kunafa zili 3106, ati anasala na ng'ombe zingati? Eyi funso niyolembewa muchiganinzo. So it's not that all the time ma question azayamba kulembewa muma numbers no, venengu vemalembewa muchani?

Pupils: mu sentences

Teacher: Yes, muma sentences, so what I was saying is that whenever you come across such a problem please you need to understand, the what?

Pupils: The question.

Teacher: understand the

Pupils: question

Teacher: ukapeza chiganizo cholembewa mu sentence iwe ufunika uvesense vamene chiganizo chikamba. Vamene chichita bwanji?

Pupils: chikamba

Teacher: so apa bafuna kuti tione kuti nizingati ng'ombe zasalapo after zinja zachita bwanji?

Pupils: zaafa

Teacher: zaafa, so what you do, vamene ufunika kucita is to arrange the numbers, in what order?

Pupils: vertical order

Teacher: are we sick?

Puipils: No

Teacher: mwandwala?

Pupils: sit up, arrange the numbers in vertical?

Pupils: vertical order

Teacher: so what you do arrange the numbers in vertical order, yakokane bwino bwino according to their place values. So choyamba ng'ombe zones zikale pamwamba which is 5431, so apa tifunika tichosemo zamene zinachita bwanji?

Pupils: zamene zinaafa

Teacher: zinachita bwanji?

Pupils: zinaafa

Teacher: Yes so that tione kuti zingati zinasalako so now you deduct or take away 3106 cattle which died from that number. So tiye tichosepo paja. Let us deduct and see or subtract and see whichever way and see how many cattle remained. Look at the board all of you. Tiye tichosepo manje. What is 1 take away 6?

Pupils: it can't

Teacher: 1 kuchosamo 6 nizingati?

Pupils: it can't

Teacher: Sichingakwanisike aii, it can't why? Because 1 nin'go

Pupils: Ning'ono

Teacher: 6, niku

Pupils: nikuulu

Teacher: can it come from 1

Pupils: No

Teacher: so what do we do?

Pupils: borrow 1 from 3

Teacher: Yes we borrow 1 from 3, tibwelekako kuti number eyi eli apa kuti ikule, so what is 11 take away 6?

Pupils: 5

Teacher: what is remaining there?

Pupils: 2

Teacher: what is 2 take away 0?

Pupils: 2

Teacher: 2 kuchosapo 0?

Pupil: 2

Teacher: yes, pasala 2, sochabe aii?

Pupils: yes

Teacher: then next pali 4, 4 kuchosapo kamonzi?

Pupils: 3

Teacher: Yes 4 kuchosapo kamonzi tusala tutantu. Pasala 3. Then the next the last number is

Pupils: 5

Teacher: 5 take away 3

Pupils: 2

Teacher: 5 kuchosamo tutantu?

Pupils: 2

Teacher: kusala 2 apa, so after ng'ombe zaafa kunasala zingati?

Pupils: 2325

Teacher: Yes 2325 cattle, so these are problems involving what? Subtraction, yolembewa muma sentences.

Teacher: Let us look at example number 2. This one goes like this, out 6000 plants 2568 were burnt by fire. Find how many plants were not burnt? Ndani angatuwuzeko ichi muchinyanja bakamba kuti chani? Yes, Izukanji

Izukanji: mwaibalapo of apo after out.

Teacher: ok here is of. Nifuna angatuwuzeko chiganizo ichi muchinyanja bakamba kuti chani? Vinja vamene twalemba muchizungu mu chinyanja tingakambe kuti chani? out 6000 plants 2568 were burnt by fire. Find how many plants were not burnt? Muchinyanja tingakambe bwanji? Ndani azayeselelako muchitundu chili choonse? Yes Dorcus

Dorcus: Ati pali ma plant yali 6000 yamene yanashokewa yali 2568, yangati yamene yanasalako?

Teacher: mutoteleni muzanu

Pupils: clapping

Teacher: akonza aii. Akamba ati ma plant, muziba ma plants?

Pupils: Yes

Teacher: so bakamba ati ma plant yali 6000 kunashokewapo 2568, manje bafunsa ati nitungati twamene situnapye namulilo? I want one to go in front and work out the example. Dalitso, clap for Dalitso as he is going

Pupils: clapping

Teacher: Yes, you can go ahead

Dalitso: 0 minus 8

Pupils: it can't

Teacher: Dalitso is that subtraction, plus or division palibe sign yamene ewonesa kuti vamene uchita nivichani. So don't forget the sign that shows what you are doing, ok continue.

Dalitso: 0 minus 8

Pupils: it can't

Dalitso: what can we do?

Pupils: Borrow 1 from 6

Dalitso: 10 minus 8

Pupils: 2

Dalitso: 9 minus 6

Pupils: 3

Dalitso: 9 minus 5

Pupils: 4

Dalitso: 5 minus 2

Pupils: 3

Teacher: so that is the number of plants which were not burnt. Clap for Dalitso

Pupils: clapping

Teacher: ok let us look at what Dalitso was doing. Tiyeni Tuyangani tiwone kuti Dalitso Azekuchita chaani? Ok so achita ati 0 kuchosamo 8, it can't, then he looked at the top number on the left and found it was also zero and the next was zero, so he kept going until he reached 6 and borrowed 1 which is a tenth and added to zero which is next to 6 and it became 10, he got 1 it remained 9 and added to this zero and became 10 and again got 1 and finally added to this zero and became 10 and he began subtracting. What do we have now here?

Pupils: 10

Teacher: yes 10, we can subtract, so 10 take away 8 is

Pupils: 2

Teacher: 10 kuchosamo 8 pasala zingati?

Pupils: 2

Teacher: then apa pasala zingati?

Pupils: 9

Teacher: So 9 kuchosamo 6 pasala zingati?

Pupils: 3

Teacher: what remained there?

Pupils: 9

Teacher: 9 take away 5

Pupils: 4

Teacher: Apa pasala zingati?

Pupils: 5

Teacher: Yes, we remained with 5 there. What is 5 take away 2

Pupils: 3

Teacher: So these are the number of plants which remained out of 6000. 3432 plants were not burnt. Are we together?

Pupils: Yes

Teacher: manje apa nifuna muvesense, I will repeat the explanation again. Masamu yolembewa muma sentences, muziganinzo, chachikulu iwe ufunika ubelenge nakuvesense kuti bafuna kuti uchite chani. If you will not understand the question very well you will not be able to solve the problem very well and you will not be able to find the answer. Let us open our text books what is the page number?

Pupils: page 33

Teacher: very good. Let us look at page 32. Have you seen it?

Pupils: Yes

Teacher: let us look at number 1, let us read everybody.

Pupils: the forest has 6725 trees. If people cut down 4351 of them. How many trees will remain?

Teacher: that's a question aii

Pupils: Yes

Teacher: Muchinyanja ikamba kuti chaani? Tifunika kuti tivesense vamene chiganizo chikamba. Who can tell us what the question is saying? Yes, Innocent

Innocent: Ati Musanaga ngati bajubamo mitengo ili 4351 pali 6725 mungasalemo ingati?

Teacher: clap for him

Pupils: clapping

Teacher: So this is what I want you to do. Ukabelenga sentence kapena chiganinzo uganizele kuti chikamba bwanji muchinyanja. Ukavesensa vamene vekambiwapo then iwe uzakwanisa kupeza answer. So who can find the answer for this question? Yes, you come.

Mary: working on the board

Teacher: Ok so yanja ma numbers ayafaka mu vertical order according to their place values.

Mary: 5 minus 1

Pupils: 4

Mary: 2 minus 5

Pupils: it can't

Mary: what do we do?

Pupils: we borrow 1 from 7

Mary: 12 minus 5

Pupils: 7

Mary: 6 minus 3

Pupils: 3

Mary: 6 minus 4

Pupils: 2

Teacher: so this are the trees which remained in the forest after cutting down, 2374. So nifuna unichitileko naiwee aii

Pupils: yes

Teacher: Do this exercise in your books. Let us look at number 7 on exercise 2. Have you seen number 7?

Pupils: yes

Teacher: can you read number 7 together.

Pupils: Mrs Kataka got 1561 votes and Mrs Kachoka got 1284 votes in the local elections. How many more votes did Mrs Kataka get?

Teacher: ok that is the first question you will find in your books. Let us also look at number 8 and read together.

Pupils: Mr Mando made 6239 clay pots. If he sold 4171, how many pots does he have left?

Teacher: Yes, write those two questions in your exercise books and this marks the end of our mathematics lesson today.