CHALLENGES OF TEACHING MATHEMATICAL PROBLEM SOLVING SKILLS: A CASE OF JUNIOR PRIMARY SCHOOLS IN KUNENE REGION RURAL-FARM SCHOOLS, NAMIBIA

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION (EARLY CHILDHOOD DEVELOPMENT)

OF

THE UNIVERSITY OF NAMIBIA

BY

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SEPTEMBER 2020

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ABSTRACT

The purpose of this study was to assess the challenges experienced by Grade 3 teachers when teaching mathematical problem solving skills in 5 selected rural farm schools in the Kunene region of Namibia. The study adopted a qualitative approach following the case study design in order to elicit the views of Grade 3 teachers and Junior Primary Heads of Department about their experiences of teaching mathematical problem solving skills in rural farm schools. Purposive sampling was used to select 5 public schools which consisted of 5 Grade 3 teachers and 3 HoDs. Participants' ages ranged between 35-50 years. Both the teachers and the HoD's were interviewed. Further, the study used an observation schedule as well as document analysis to collect data.

A content analysis approach was used to analyse data by categorizing them using a specific coding method. The main findings of this study indicated that the majority of teachers struggled to employ appropriate teaching methods when teaching mathematical problem solving skills to young learners. Identifying key words in the story problems as well as the use of manipulatives were the most common teaching strategies teachers employed when teaching mathematical problem solving skills. Furthermore, the study revealed major challenges which included learners' poor reading ability, lack of proper teaching materials, lack of support from the Education Regional Office, and lack of pedagogical knowledge. The study recommends that teachers should prepare reading activities that aid the learners in how to identify, understand and implement the terminologies which relate to the operation signs in order to enhance learners' reading comprehension. Further, the study recommends that the Education Regional Offices should provide Grade 3 teachers with a series of professional development training workshops. All schools in the region should also be supplied with the same, effective teaching materials.

Key words: Mathematical problem solving skills; rural-farm school; medium of instruction; Education Reginal Office.

Table of Contents

LIST OF ABBREVIATIONS AND ACRONYMS

ASCD	Association for Supervision and Curriculum Development
BED	Bachelor of Education
BER	Bureau of Education and Research
CPD	Continuing Professional Development
DBE	Department of Basic Education
DHET	Department of Higher Education and Training
DMI	Developing Mathematical Ideas
DJPE	Diploma in Junior Primary Education
FoE	Faculty of Education
INSET	In-Service Training
MCPD	Mathematics Continuous Professional Development
HoD	Head of Department
MoEAC	Ministry of Education, Arts & Culture
NAEP	National Assessment of Educational Progress
NCTM	National Council of Teachers of Mathematics
UNAM	University of Namibia
ZPD	Zone of Proximal Development

ACKNOWLEDGEMENTS

First and foremost, I would like to thank God for giving me the strength and courage to complete my thesis. Further, I would like to register my words of gratitude and appreciation to my supervisors, Dr. S.M. Iipinge and Dr. E.I. Tobias for the guidance and support you rendered to me in this study. I recognised and appreciated your commitment and effort you showed in my study. The research knowledge which you invested in me will remain a grateful gift throughout my entire academic life. Most importantly, I would like to thank all the participants for their willingness to participate in this study and share their teaching experiences as well their knowledge about mathematical problem solving skills.

My sincere appreciation also goes to the Director, Education, Arts & Culture of Kunene region, Ms. Angeline A. Jantze for granting me permission to conduct this study in the region. I also thank the principals of the schools where this study was conducted for welcoming me and organising accommodation for me. Finally, I would like to extend my gratitude to the University of Namibia for granting me free study.

DEDICATIONS

This thesis is dedicated to my mother, Selma Nghipundaka and my late father, Kleopas Naivela who took care of me throughout my childhood. I also dedicate this thesis to my guardian, Rosalia Haitembu for raising me for more than 20 years. I will always appreciate everything she has done for me in life. Further, this thesis is dedicated to my sisters and brothers including my late brother Joseph Naivela for their prayers and support.

I also want to dedicate this thesis to all the Junior Primary teachers in Namibia. They are doing a tremendous job by developing a strong foundation in numeracy skills for the young children. Finally, I dedicate this study to my colleagues and friends for your support and encouraging remarks during my study.

DECLARATIONS

I, Erastus Kleopas, hereby declare that this study is my own work and is a true reflection of my research, and that this work, or any part thereof has not been submitted for a degree at any other institution.

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Erastus Kleopas Signature Date

CHAPTER 1

INTRODUCTION

1.1 Introduction

The aim of this case study is to assess the challenges experienced by teachers when they teach mathematical problem solving skills in Grade 3 at rural farm schools in the Kunene region. In the introductory chapter, I briefly discuss the background context of the study, the statement of the problem, the main research questions, the significance of the study, the limitations and delimitations of the study, as well as the definition of terms used in the study. These areas form the structure of this chapter.

1.2 Background context

The Ministry of Education, Arts & Culture (2015) has included problem solving skills as one of the most critical competencies in Mathematics in the Namibian Junior Primary curriculum. The reason for this is that this skill leads to learners having the ability to solve real life problems as they progress through life. Therefore, teachers are required by the Ministry of Education, Arts & Culture (MoEAC) to introduce problem solving into the teaching and learning of Mathematics from an early age.

Several research findings have shown that the lack of the development of a mathematical vocabulary affects learners' abilities in Mathematics. Blessman and Myszczak (2001), Amen (2006), Georgius (2008), Kranda (2008) McConnell (2008) and Sharma (2001) have all stated that one of main causes of confusion in Mathematics is vocabulary. Findings from other studies for example, indicated that learners need a strong understanding of mathematical vocabulary to be successful in mathematics. According to Amen (2006) an understanding of mathematical vocabulary influences the comprehension of lessons, tasks, various tests, especially in solving word

problems, which leads to the assumption that a lack of understanding of mathematical terms will severely affect learners' capability to solve problems.

The research suggests that a direct link exists between success in problem solving and vocabulary. A learner's ability to understand the terms used in Mathematics classes is related to their ability to be successful in the classroom and solve word problems in particular. Georgius (2008) found in his research that learners stated that a knowledge of the definitions of mathematical terms was a significant predictor of their achievement in Mathematics. McConnell (2008) pointed out that when learners are directly instructed to use the language of Mathematics, in most cases they develop a better understanding of mathematical concepts and word problem solving becomes easier.

Burns (2007) accounts that mathematical problem solving is the tool used not only to help learners develop their thinking ability but also to help them to develop their basic skills in solving all problems especially problems encountered in daily life. However, the fact is that most learners struggle to comprehend Mathematics, most especially with regard to problem-solving activities (Garderen, 2006). At a global level, (Miheso, 2012) acknowledged that the learners' experience in solving story problems in Mathematics is a vital step in developing their thinking skills.

According to Sharma's (2001) study, the most difficult part of solving story problems in Mathematics, is understanding the language that is used to express the problem. The same study compared the performance in Mathematics with learning a second language because Mathematics is also a "kind of language where communication takes place through the symbols, it has its letters, symbols, vocabulary and grammar" (p. 66). When the operations that are required are behind word problems, many learners struggle to know what to do. In some instances learners attempting to solve a word problem can identify some elements of the problem such as the vocabulary used,

numbers, etc. but are unable to complete all of the required operations and are unable to produce an acceptable answer (Miheso, 2012).

Given this situation, teachers find the concepts of problem solving complex to teach and equally learners exhibit difficulties in solving word-problems in Mathematics, even when they may be skilled in other components of Mathematics (Pimm, 2007).

Namibian learners as part of the global education system, are also expected to have a level of competency in mathematical problem solving. Specifically, learners at the junior primary level of schooling in Namibia, are expected to be able to demonstrate the following competencies in mathematical problem solving: (a) apply their understanding of number concept to solve simple problems in everyday context by computing, (b) estimate and measure, using their own methods and strategies, and (c) use numbers within the required number range (Ministry of Education, Arts & Culture, 2015).

1.3 Statement of the problem

Although problem solving is among the mathematics learning skills which should be developed at the foundation phase, most learners struggle to apply mathematical problem solving activities in their daily life (Murchan, Shiel & Vula, 2012). Furthermore, they find it difficult to reason critically across other subject areas since their higher order thinking capacity is not fully developed (Pimm, 2007). The Ministry of Education, Arts & Culture (2015) emphasises that, by the end of the Junior Primary Phase, learners are expected to solve story problems about everyday contexts using addition, subtraction, grouping or sharing by using any logical strategies. Mathematics is one of the compulsory subjects where learners must obtain 40% or more for them to be promoted to the next grade (Ministry of Education, Arts & Culture, 2015). However, poor performance in the mathematical problem solving component of the curriculum results in many learners having to

repeat various grades (Pimm, 2007). In addition, I have observed throughout my teaching experience at rural farm schools that learners continuously perform poorly in the problem solving aspect of Mathematics. This led to my interest in investigating the challenges of teaching mathematical problem solving skills to Junior Primary school learners. Most research literature on mathematical problem solving has been conducted in urban school settings so the situation at rural farm schools has been neglected (Eshiwani, 2016; Libeskind & Lott, 2013). This study therefore, explored the challenges of teaching mathematical problem solving skills in Junior Primary schools in the Kunene Region rural farms in Namibia.

1.4 Purpose of the study

The purpose of this study was to explore the challenges of teaching mathematical problem-solving skills in Junior Primary schools in the Kunene Region rural farms.

1.5 Research Objectives

The specific objectives of this study were:

1. To identify and describe the teaching methods used by teachers when teaching mathematical problem-solving skills.
2. To find out the challenges experienced by the teachers in the process of teaching mathematical problem-solving skills to Grade 3 learners.
3. To suggest the best/effective teaching methods/ strategies for teaching mathematical problem solving skills in Junior Primary schools.

1.6 Research questions

In light of the research objectives, the following research questions were designed as follow:

1. How do Grade 3 teachers at the selected rural farm schools teach mathematical problem solving skills?
2. What are the challenges experienced by Grade 3 teachers at selected rural farm schools in teaching mathematical problem solving?

3. What should be done to minimize the challenges of teaching mathematical problem solving skills in Grade 3 at selected rural farm schools?

1.7 Significance of the study

The findings of this study might contribute to the existing global body of knowledge on teaching problem solving in Junior Primary schools. Moreover, I hope the findings will benefit all Junior Primary school teachers, learners and other stakeholders in the Kunene region and to some extent, the entire Namibian population since effective solutions to teaching and learning mathematical problem solving skills would benefit everyone. Once the challenges of teaching mathematical problem solving skills at rural farm schools are revealed, the study as informed by the findings, could determine the support which teachers receive from their respective schools and from the Kunene Education Region in general.

1.8 Limitation of the study

The first limitation is that the research was conducted in only five of a possible 30 primary schools in the Kunene region. The findings cannot be generalized to other schools in the region. However, other schools in the region can learn some lessons from this study. Secondly, my presence in the classroom during observation might have influenced the teachers' usual teaching strategies. To mitigate this influence, I played the role of an observer and did not participate in any discussion or activities that might influence the behaviours of learners or teachers. Thirdly, some teachers might have been nervous about their shortcomings in teaching mathematical problem solving skills. However, in an attempt to mitigate against this, I used more than one research instrument such as interview schedules, observation schedules and document analysis to collect data. Fourthly, although I had stepped into the research site wearing the lenses of a researcher and not a teacher, my prior knowledge of research sites was likely to interfere with my objectivity. Besides, I did not

need gate keepers and it was easy to get authorization. Therefore, I established rapport easily and could tell when people were not being truthful.

1.9 Delimitation of the study

The study was limited to Grade 3 Junior Primary phase teachers of five schools in the Kunene region.

1.10 Definition of terms

In this study the following terms are defined as follows:

Mathematical problem solving: Problem solving means engaging in a task for which the solution method is not known in advance. In order to find a solution, learners should draw on new mathematical knowledge, and through this process, they will often develop understandings (National Council of Teachers of Mathematics [NCTM], & Association for Supervision and Curriculum Development [ASCD], 2015).

Rural farm school: This is an institution with limited or sometimes no available social services such as health facilities, electricity, sanitation, telecommunication services and road infrastructures (Namibia Statistics Agency, 2016).

Medium of instruction: Refers to the language which is the medium of instruction (Muller, 2015).

Learner: According to the Namibian Education Act, a learner is a person who is registered and receives basic education or a course of study in terms of this Act, (Education Act, no. 16, 2001).

Integration: An approach to teaching and learning that is based on both philosophy and practicality and it occurs when components of the curriculum are connected and related in meaningful ways by both the learners and teachers (Ministry of Education, Arts & Culture, 2015).

District: An area of a country or town, which is characterized by particular features (*Oxford Advanced Learner's Dictionary*, 2010).

Education Regional Office: This is the office responsible for the administration of the affairs relating to education and culture as may be assigned to the office by or under the Act or any other law (Education Act, 2001).

1.11 Conclusion

This chapter outlined the background information on the study that investigated the challenges of teaching mathematical problem solving to Grade 3 learners in rural farm schools in Kamanjab and Outjo districts, Kunene Education Region. The chapter also highlighted the potential significance of this study for teachers, learners, parents and other stakeholders in education. In the next chapter, I present the theoretical framework employed and a review of the literature relevant to this study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter describes the theoretical framework used in this study in an attempt to understand the many challenges that Junior Primary teachers experience when teaching mathematical problem solving skills. The review of literature focuses on (a) mathematical problem solving teaching methods, (b) challenges of teaching mathematical problem solving skills; and (c) strategies for handling problem solving related activities. This is followed by a review of evidence and research-based findings relating to the problem and highlight the gaps that have been identified within the reviewed literature.

2.2 Theoretical framework

In order to address the purpose of this study which is to establish the challenge of teaching mathematical problem solving skills at selected rural farm Junior Primary schools, the research is guided by Vygotsky's social constructivist theory. This theory is founded on the premise that, "… knowledge construction [should] occur in social contexts as learning activities are socially and contextually bound" (Mukeredzi & Mandorona, 2013, p. 143). Through this philosophy, learners "actively and uniquely construct knowledge within their framework of their own experience" (Leder, 2012). Here, the learning and teaching contexts are situated in rural farm Junior Primary schools.

This theory tries to make teachers understand that learners do not learn in a vacuum but rather in an interacting environment and this understanding may help teachers to employ variety of teaching methods which enhances acquiring of new knowledge. This includes group work, pair work, whole class, etc. Through social constructivism theory, learners may acquire the new knowledge from teachers through interaction during teaching and from their peers during the lessons. Learners need

to observe how the teacher solves examples of story problems and learn more strategies of solving the story problems as demonstrated by the teacher as well as by peers which later they can practice the acquired skills and abilities on their own. “What a child can do today with assistance, s/he will be able to do by him or herself tomorrow” (Jones, 2015). In addition, Vygotsky believed that peer interaction is an essential part of the learning process, and this relates to the study in question. In order for children to learn new skills, the theory suggested pairing the more knowledgeable learners with those who need learning support.

According to Vygotsky (1978) children’s cognitive development increases through exposure to information within the child’s Zone of Proximal Development (ZPD). Mukeredzi and Mandorona (2013) in their study explained well that ZPD is the level at which a child can almost perform a task individually, but can only fully do this task with the help of someone more competent than a learner. For example, the children can be able to read the story problems on their own while the teacher plays a crucial role to guide them on how to comprehend the story problems. The social constructivism theory encourages teachers that they should teach through identifying the key words from the story problems and teach the learners the best strategies to solve story problems. From this study it seen that teachers need to couch learners step-by-step when solving story problems. This helps the child to increase understanding and do new tasks. Therefore, new information should be presented by peers and teachers within the ZPD. Teachers should take advantage of using practical examples by continually providing a slight stretch of a child's existing knowledge and skills.

Therefore, I chose social constructivism theory because it helped to reveal and address the challenges of teaching mathematical problem solving skills at selected rural farm Junior Primary

schools. It also helps to support and link the teaching of mathematical problem solving skills in a dynamic social context such as that of rural farm schools.

2.3 The mathematical problem solving teaching methods

It is acknowledged that the concept of problem solving is important for the learning and understanding of Mathematics (Van de Walle, 2013). Ronden (2012) explained that problem solving promotes reasoning, logical thinking and critical thinking. Ronden (2012) further explains that learners are exposed to practices such as interpreting, representing, analysing, reasoning and providing answers. Thus, Billstein, Libeskind and Lott, (2013), and Van de Walle (2013) are of the opinion that the teaching and learning of Mathematics in the early primary schools should be based on the five standard processes, namely: problem solving, reasoning and proof, communication, connections and representation. The current status of teaching methods employed in the Junior Primary classrooms in Namibia is that teachers demonstrate mathematical problem solving activities using local examples such as concrete materials found in the environment, e.g. stones, sticks, bottle tops, etc.

Learners work in well-organized small groups, pairs, individuals or whole class so that they learn from one another (Ministry of Education, Arts & Culture, 2015). Other teaching methods include demonstration, brainstorming, peer teaching and problem solving.

2.3.1. Group work, pairs, individual or whole class

A study conducted by Tanveer (2008) on group work vs. whole class activity in Pakistan investigated how teaching methods can be used effectively in the classroom as well as highlighting some areas of concern. The reviewed study aims to provide an overview of teaching strategies to determine which strategy of learner organisation works best while performing different classroom tasks. What is significant is that an important aspect of whole class discussion is the bonding

together of the whole group. Further, the larger the group, the greater the variety of ideas, opinions and experiences are expressed all of which contribute to the learning process. In addition, whole class activity is also widely used at the end of any lesson to summarize what has been taught or achieved in that particular lesson. Furthermore, Tanveer (2008) emphasised that group activities increase learners' involvement in class activities. Tanveer (2008) provided examples that when learners are in groups a) they talk and communicate more readily with each other; b) group activities encourage learners to learn through discussion; c) group activities, encourage learners to work in collaboration with one another. From my experience as a primary teacher, I have observed that group activities ensure maximum participation from all group members.

By way of contrast, Tanveer (2008) said that organising the whole class or groups into one cluster is a useful teaching strategy but it also has its shortcomings and disadvantages. For instance, its efficiency and effectiveness depends on the level of attentiveness of the learners. If the lesson is not interesting enough, it fails to capture the learners' attention. Another disadvantage of this activity is that only a limited number of learners participate when they are organised as whole class or a group. The shy or the passive ones prefer to be quiet while the others actively participate.

Similarly, Chiriac and Frykedal (2011) carried out a qualitative study on the management of group work and pair work as a classroom activity in Sweden. The main focus of this qualitative study was to address group and pair work as classroom activities from the teachers' perspectives, and more specifically to ascertain why teachers are reluctant to use group and pair work as modes of working in education. Data were collected by means of focus group interviews with teachers from three different schools, and the analysis was carried out using grounded theory. The findings indicated that teachers are still reluctant to use group work as a pedagogical tool in the classroom.

These reviewed studies examined the value of using whole class, group work as well as pair work as teaching methods to ensure effective teaching and learning. These authors hold that using whole class, group and pair work methods maximize learning and gives learners an opportunity to interact with one another. By doing so, they are learning from each other since they are sharing ideas and recognise how others think. However, the authors concurred that these teaching methods require excellent teacher management skills and effort. The scope of these studies did not include teaching methods in mathematical problem solving contexts nor the use of these methods in Grade 3 rural farm schools. Therefore, this study will aim to look at the teaching methods that selected Grade 3 Junior Primary teachers employ when teaching mathematical problem solving skills at rural farm schools.

2.3.2 Demonstration

Demonstration is another teaching method which is used to ensure effective and efficient teaching and learning. Noah (2017) explained demonstration as a method of teaching by manipulating and showing things, events, rules, and sequences of activities, either directly or through using instructional media which is relevant to the subject matter or materials. The purpose of teaching using the demonstration method is to show the process of the occurrence of an event according to the teaching materials, and how this aids the learners' understanding which is a vital outcome of the teaching and learning process.

The demonstration method has several advantages and disadvantages. The results show that the demonstration method has a significant effect on students' achievement over teaching by the conventional lecture method. This outcome recommends that teachers must put more effort into enhancing the learners' understanding of Mathematics. The demonstration method is difficult to integrate especially if teachers do not have a sound pedagogical knowledge. The result of this

method is that more abstract learning becomes understandable as learners experience the complexity of the content being shared.

The study carried out by Motshoane (2006) investigated teachers' knowledge of and insight into demonstrations and attempted to identify what benefits, if any, and constraints teachers associate with the use of demonstrations. The results show that teachers experiencing real problems with the concept of demonstration with the result that many do not use the technique as a teaching method. Furthermore, due to poor economic conditions of the government schools, there is a scarcity of audio-visual aids and equipment and the teachers are not sufficiently creative to produce handmade models for demonstration. In addition, there is a general lack of diligence among teachers who wish merely to complete the syllabus or syllabi as quickly as possible without putting sincere effort into improving the learners' understanding of the content.

A reasonable conclusion is that teachers are not yet conversant with the benefits and alternative ways whereby demonstrations can be implemented. Both researchers emphasised the benefits of demonstration if it is correctly integrated in the lesson.

2.3.3 Brainstorming

Agha (2009) from United State of America defined brainstorming as method or way of teaching used by teachers in which maximum or all the learners participate by responding or presenting views on one topic. This technique encourages new ideas among learners which would never have happened under normal circumstances. With this teaching method, the teacher begins the session by posing a question, problem or by introducing a topic. The learners then express possible answers, relevant words, and ideas toward the topic, question or problem. These strategies helped

the learners to share ideas and expand each other's knowledge. The contribution is then accepted without criticism or judgment and is then summarized on a white board by the teacher whereby ideas are examined and are usually in an open class discussion format.

Agha's (2009) study aimed at finding out the effect of using the strategy of brainstorming as a means to developing mathematical thinking skills on both sides of the brain in eleventh grade learners. Using an experimental approach, the study sample consisted of two groups, the experimental group of (30) learners, and the control group of (30) learners from the eleventh grade. The sample was chosen purposefully, and the parity between the two groups was considered in terms of chronological age and previous achievement in Mathematics. The study tools were a brain control test, and a test of the researcher's design relating to some mathematical thinking skills (induction, inquiry, conclusion, rationalism, problem solving, and symbolization). Using statistical methods, the researcher established the following results. The differences between the experimental and control groups showed a positive impact from the use of the brainstorming strategy on the experimental group. Therefore the development of mathematical thinking and mental ability was evident from the use of the brain storming strategy in the teaching of Mathematics.

In summary, the teacher should brainstorm the concepts and learning procedures which relate to mathematical problem solving. The teacher should give meanings of the concept to allow learners to understand. Further, brainstorming should be stretched on what learners are required to do, for example, the procedures of doing problem solving activities. This involves teaching learners about the synonyms of operational signs (addition, subtraction, multiplication and division).

2.3.4 Guided method

Newton (2013) maintains the guided method allows teachers to address students at their instructional level in order to take them to reach their potential. He reiterates that guided mathematics allows the teacher to support learning by grouping students in small instructional groups to teach them in their zone of proximal development. The zone of proximal development (sometimes abbreviated ZPD), is the difference between what a learner can do without help and what he or she can do with the help of either a peer or teacher (Vygotsky, 1978). This is also complemented by Jones (2015) who stated that what a child can do today with assistance, she will be able to do by herself tomorrow. As mathematical problem solving perceived to be a complex concept in Mathematics, Vygotsky (1978) believed that complex tasks outside of a learner's ZPD, teachers should ensure the learning is simplified to render more assistance (scaffolds), including the use of tools like manipulatives or more assistance from peers.

Newton (2013) states that the goals of guided Mathematics are for students to become proficient mathematicians who have conceptual understanding, procedural fluency, strategic competence, adaptive reasoning and mathematical confidence. Guided Mathematics aims at getting students comfortable with numbers, operations and mathematical concepts so that they can work independently with new and different contexts. The study of Murray and Jorgensen (2007) describes the guided method in Mathematics as an environment in which some students are given the opportunity to work independent of teacher guidance to building student's skills, concepts and strategies through the use of teacher directed tasks and/or Mathematics Learning Centres. The teacher pre-selects a group to observe and conference with for the purpose of assessing student growth and development, while noting areas where additional support is needed. Ideally, guided mathematics should take place daily for at least 15 minutes, but as little as once per week, has a

significant benefit in building student self-reliance, independence and critical thinking skills (Newton, 2013).

According to the South African Department of Education (2007), it is explained that teacher's guidance makes it easier to transfer the knowledge to the learners of how to do Mathematical problem solving activities. The same policy document recommends that the teacher should be around and render maximised learning support to ensure that learners comprehend the story problem, can identify the key words, can select appropriate key words from the story problem and compute effectively using strategies (Department of Education, 2014).

2.3.5 Integration

Jacobs (2011) carried out a study on the effects of the introduction of integration in middle grades in the United States. The movement towards an integrated curriculum is a move away from memorization and recitation of isolated facts and figures to more meaningful concepts and the connections between these concepts. The twenty-first century requirement for a flexible use of knowledge goes beyond a superficial understanding of multiple isolated events to insights developed by learning that is connected - or integrated. Perkins (2016) advocates teaching for transfer and thoughtful learning when he states: A concern with connecting things up, with integrating ideas, within and across subject matters, and with elements of out-of-school life, inherently is a concern with understanding in a broader and a deeper sense. Accordingly there is a natural alliance between those making a special effort to teach for understanding and those making a special effort toward integrative education (p. 7).

Vars (2010) undertook a study about the historical perspective on integration teaching in middle grades in Kent. His view supports the notion of curriculum integration as a way of making education more meaningful. Concerns about national achievement levels and high dropout rates

have put the spotlight on any educational change that would lead to increased student success. In addition to the realization that curriculum integration may be an effective element in making education both manageable and relevant, there is a body of research related to how children learn that supports curriculum integration. Cromwell (2017) looks at how the brain processes and organizes information. The brain organizes new knowledge on the basis of previous experiences and the meaning that has developed from those experiences. The brain processes many things at the same time, and holistic experiences are recalled quickly and easily. "The human brain," writes Shoemaker (2011) "actively seeks patterns and searches for meaning through these patterns" (p. 13).

According to the Ministry of Education, Arts & Culture (2015) integration matches the way that learners think. Brain research supports the theory that younger learners take in many things and process and organise them at one time. Teaching ideas holistically, rather than in fragmented pieces, better reflects how young learners' brains process information. In Junior Primary, all integration topics are chosen from the Environmental Studies syllabus and content for the other 6 subjects is integrated and linked to this where possible. Each of these integration topics comes from one of the three Environmental Studies themes: The Social Environment, Health, Safety and Nutrition, and the Natural Environment. Mathematics and numeracy is another key skill to explore and develop in the Junior Primary phase. However it is not always suited to integration. Sometimes the content of a problem can be linked or an element of data handling or measurement might fit with the topic. Möller (2018) remarked that it is a good practice to introduce lesson activities or concepts with a story problem so that if becomes familiar to learners.

In conclusion, Jacobs (2011) and Vars (2010) both described curriculum integration as a method of relating subjects' content to the 'real world' by making teaching meaningful to the learners.

Cromwell (2017) and the Ministry of Education, Arts & Culture (2015) have both considered the memory capacity of younger learners and recommend that the processed teaching ideas should be holistically and arranged in patterns.

2.4 Challenges in teaching mathematical problem solving skills

From the review of relevant literature, the following challenges were identified in teaching mathematical problem solving skills namely; the language used as the medium of instruction, teachers' experience and in-service training (INSET), class size and performance, and learners' perceptions of Mathematics.

2.4. 1 Language used as a medium of instruction

The question of whether language proficiency is related to learning ability in Mathematics and general academic achievement has been debated for many years (Moore, 2013). Much of the debate is centred on the performance of disadvantaged learners with limited proficiency in English (Moore, 2013; Pimm, 2007).

Olivas and Marie (2005) conducted a study on building linguistic and mathematics competence in Hispanic English language learners. From a sociocultural framework, this study was conducted to examine how Spanish speaking Hispanic learners were negotiating for mathematical meaning in a communicatively demanding mathematics environment. The findings resulted in patterns of discourse across mathematical performance levels and English language proficiency levels. For example, the more advanced English language learners who were also proficient in mathematics were able to justify their mathematical strategies and reasoning more adeptly in their discourse. However, learners who were less fluent in the use of the English language and less mathematically proficient were also less capable in expressing their mathematical strategies and reasoning in their classroom discourse. Findings imply that Mathematics educators should support English language

learners, most especially those whose home language is not English, through providing learners with more opportunities to interact in mathematical discourse which is a complicated language in itself.

Silver and Thompson (2014) carried out a study on problem solving in Elementary School Mathematics in the United State of America. The study revealed that one common explanation proposed for children's difficulty with verbal problems is their lack of reading ability. The study observed that children cannot solve a problem presented in a written verbal format if they cannot read it with understanding. Just as problem solving ability is not a unitary phenomenon, reading ability is also a complex process; thus it is not surprising that there is clear research evidence about the role that reading ability plays in problem solving performance. Chase and Lee (2009) whose study concerned Mathematics difficulties and reading difficulties in the USA acknowledged that the findings of several studies suggests that reading ability is directly associated with performance in solving standard word problems. In contrast, there is also evidence that reading ability plays only a minor role in successful problem solving (Balow 2014; Knifong & Holtan, 2015). In particular, Knifong and Holtan (2015) experimented with the computational requirements of standardized word problems tests in the USA and observed that no more than 10% of the errors sixth graders made on standardized test problems could be attributed to reading difficulties. The majority of the learners who failed to solve the problems correctly could read the problems orally and paraphrase the problem statement in their own words. Moreover, in the mathematics assessments conducted by National Assessment of Educational Progress (NAEP), all the problems were read on an audiotape to the learners in an effort to control the effect of reading difficulty. Although the learners did not have to read the problems, performance was quite poor on the problem solving tasks.

Thompson (2014) related that there is also conflicting evidence on whether or not instruction on reading skills can improve problem-solving performance. Some attempts to develop instructional sequences to improve mathematical reading skills have not been very successful (Henney, 2012). On the other hand, Knifong and Holtan (2015) provided evidence that instruction in reading skills can lead to higher problem-solving scores. As we look across a wide range of studies that relate to the role of reading ability as a factor in problem-solving performance, the general conclusion that we draw is that it is overly simplistic to attribute learners' general lack of success in problem solving to reading difficulties in the developed world.

It is noted that an inability to decode printed words or to comprehend a written problem statement would make it extremely unlikely that one could solve a standard textbook story problem. Yet, it is equally clear from much of the research discussed above that these abilities are not sufficient to guarantee success in problem solving. In addition to decode the words and comprehend the problem statement, problem solvers must also relate the problem situation to the mathematical knowledge that they possess. It is this later process - the mathematization of the comprehended problem statement that apparently distinguishes reading ability and mathematical problem-solving ability.

Even though reading and problem-solving difficulty are not synonymous, learners do need instructions on how to read and interpret the words that they encounter in mathematical problems. The study suggests that teachers should emphasise teaching learners to search for "key words" that trigger the choice of a mathematical operations.

Meanwhile, the study conducted by Beardslee and Jerman (2013) in the USA described a situation in which 14 linguistic variables were used to determine which variables would account for a significant amount of the observed variance in the error rate in verbal arithmetic problems. Some

researchers, employing various techniques of correlational analysis, found that characteristics of the problem statement such as the length of the problem, the grammatical complexity of its sentences, and the order in which the information appears were associated with problem difficulty (Beardslee & Jerman, 2013). A number of studies have focused on the effect of the syntactic characteristics of a problem's statement on its solution. Chase and Lee (2009) found that the difficulty level of the syntax had a significant effect on the solution of the problem. Changes in the length of the problem statement have been found to affect problem difficulty; however, other factors do not seem to influence problem difficulty as much. Ireland (2014) carried out a study about the effects of certain factors upon third grade children's ability to solve written verbal arithmetic problems in the United State of America. He analysed whether the sentences in the problem were simple or compound and discovered that this factor did not seem to matter in terms of problem difficulty.

All the above reviewed studies have focused on the sixth grade except Ireland whose analysis focused on the third grade. None of the studies was carried in a Namibian context or curriculum. Even though Ireland analysed mathematical problem solving skills factors in the third grade, the nature of the education system of two countries is not the same (USA and Namibia), one in a sophisticated first world urban environment and the other in a developing society in sub-Saharan Africa. This study therefore, needs to investigate the challenges of teaching mathematical problem solving skills in Junior Primary schools in the Kunene Region rural farm schools in Namibia where the use of English appears to have implications on the medium of instruction. In conclusion, it is necessary that problem statements for Junior Primary learners should not consist of long sentences because they may lose the meaning of the problem statement as their reading concentration span is very short (Moyer & Gilmer, 2011).

Silver and Thompson (2014) considered that one common explanation proposed for children's difficulty with verbal problems is their lack of reading ability. Many of the characteristics of the problem statement that contribute to its difficulty that were discussed in the preceding section attest to the importance of reading ability in problem solving. The study revealed that children cannot solve a problem presented in a written verbal format if they cannot read it and grasp the meaning. Indeed, much of the research discussed in the previous section of this paper attests to the importance of many reading related factors. Just as problem solving ability is not a unitary phenomenon, reading ability is also complex; thus it is not surprising that there is conflicting research evidence about the role that reading ability plays in problem solving performance. For example, the findings of several studies suggest that reading ability is directly associated with performance on standard word problems (Chase & Lee, 2009; Linville, 2005; Martin, 2000). However, the studies of Balow (2014) and Knifong and Holtan (2015) indicated that reading ability plays only a minor role in successful problem solving. In particular, Knifong and Holtan (2015) observed that no more than 10% of the errors sixth graders made on standardized test problems could be attributed to reading difficulties. The majority of the learners who failed to solve the problems correctly could read the problems orally and paraphrase the problem statement in their own words. Moreover, in the mathematics assessments conducted by NAEP, all the problems were read on an audiotape to the students in an effort to control the effect of reading difficulty.

2.4.2 Teachers' experience and in-service training

Ball and Wilson (2010) examine the impact of a nationally disseminated professional development program, Developing Mathematical Ideas (DMI), on teachers' specialized knowledge for teaching mathematics and illustrates how such research could be conducted. They discovered that Mathematics primary teachers often lack sufficient subject knowledge to teach the subject effectively because of the type of training programs that they have received. NCTM and

Association for Supervision and Curriculum Development (ASCD), (2015) recommended that Mathematics teachers must be well grounded in the subject and continue to grow professionally by staying involved in educational issues that affect the quality of their teaching. The lack of adequate in-service training opportunities for some teachers was also identified as a barrier to learners' academic achievement in Mathematics (Ronden, 2012).

Hill, Rowan and Ball (2005) explored whether and how teachers' mathematical knowledge for teaching contributes to gains in learners' Mathematics achievement. The authors used a linear mixed-model methodology in which first and third graders' mathematical achievement gains over a year were nested within teachers, who in turn were nested within schools. They found that teachers' mathematical knowledge was significantly related to student achievement gains in both first and third grades after controlling for key learner- and teacher-level covariates. This result, while consonant with findings from the educational production function literature, was obtained via a measure focusing on the specialized mathematical knowledge and skills used in teaching Mathematics. This finding provides support for policy initiatives designed to improve learners' Mathematics achievement by improving teachers' mathematical knowledge.

Matlala (2015) investigated the experiences of Mathematics teachers facilitating Mathematics using problem solving in a context that resembles the Namibian situation, the Kuruman area, in Northern Cape Province, South Africa. Statistics indicated that the majority of secondary Mathematics teachers in South Africa are either underqualified or unqualified to teach secondary school Mathematics (Department of Higher Education and Training [DHET], 2012, p. 4). According to News Channel Africa (2013) in South Africa, there were 7 076 unqualified teachers and 2 642 underqualified teachers out of nearly 400 000 teachers on the Department's payroll at the time of the study. These teachers hold either a Grade 12 qualification or completed a Grade 12

qualification but only have a one- or two-year tertiary qualification. Therefore, in 2009, the Department of Basic Education (DBE) introduced teacher development strategies to reduce the number of unqualified and underqualified teachers (DBE, 2011, p. 10). One of the Department's strategies is to encourage mathematics teachers to participate in in-service university programmes.

Matlala (2015) used an interpretive qualitative paradigm centred on the significance of participants' experiences and what meaning can be made from their experiences. As this was a case study, the focus was on four teachers (purposefully and conveniently selected among 12 teachers) in the John Taolo Gaetsewe district of the Kuruman area, Northern Cape Province, South Africa. The focus was on how problem solving has impacted their teaching practices as individuals. The four selected teachers were in their third and final year of the Bachelor of Education (B.ED), (in-service) programme at the time of the study. This study made use of a variety of data-generation techniques that included a questionnaire, semi-structured interviews and observations. The findings of the study indicated that teachers still facilitate Mathematics lessons using a 'traditional' approach, namely 'telling and showing'. The teachers confirmed that they experienced challenges that prohibited them from incorporating a problem-solving approach, mostly stemming from a lack of expertise on how to use the approach effectively.

The same study cited above revealed that about 10 000 teachers teaching in the secondary phase in South Africa do not hold appropriate teaching qualification. The group of teachers in Matlala's study were found to lack the methodology as well as pedagogical knowledge to teach Mathematics, most especially problem solving skills. In an attempt to address this problem of under-qualification, teachers are encouraged to register as distance or part-time students.

A mixed method study by Kasanda (2015) reporting on the pilot study that was carried out in the northern part of Namibia elaborated on the provision of Mathematics Continuous Professional Development (MCPD) in the Namibia Department of Mathematics, Science and Sport Education. The main purpose of the pilot study was to test the validity of the research instruments used among mathematics teachers to ascertain whether MCPD existed in the Namibian schools and its status. The pilot results show that MCPD has not taken root in Namibian schools as a formally established mode of improving the professional conduct and skills of Mathematics teachers at the different education phases. Even though ad hoc professional development activities have taken place in the country, these have not been formalized. The newly established Continuing Professional Development (CPD) unit at the University of Namibia promises to usher in the necessary formalization of CPD activities and intends to provide CPD for knowledge enhancement and improvement of qualifications.

Kasanda used both a qualitative and quantitative research design to obtain information from the school principals, teachers and advisory Mathematics teachers in the northern part of Namibia. A questionnaire comprising both closed and open ended questions was used to interview the participants of this study. The use of interviews to collect data from the participants was viewed as appropriate given the small number of participants involved in this pilot study. The study recommended that teachers should be made aware of MCPD and the benefits it offers. Knowledge of the MCPD and its value was not apparent among the surveyed principals and teachers.

A study conducted by Boudersa (2016) assessed programs in the Algerian educational context. Globally it is a commonly held belief that learning is a continuous process that contributes to the improvement of teachers' teaching skills and the acquisition of new knowledge in subject areas, and this will, in turn, improve learners' learning. The content of training is usually

determined by experts such as education officers and is often available in standard training formats or through prescriptions in methodology books. These methods include learning how to use effective strategies to open a lesson, learning how to use group activities in a lesson, using effective questioning techniques, using classroom aids and resources (e.g. video). Teachers' training involves providing training in various curriculum subjects by organizing workshops with the objective of keeping teachers up-to-date in their subject area (McChesney, 2015). According to the Ministry of Education, Arts & Culture Manual Guide (2016) the Education regional office in Namibia is responsible for arranging workshop to ensure that the professional development of teachers and principals is taken care of.

Page and Flinders (2012) explored the experiences of learning and teaching Mathematics in elementary schools in Australia. This paper is part of a larger qualitative study focusing on how teachers incorporate the affective domain into the primary Mathematics classroom. The affective domain is an ambiguous construct but is commonly defined as a broad term encompassing feelings, emotions, attitudes and values that are attached to an idea, subject or object (Leder & Forgasz, 2006). Researchers suggest the affective domain is ever present in the classroom but is often an incidental accompaniment to mathematical learning (Leder & Forgasz, 2006). The researchers further emphasized that the affective domain is critically important in all teaching and learning but especially in Mathematics. This paper focused on two participants and their experiences in teaching and learning Mathematics. It is an important aspect of teaching because teacher's personal beliefs, attitudes, theories and experiences play a pivotal role, one which is described as "one of the most important influences on learning" (Leder & Forgasz, 2006). This case study comparison of two teachers has many implications for Mathematics education and research. Firstly, it is imperative that time and space is given for teachers to reflect on their own mathematical identity and how this

shapes their teaching. Secondly, it is important that time is given to teachers to discuss, reflect and explore pedagogies.

As teacher's experiences influence the performance or achievement of learners (Ball & Wilson, (2010), in 2015 the Ministry of Education, Arts and Culture, through the Ministry of Higher Education, Training and Innovation, requested the University of Namibia to develop an in-service programme for the unqualified and under-qualified teachers in the Junior Primary phase. The Diploma in Junior Primary Education (DJPE) is a modular in-service programme intended to equip the un- and under-qualified serving / practicing teachers in Namibia with the necessary range of professional teaching knowledge, skills and attitudes in order to ensure quality teaching in schools. It is vital that teachers in the Junior Primary phase are professionally trained and possess the essential skills for the teaching of literacy and numeracy in the Pre- Primary and Junior Primary grades, thus laying a sound foundation for subsequent / further learning. This course is specifically for teachers and has set a target to train one thousand in-service teachers annually, for the next four years, across the country.

The exercise revealed that more than four thousand teachers were teaching without the necessary qualifications required for entry into teaching. This report motivated the Ministry of Education, Arts & Culture to place the identified the un- and under-qualified teachers in the Faculty of Education (FoE) in University of Namibia (UNAM) campuses country-wide whereas, in South Africa it is the responsibility of the teachers to look for accredited institutions of higher learning and register themselves in order for them to obtain the required teaching qualification. None of the reviewed studies have concentrated on the experiences of teachers and those in in-service training of teaching mathematical problem solving skills in the Junior Primary phase at rural farm schools. Therefore, this study aims to find out how teachers, both qualified and un/under qualified, teach

mathematical problem solving skills in Junior Primary grades at rural farm schools. Teachers will also be questioned through interviews about their feelings about teaching Mathematics to young children.

2.4.3 Class size and learners' performance

Eshiwani (2016) investigated factors influencing performance among primary and secondary school pupils under the auspices of Bureau of Education and Research (BER) at Kenyatta University. The target population for this study constituted 750 (2013) form 4 learners and 145 teachers. All the head teachers and form 4 class teachers of the sampled seven schools were purposively included in the sample of respondents. The study used a descriptive cross-sectional survey design. The study revealed that large classes do have an influence on learners' performance. It showed that the larger the class, the less individual attention was given to learners and the retention rate was very low, especially in Mathematics. The study recommended that the analysed data of overcrowded classrooms should be addressed by constructing more classrooms and more teachers should be employed. It was recommended that the relevant educational stakeholders should adopt the findings of the study.

Murphy (2010) examined the effects of class size on learners' achievement in a Title I elementary school in Virginia, USA. The data collection in this study was conducted through two separate phases. The first qualitative phase was a case study comprised of teachers' interviews and classroom observations. The case study took place at a Title I school in Central Virginia, chosen for its diverse representativeness of the learner population. Classroom interactions were coded during five-minute segments in each full-day classroom observation, as well as field notes made for specific types of instructional methods being used within each Title I classroom: individualized instruction, small group instruction, connecting personally with learners, and incorporating

technology into daily instruction. Interview responses indicated that the professed ideal class size for Title I schools is between 12-18 learners which would best serve the needs of the perceived effects of class size on learner achievement. Findings from the first phase were used to create a survey that was distributed during the second qualitative phase of this study. This survey was distributed to the larger Title I teacher population within the same school district to generalize the findings from the case study. Finally, systematic learner assessment data was collected to compare the perceived effects of class size to the observed effects of class size on student achievement data.

Both the study of Eshiwani (2016) and Murphy (2010) supported that learners learn best in a less crowded classroom. This enables teachers to attend to all the learners' needs and instruct them accordingly. Although many studies have examined the influence of class size on learners' performance none has focused on teaching mathematical problem solving skills in the third grade at rural farm schools. Therefore, this study seeks to assess the impact of class size when teaching problem solving skills. The Ministry of Education, Arts & Culture recommends that the ideal class size is 1 teacher to 35 learners per class at primary level. The Annual Education Census (Namibia Statistics Agency, 2016) revealed that rural farm schools have large classes and exacerbated by a lack of infrastructure and teachers, the situation forces the school to squeeze learners into one classroom.

2.4.4 Learners' perceptions of mathematics

Sidhu (2014) observed that the majority of learners have misconceptions about Mathematics being a difficult subject. This results in learners taking little interest in it, and hence the use of appropriate aids at every step to encourage learners is crucial. The use of different resources in a creative way may positively contribute to learners' perceptions toward learning Mathematics.

A quantitative study carried out by Mutodi (2014) investigated the influence of learners' perceptions on mathematics performance at a selected South African secondary schools. The influence of factors such as strength and weaknesses in Mathematics, teacher support/learning materials, family background and support, interest in Mathematics, difficulties or challenges in doing Mathematics, self-confidence and myths and beliefs about Mathematics were identified as constructs of perceptions that influence students' performance. Quantitative methods were used to analyse the data collected from a questionnaire which was administered to randomly selected secondary school students (n=124) in Polokwane, South Africa. Results from the tests, indicated that there were significant differences in the perceptions and beliefs about Mathematics between males and females learners; between mature and juvenile learners and among learners from different language backgrounds respectively. The respondents tended to view a lack of proficiency in Mathematics as a challenge, and attributed success in Mathematics to effort and perseverance. Learners also perceive difficulty in Mathematics as an obstacle, and attributed failure to their own lack of inherent mathematical ability. These findings suggest that differences in (i) myths and beliefs about Mathematics success, (ii) motivation given by Mathematics teachers and parents, (iii) Mathematics teachers' teaching styles and learning materials, and (iv) self-confidence in Mathematics may lead to differences in perceptions about Mathematics.

Yang (2013) examined how secondary school learners in China perceived their Mathematics classroom environments and the relationship between their perceptions and attitudes towards Mathematics. Questionnaire was adapted and data were collected from 994 Grade 10, 966 Grade 11, and 657 Grade 12 students from 75 classrooms in six provinces in China. These senior secondary learners generally did not perceive their Mathematics classroom environments very favourably and did not hold positive attitudes towards Mathematics. Positive correlations between

the Mathematics classroom learning environments and attitudes towards Mathematics were identified. Gender differences and grade differences of learners' perceptions of their classroom learning environments were found. This study may further stimulate a comparative study of Mathematics learning environments in China and other countries, and this could contribute to an understanding of how the Mathematics learning environment is influenced by social and cultural contexts and its associations with learners' attitudes towards Mathematics.

The study of Mutondi (2014) and Yang (2013) both focused on secondary school learners' perceptions toward learning Mathematics in South Africa and China. Both studies adopted a quantitative approach where a different number of questionnaires were administered. In this study, I use a qualitative case study which includes an observation as one of the research methods. I observe Grade 3 learners' interest toward learning Mathematics and whether the learning environment encourages them to have a positive view of Mathematics. I will also probe teachers about their perceptions on teaching Mathematics to children at rural farm schools. Although the above-mentioned studies used a large number of participants, this study only targeted participants from five primary rural-farm schools. The outcome of this study will have variations due to indifferences in the variables of the above studies.

2.5 Strategies for handling problem solving related activities

There are many strategies and tools to help learners learn Mathematics without difficulty. A study conducted by Manches, O'Malley and Benford (2010) indicated that one strategy for learners to learn problem solving is the use of manipulatives. Manipulatives are helpful to learners in visualizing what they are reading in the word problem. They are able to concretely look at the problem and physically manipulate the materials in order to find a solution. Van de Walle (2013) added that other strategies that are used for problem solving are drawing pictures, making charts,

working backwards, guessing and checking. Richard (2005) indicated that learners who are visual learners will benefit from the strategy of drawing pictures. This makes the problem more concrete and real for the learner. Furthermore, Richard (2005) said that making charts is a method that is good for organizing data to find a solution. Working backwards is sometimes a good strategy when the problem presented does not offer a forward solution. He also revealed that to guess and check is always an excellent strategy to use even after you have already used a previously mentioned strategy. It never hurts to go back and check your work when solving mathematical word problems.

Burmeister et al. (2018) pointed out that some learners act out the score combinations and then record their total push-ups. Other learners use tables and charts to keep track of the scoring opportunities and total push-ups. Learners who are thinking at a more abstract level use fact fluency and represent unknowns with variables as they look for patterns in the task. During implementation, a teacher might first group students with peers who use similar types of strategies and then later have groups compare strategies. Another approach is to group learners heterogeneously to consider a variety of strategies when working through a solution. After task completion, the teacher facilitates a whole-group reflection and intentionally selects learners - one who acted out the problem, another who used a table and chart, and a third learner who used abstract fact fluency - to share their thinking. This allows learners to make and celebrate the connections among number, algebraic thinking, and solution strategies.

Silver and Thompson (2014) noted that at the outset, the teaching of problem solving is regarded by many as the most important and fundamental goal of school mathematics instruction. It is natural to look to the research literature for some guidance concerning the instructional programs and methods that promote the learning of problem solving. Of course, we should recognize that there is no single best way to teach mathematical problem solving skills. Decisions regarding

instructional programs and methodologies need to be made in light of curriculum goals, learners' abilities and needs, and teachers' interests and skills. With this caveat firmly in mind, we now turn to a consideration of some research that has dealt directly with the teaching of mathematical problem solving skills and strategies to elementary school children. Recently, Marcucci (2014) examined the findings of 33 research studies conducted in elementary school classrooms since 1996. Using a statistical technique known as meta-analysis, which allows for the quantitative comparison of different studies on the same topic, Marcucci (2014) concluded that heuristic teaching methods are good. "A heuristic technique, often called simply a heuristic, is any approach to problem solving, learning, or discovery that employs a practical method not guaranteed to be optimal or perfect, but sufficient for the immediate goals" (https://www.101computing.net/heuristic-approaches-to-problem-solving/).

Much of the recent work in this area has been greatly influenced by the writings of the eminent mathematician Polya (1973) from Hungary. In 1957 George Polya published a book called *How To Solve It* in which he proposed a four-phase model for problem solving (1) understand the problem, (2) devise a plan, (3) carry out the plan, and (4) look back - and emphasized the importance of heuristic thinking and reasoning at each phase of his model. Although Polya's model is clearly deficient as a description of actual problem-solving behavior, it has been useful in suggesting ways to organize instruction to promote improved problem-solving performance. Most of the research on the teaching of general problem-solving skills and strategies has been conducted with secondary school and college students; there have been a few studies that have shown the feasibility of such instruction with elementary school children. For example, Lee (2009) was able to teach fourth graders to use general heuristic strategies, such as making tables or drawing

diagrams. The learners in Lee's study used the strategies and were able to solve more problems than learners who did not receive the special instruction.

Van de Walle, Karp and Bay-Williams (2010) focused on Elementary Middle School Mathematics teaching in the United State of America where they proposed the use of problem-solving strategies. Strategies for solving problems are identifiable methods of approaching a task that are completely independent of the specific topic or subject matter. Learners select or design a strategy as they devise a plan (step 2). When learners discover important or especially useful strategies, they should be identified, highlighted, and discussed. Labelling a strategy provides a useful means for learners to talk about their methods and for you to provide hints and suggestions, which can be appropriate in the *before* or *during* phases of the lesson. The following labelled strategies are commonly encountered, though some may not be used at every grade:

- *Draw a picture, act it out, use a model.* A model for a mathematical concept refers to any object, picture, or drawing that represents the concept or onto which the relationship for that concept can be imposed, whereas manipulatives are physical objects that learners and teachers can use to illustrate and discover mathematical concepts, whether made specifically for mathematics, like connecting cubes, or objects that were created for other purposes. “Act it out” extends models to a real interpretation of the problem situation.”
- *Look for a pattern.* Pattern searching is at the heart of many problem-based tasks, especially in the algebraic reasoning strand. Patterns in number and in operations play a huge role in helping learners learn and master basic skills starting at the earliest levels and continuing into the middle and high school years.
- *Guess and check.* This might be called “Try and see what you can find out.” A good way to work on a task that has you stumped is to try something.

- *Make a table or chart.* Charts of data, functions tables, tables for operations, and tables involving ratios or measurements are a major form of analysis and communication.
- *Try a simpler form of the problem.* Modify or simplify the quantities in a problem so that the resulting task is easier to understand and analyse. Solving the easier problem can sometimes lead to insights that can then be used to solve the original, more complex problem.
- *Make an organized list.* Systematically accounting for all possible outcomes in a situation can show the number of possibilities there are or verify that all possible outcomes have been included.
- *Write an equation.* As it implies, in this strategy, the story is converted into numbers or symbols, and the equation is solved (Van de Walle; Karp and Bay-Williams, 2010, p. 43).

There is ample evidence from numerous studies that problems with manipulative materials, pictures, diagrams, or some other type of visual aids are generally easier to comprehend and solve than problems without manipulative aids. Although the use of such aids is most desirable for enhancing problem comprehension, particularly that of young children, some researchers have urged caution in their use. Moser (2010) in the United States noted that children who were able to use sophisticated strategies to solve simple addition and subtraction problems often used less efficient procedures when manipulative materials were available. In a study of young children's behaviour in solving problems using manipulative materials, Bana and Nelson (2015) in the United States observed that the children tended to focus their attention on irrelevant aspects of the problem situation.

Bruce and Ross (2008) in Canada examined the effects of peer coaching on mathematics teaching practices and teacher beliefs about the capacity to have an impact on student learning. Of twelve

teachers in Grade 3, 6 participated in a brief but intensive professional development program over six months. The program focused on effective mathematics teaching strategies and peer coaching opportunities. Data sources included classroom observation, teacher self-assessments, interviews, and field notes. Data were analysed using a two-level qualitative coding strategy with multiple interpreters. Findings showed that teachers implemented key strategies for effective Mathematics teaching, especially in facilitating student interaction and improving the quality of tasks assigned.

Even though not all of the proposed teaching strategies apply to Junior Primary level most of the reviewed literatures support the use of manipulatives; illustrating the problem; act it out, etc. Van de Walle, Karp and Bay-Williams (2010) advocated that learners are free to use their own strategies when answering mathematical problem solving activities. However, the teacher should ask learners to reason how the strategy is applied and take note of their strategies so that they can also be used by others. Although these studies were not done in a Junior Primary classroom, in the Grade 3 Mathematics lessons I observe I will take note of how the teacher is teaching mathematical problem solving skills and note whether she or he uses manipulatives and other teaching strategies which can make problem solving activities meaningful to the learners when they are properly applied.

2.6 Conclusion

Several studies that have been reviewed showed the challenges of teaching mathematical problem solving skills at selected rural farm Junior Primary schools specifically to the third grade. Even though the majority of the reviewed studies have looked at teaching mathematical problem solving skills, only a few of them were undertaken in a Namibian context with its unique the education system. The literature has specifically highlighted possible (a) mathematical problem solving teaching methods, (b) challenges of teaching mathematical problem solving skills; and (c) strategies for handling problem solving related activities in the third grade. In attempting to

understand how learners learn mathematical problem solving skills in Junior Primary classroom within the context of rural farm school settings, Vygotsky's social constructivism theory has been used to provide the conceptual framework of the study. Vygotsky's theories stress the fundamental role of social interaction in the development of cognition (Vygotsky, 1978), as he believed strongly that community plays a central role in the process of "making meaning." In the following chapter I present the methodology used in this study in the collection and analysis of data.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the data collection methods used in this study. It explains the research design, the instruments used for data collection and how the data was analysed. Finally, ethical considerations in the process of data collection as well as the techniques employed to ensure validity and reliability of the study are also discussed.

3.2 Research design

This study used a narrative qualitative case study. Gay, Mills and Airasian (2011) define a narrative qualitative case study, as "the study of how different humans experience the world around them, and it involves a methodology that allows people to tell their stories of their storied lives" (p. 399). I chose a narrative qualitative case study because it enabled me to probe, understand, and report the real-life events using narrative description or words which give more meaning to the phenomena under study; namely, the challenges of teaching mathematical problem solving skills to Grade 3 learners.

Qualitative research design is defined by Denzin and Lincoln (2005, 2):

> Qualitative research is multimethod in focus, involving an interpretative, naturalistic approach to its subject matter. This means 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. Qualitative research involves the studied use and collection of a variety of empirical materials – case study, personal experience, introspective, life story, interview, observational, historical, interactional, and visual texts – that describe routine and problematic moments and meanings in individuals' lives.

I adopted a qualitative research approach because data collection, in this study, was done in a natural social setting in order to build a complex, holistic picture which I can describe in words, including the detailed views of the participants, and were possible, using their personal language.

The underpinning philosophy for this study is that of interpretive constructionist theory. This is because, in this study, I made meanings from the views of the participants on how they observe and deal with the challenges of teaching mathematical problem solving skills.

3.2 Population and sampling procedures

The targeted population for this study was the Junior Primary teachers and their learners in the Kunene region.

The sample consisted of 5 public primary schools which teach through the medium of English in Outjo and Kamanjab districts of Kunene region (see Appendix 10 of Kunene region map). These five primary schools were purposively sampled based on the following criteria: (a) the school should have a diverse population of learners; (b) the school should be within 50 km radius in and around Outjo and Kamanjab districts; (c) the school should have professional qualified teachers for Grade 3, with at least a teaching diploma; (d) the school should have been in existence for more than 5 years; and (e) the school should be using English as a medium of instruction in the Junior Primary schools because that is the only language I am conversant with compared to other languages of medium of instruction in the Kunene region such as Afrikaans, Khoekhoegowab and Otjiherero.

3.3 A brief overview of the research sites

The study was conducted at 5 rural farm schools in Kunene region of Namibia. These schools are situated a long distance from town with limited network and poor road infrastructures. Parents of participants (learners) are mostly farm workers of whom the majority have either little or no

education and depend on their monthly low income farm wages. There are also a number of parents who are unemployed. These schools cater for a diverse range learners from different cultural backgrounds who mostly adopt a nomadic life. The average class size consists of 30-45 learners. These farm schools, generally have low enrolment as compared to township/urban schools.

3.4 Research instruments

The three instruments used during data collection in this study were interview schedules, classroom observation schedules and document analysis. Each of the instruments was used as follows:

3.4.1 Interview schedule

According to Hartas (2010), an interview is a conversation that involves face to face interaction between the researcher and participant. The interviewer makes an arrangement with the concerned people before conducting the interview to inform them of the procedure and materials that will be used. Through the process, participants' unique thoughts and experiences later become data which is interpreted and synthesized in order to make the participants' knowledge heard and understood (Hartas, 2010).

Following the instructions above, I used semi-structured interviews for both teachers and Head of Departments (HoD's). Hartas (2010) affirms that this method allows the investigator to control the interview process by delving deeper into the initial responses of the respondents to gain a more detailed answer to the question. Sometimes during the interview, it occurs that the participant's response is not clear, or they have not fully understood the question, then further explanations can be provided by the interviewer as recommended by Hammersley (2003).

I interviewed both teachers and HoDs using a voice recorder. The interview with teachers took approximately 30 minutes while for HoD's, it lasted for 20 minutes. All interviews were conducted

in English and were done after school. Each interview was transcribed thereafter so that the information was still fresh.

Subsequent interviews were informal conversational interviews that I had with the teachers after their lessons. Cohen, Manion and Morrison (2007, p. 353) suggest that the characteristics of an informal conversational interview are that "questions emerge from the immediate context and are asked in the natural course of things; there is no pre-determination of question topics or wordings." I referred participants to specific events which I had observed during the lessons such as learners' interest, the roles of teaching media and play during the lesson.

3.4.2 Observation schedule

Kumar (2005) describes an observation as "a purposeful, systematic and selective way of watching and listening to an interaction [between teachers and learners, and between learners and learners] or phenomenon as it takes place" (p. 118). Similarly, Merriam (2001) argues that observations are one of the major means of collecting data in qualitative research because they offer a first-hand account of the situation under study and when combined with interviews and document analysis they allow for a holistic interpretation of the phenomenon being investigated.

I observed a total of 5 lessons using my own design of a classroom observation checklist (see Appendix 7). I compared observation data with interview data and document analysis, and checked for consistency between their actual teaching practices and what they had said in the interviews as well as what I read from related documents. The aspects on the classroom observation checklist guided me to collect data about challenges experienced by Grade 3 teachers when teaching mathematical problem solving skills and to compare this with data collected through interviews as well as document analysis. This cross checking made it easier to write field notes since some of

the aspects that were not outlined in the observation schedule occurred in the classroom and proved equally valuable to the study.

I chose to use nonparticipant observation because I did not want to be directly involved in the situation being observed. I did not react to any events during the lesson nor to what the learners and teachers did in the classroom. This enabled me to understand the natural environment as lived by participants without changing or manipulating it.

3.4.3 Document analysis guide

The term document in its broadest definition, includes not just texts, but also sound, photos, video and any materials that carry relevant messages (Dia de Figueiredo, 2010, p. 29). Documents reveal what people do or did and what they value, and my role as a researcher was that of reviewing, interpreting and analysing some of the relevant documents such as lesson plans, syllabuses, assessment sheets, attendance registers, worksheets and learners' exercise books. This was done in order to uncover what work is expected to be done both by Grade 3 teachers and learners as far as mathematical problem solving skills are concerned.

I therefore chose to collect and analyse a sample of mathematical problem solving activities. I also reviewed the syllabus as well as the lesson plans to see whether teachers had interpreted the syllabus correctly; if the competencies for problem solving were properly interpreted; and whether comprehensive lesson objectives were formulated (see Appendix 6). The assessment sheet was another document which I reviewed and analysed to examine learners' performance in problem solving (see Appendix 8). In addition, I compared the performance over 3 terms using results from the assessment sheets in order to help me understand the progression in the problem solving skills of learners. Further, I checked at the attendance register to get insight into the general attendance

of learners. Finally, I looked at learners' exercise books in order for me to have an overview of the learners' performance (see Appendix 13).

3.5 Pilot study

Johnson and Christensen (2012) stated that the testing of instruments allows the researcher to examine the reliability and validity of the data. The research instruments were piloted at a rural farm school 40 kilometres outside Tsumeb in the Oshikoto Educational Region. The school had conditions comparable to the schools in the Kunene Region which were used for the actual study.

The primary school selected for the pilot study was not part of the actual study. This pilot study ensured that the instruments were well understood by the targeted research participants. This was helpful for the researcher to relook at the device I chose and make any requisite amendments to the research instruments.

Both the teachers' and HoD interview questions seemed to work well. Most of the responses from the participants responded to the main research questions and participants did not experience any difficulty in answering the questions. However, I did need to add a question to the teachers' interview schedule which focused on the teaching strategies the teachers used when teaching mathematical problem solving skills.

Also, I discovered that the teachers needed more time to respond to questions, therefore the scheduled time was extended from 15 to 30 minutes. I also realised that the teacher's tea break time was not the right time to conduct interviews because they were always busy with their administrative activities. Furthermore, break time was not convenient since learners caused a lot of distractions by coming into the classroom as well as peeping through the windows where the interview sessions were held. The decision was then made for interviews to occur after school.

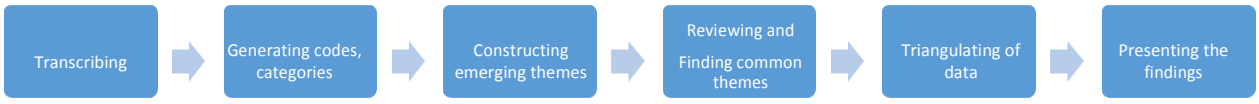
My observation schedule worked well, although I had to remove some of the items which were difficult to observe especially during the lesson introduction. I also needed to adjust the observation schedule and look at how learners were creating their own story sums and how this contributed to their understanding of the topic. In addition, I discovered that I needed two Mathematics periods to observe the teaching and learning in mathematical problem solving skills instead of one period. This would enable me to look at every aspect which I had on the observation schedule.

3.6 Data collection procedures

I used three sets of instruments namely: interview schedule; observation schedule and document analysis guide. The interview schedule comprised open and closed questions with individual teachers and HoDs to gain an understanding of the challenges faced and the teaching strategies used by teachers (see Appendix 4 and 5). All the interviews were voice recorded and later transcribed. The observation schedule was used to observe and understand the natural environment as lived by Junior Primary school learners without changing or manipulating it (Charles, 2005). A document analysis guide was used to look at learners' performance and its development as far as mathematical problem solving was concerned. Permission to examine learners' record was sought from the school principals.

3.7 Data analysis

According to MacMillan and Schumacher (2006) data analysis in qualitative research involves organising, analysing, categories and regularities, and interpreting data. They further added that data analysis entails coding, categorising, and discerning patterns for possible explanation of events. I had followed the following process in the diagram below to analyse and present data.



Information collected using interview schedules was compared to other information collected through observation schedule and document analysis guide in order to develop patterns of similarities and differences of various themes (Cohen et al., 2007, p. 461).

The participants' responses to semi-structured interviews were transcribed verbatim and analysed. I repeatedly listened to the recorded audios of interviews participants in order to capture what participants had said during the interviews and able to write down their responses. After transcribing, I then looked for common themes and subthemes emerging from the data.

I used different coloured pencils of which similar or related comments were coloured with the same coloured pencils. Thereafter, I coded participants as Teacher Blue, HoD purple, etc.

Having collected relevant data around each of my main research questions, I looked for similarities, differences, comparisons and themes from which to create a more narrative account of how each of the teachers taught mathematical problem solving skills to his or her Grade 3 learners (Patton, 2002; Slevitch, 2011; MacMillan and Schumacher, 2006).

The following later emerged as themes and were grouped or categorized as follows: (1) teaching methods for mathematical problem solving skills;(2) teaching strategies used to promote reading skills for increasing mathematical problem solving skills; (3) teaching materials and resources used in the teaching of mathematical problem solving skills; (4) learning support of mathematical problem solving skills; (5) challenges of teaching mathematical problem solving skills in Grade 3;
(6) mitigating the challenges of teaching mathematical problem solving skills in Grade 3. Each theme was described separately to identify relevant inferences after the data was transcribed.

3.8 Ethical considerations

Punch (2008) explains that all "social research involves consent, access and [all] associated ethical issues, since it is based on data from people and about people" (p. 57). First, I submitted a Research permission letter from the University of Namibia (see Appendix 14). Second, I requested permission from the Ministry of Education, Arts & Culture to have access to the selected region (see Appendix 2). Third, I sought permission from the Kunene Regional Education office in Khorixas to access the selected schools (see Appendix 1). Fourth, I informed the participants that their participation was voluntary and that they were free to withdraw from the study at any time they wanted to. Fifth, participants who took part in the study completed a consent form before any data collection sessions were held (see Appendix 3). Sixth, I promised the participants that the data which they provided would be kept confidential and no real names would be used and the data collected would only be used for the purpose of the study. Lastly, the information collected from the participants would be kept on my personal computer protected by a password known only to me. The information would be kept for a period of 3-5 years, thereafter, I would discard it.

3.9 Conclusion

In this chapter, I discussed the research methodology used to collect data on the challenges experienced by Grade 3 teachers when teaching mathematical problem solving skills at rural farm schools. The study used 3 research instruments namely; interview schedules, observation schedules and my document analysis guide. Data collected through these instruments were later triangulated as recommended by Patton (2002). A pilot study was carried out at one of the farm schools in order to effect any necessary improvements and adjustments to the research instrument. This chapter further described the population, sample and sampling procedures applied in this study. Finally, this chapter discussed the ethical issues that were taken into account when conducting this study. The next chapter presents the findings of the study.

CHAPTER 4

PRESENTATION OF FINDINGS

4.1 Introduction

This chapter presents the findings of the study that investigated the challenges of teaching mathematical problem solving skills at rural farm schools in the Kunene region of Namibia. It further provides biographical information on the participants. In addressing the research questions of the study outlined in chapters 1 and 3, the findings are structured in accordance with the themes that emerged from the study. These themes were: (1) teaching methods for mathematical problem solving skills; (2) teaching strategies used to promote reading skills for increasing mathematical problem solving skills; (3) teaching materials and resources used in the teaching of mathematical problem solving skills; (4) learning support of mathematical problem solving skills; (5) challenges of teaching mathematical problem solving skills in Grade 3; (6) mitigating the challenges of teaching mathematical problem solving skills in Grade 3.

4.2 Biographical information of the participants

A total of 8 participants took part in this study - five Junior Primary teachers and three Junior Primary Heads of Department (HoD's). The 8 participants were coded as HoD Purple, HoD Brown, HoD Pink, Teacher Red, Teacher Blue, Teacher Orange, Teacher Green, and Teacher Yellow. Among the participants, there was only one male participant with the remaining seven being female. Participants' ages ranged between 35 and 50 years. Except for one participant who was upgrading through in-service training, all participants had professional teaching qualifications, either having a degree or a diploma. All participants had more than 5 years of teaching experience.

4.3 Presentation of findings according to themes and sub themes

I will now present the themes and sub themes as outlined in the introductory part of this chapter.

4.3.1 Teaching methods for mathematical problem solving skills

Teachers who participated in this study indicated that they use different teaching methods to teach mathematical problem solving skills. All the participants interviewed identified pair and group discussions; whole class participation; demonstration; integration; guided method and brainstorming as the best teaching methods. Teachers' views on each of these teaching methods are presented below.

4.3.1.1 Pair and group discussions

Three participants out of 8, indicated that they used pair and group discussion to carry out the tasks. For example, Teacher Red, specifically mentioned that, *"I give learners to do work in pairs and small groups…"* Similarly, HoD Purple cemented that, *"…my teachers make use of small groups during mathematical problem solving activities so that each learner gets attention of the teacher."* In addition, Teacher Blue said that, *"… I usually discuss with the learners in small groups and as time goes on you will see the improvement with these learners [cos] discussion make them interested in word sums activities*." HoD Purple suggested during his interview that, *"teachers should do more group activities because learners learn from the peers, so they should not arrange desks in rows but in groups to allow interaction during activities."*

During observations, it was detected that Teacher Blue used pair work while Teacher Orange allowed learners to work in groups of 3 prior to the individual task (see Appendix 9).

4.3.1.2 Whole class participation

The analysis of data shows that all 8 participants indicated that they used whole class teaching methods when teaching mathematical problem solving skills. For example, Teacher Green explained *"I employ more of whole class activities but as time goes on I give them individual tasks..."* This was supported by Teacher Blue who said that *"... mostly I ask the whole class to read together the word sums either in the worksheets, chalkboard or posters as a choral."*

From the observation, all five teachers employed whole class participation mostly by letting learners to read the word sums as a choral. Learners also read terminologies on posters as a whole class. The teacher read first and then learners repeated after the teacher.

4.3.1.3 Demonstrations

In order to enhance the teaching of mathematical problem solving skills manipulation of objects should be employed to attract learners' attention and facilitate their comprehension. Three (3) participants explained that learners were instructed to do some activities on the chalkboard by demonstrating with sketches how to solve a certain word sum. For example, Teacher Yellow mentioned that *"I instruct the learners to do activities and demonstrate in front of the class…"* Teacher Green added that, *"…I let learners to act out the problem. They demonstrate by drawing and they are encouraged to draw first before they solve the word sums…"* Teacher Blue emphasised that *"since he has learners who are facing challenges in problem solving in the class, he puts more emphasis by demonstrating word sums with physical objects to help learners to compute correctly…"*

What I observed in the various classes was that only two teachers out of five showed learners the procedures of doing mathematical problem solving skills through demonstration. In Teacher

Blue's and Teacher Red's classes, I observed learners demonstrating how to solve word sums to the learners while fellow learners looked on.

4.3.1.4 Integration

Participants recommended the integration approach in Mathematics to be taught across all Mathematics topics so that learners can get used to it. Two (2) of the participants said that they integrate problem solving in everyday mathematical activities to ensure that learners have mastered the skills. They further mentioned that this practice works better for them and learners also performed better as a result. Specifically, Teacher Green explained that, *"I don't teach it differently, I do the way it is working for me ..... Every day I integrate problem solving in each component of Mathematics rather than just teaching it separately. So, I think is better if you integrate it in every topic of Mathematics to make learners get used to it.* Teacher Orange reported that, "*in the first term, one can teach skills in isolation but it should not remain that throughout the year…"*

In all the five lessons I observed, only 2 teachers knew how to integrate in Mathematics. These teachers could at least integrate topics from Environmental Studies across to Mathematics in order to add to the meaning of what was taught and learnt. However, I checked the lesson plans of 3 teachers and noted that they did not integrate components of Mathematics in their lesson preparations. Their activities on word sums did not talk about the topic of integration which should be taken from the Environmental Studies syllabus. I have included the lesson plan of Teacher Yellow and the activity (see Appendix 6 and 13).

4.3.1.5 Guided method

The majority of teachers used various strategies to guide learners when doing problem solving activities. This was supported by Teacher Red, who revealed that there are five steps which she used when teaching learners how to solve word sums. These are: *(1) reading the story problem and*

decide on the operation; (2) finding the number in the word sum; (3) writing the number sentence using an operation place holder; (4) doing the calculation; and (5) writing the correct answer and unit". Both Teacher Green and Teacher Orange stressed that "*it is important to use whole class method by following five steps which learners have to master when solving word sums.*" In addition, the HoD Brown confirmed that *"there are steps that you can use with the children who have difficulties in mastering problem solving. However, you can teach the steps even to fast learners who don't have challenges of learning."*

When it came to observation, only 2 out of 5 teachers were observed teaching learners the five steps of doing word sums. I had seen a poster with the steps to be followed when doing mathematical problem solving activities displayed in Teacher Blue's classroom (see Appendix 11). Teachers drilled these 5 steps to ensure that learners mastered them. The other 3 teachers observed did not use the 5 steps and apparently were not aware of them.

4.3.1.6 Brainstorming

Three participants out of 8 used brainstorming as a teaching method when solving word sums. For example, Teacher Blue indicated that *"I ask my learners to identify key words from the word sums and think of the appropriate operation sign. Further, I instruct learners to write down an equation".* Similarly, Teacher Orange explained that *"I prepare word sums on a poster for example Petrus has 2 fewer caps than Tomas. Tomas has 6 caps. How many caps does Petrus have? I gather learners together to get their ideas about the activity, by identifying key words, identifying the correct operation signs and drawing the problem."* HoD Brown suggested that *"… the teacher needs to strengthen learners' ideas after brainstorming and assist them to think critically."* Similarly, I observed Teacher Green using word sums and asking learners to brainstorm ideas before they solved the word sums for example, requiring learners to look for the key words from

the word sums, identify the operations sign, formulate the equation, etc. Before the presentation of the lesson, Teacher Yellow wrote the operation signs on the chalkboard and asked learners to mention all terms which related to the operation signs.

4.3.2 Teaching strategies used to promote reading skills for learning mathematical problem solving skills

Three sub-themes were identified by the majority of participants as having a major influence on mathematical problem solving skills. These sub-themes are presented below.

4.3.2.1 Drawings and pictures

All eight of the participants who participated in the study were of the view that giving activities with pictures stimulated learners' interest to a much greater degree than giving learners texts without pictures. This was explained by Teacher Blue who said that, "*pictures last longer in learners' memories and this makes them to remember what they have learnt previously."* In addition, Teacher Green pointed out that, *"... most of my things [activities or posters] have pictures so, preparing these worksheets with pictures help learners, revise what they have done, and especially that they get interested when reading texts with pictures."* Participants further felt that learners should visualise the context of the word sums by drawing it. For example, HoD Brown mentioned that, *"learners have to see the situation, for example, if I talk about four dogs having four legs each, how many legs do you see? First they have to see the situation, they have to see the 4 dogs. So that means at the start, you have to tell them to draw, draw the 4 dogs and put 4 legs on each dog. Grade 1 is when they will draw to see these situations but as they progress to Grade 3, I have told the teachers that if learners are still struggling, get them to see the 4 dogs and get them to see the 4 legs."*

Although the 5 teachers described the importance of using drawings and pictures in the lesson activities, I only observed 2 teachers making pictorial representations. I observed Teacher Blue and

Teacher Red asking learners to illustrate the problem as one of the strategies to do word sums. Further, in most of the activities they gave to learners which are either prepared on worksheets, posters or on flash cards; they used pictures or images to stimulate learners' interest.

4.3.2.2 Learning terminologies for mathematical problem solving skills

In their interviews, the participants identified learning terminologies as concepts they used to assist learners to understand word sums. Participants felt it was important for learners to master the terminologies that are used in the word sums. In this regard, Teacher Yellow asserted that, *"a poster with terminologies should be pasted on the classroom wall for learners to look on more often since these terminologies are the synonymies of the four operation signs (addition, subtraction, division and multiplication). Therefore they should be drilled into the learners."* Similarly, Teacher Green agreed that *"learners must know the vocabulary of what addition is, they must know what subtraction is about, they must know what multiplication is …. All the four operation signs, need to be mastered."* Teacher Red observed that "*if a learner does not know or understand the vocabulary, definitely s/he won't understand what s/he is doing. I tell learners to look for key words in the statements which can direct them of what to do."* This was also affirmed by Mr. Pink, the HoD, who said that, *"let learners understand the situation of the story sum by helping them to explain the vocabulary and always take time since some of them learn very slowly."* I only observed Teacher Blue, Teacher Green and Teacher Red emphasising and displaying the terminologies on the classroom walls as well as on the chalkboard (see Appendix 12). Teacher Orange and Teacher Yellow did not refer to the terminologies and the terminologies were not even displayed in their classrooms. As a consequence, learners struggled to figure out of what to do.

4.3.2.3 Manipulative physical objects

The participants who were interviewed mentioned that they used teaching aids to clarify concepts to learners and assist learners to get answers to story problems. For example, Teacher Orange

indicated that, "*I use physical objects like paper money, counters and so on, which can connect them to what problem solving is all about."* Teacher Blue mentioned that, *"I mostly improvise and use materials which are available in the environment such as concrete stones for counting, number charts, sticks, number line. I gather objects together so that I can be able to use them as a media to demonstrate. So, my learners rely on counters when solving word sums. Each child has his or her tin where they put their stones.*"

From what I observed, learners in Teacher Green's classroom used counters such as beads on the abacus, stones, sticks and bottle tops to find answers. I checked the lesson plan of Teacher Orange where she stated she used teaching aids such as counters but I did not see any evidence of counters during my observation. Learners drew lines and circles on paper to find answers.

4.3.3 Teaching materials and resources for mathematical problem solving

According to Ms. Purple, the HoD, teaching and learning media are significantly useful materials because they help learners to concentrate attentively and assist the teacher to achieve his or her lesson objectives. The majority of the teachers mentioned different teaching and learning materials which they used when teaching mathematical problem solving skills. For example, Teacher Blue said, *"It is fortunate that we have a computer room at school where I take learners to view videos about teachers teaching mathematical problem solving. …learners are interested in videos and they remember well what they have been taught...."* Teacher Orange indicated that, "*I use printed posters with terminologies, and physical objects like paper money, counters and so on, which can connect them to what problem solving is all about." The school provides books and there's even an overhead projector which is used to show them things on the screen."* Teacher Blue, however, continued that, *"if materials are not available at the school, teachers should always try to improvise".* Teacher Blue confirmed this by saying, *"I mostly improvise and mostly use materials*

which are available in the environment such as concrete stones for counting, number charts, sticks, number line, I am gathering objects together so that I can be able to use them as a media to demonstrate. So, they rely on counters when solving word sums. Each child has his or her tin where they put their stones."

Nevertheless, Ms Pink, the HoD, suggested that, "*teachers need to be creative and come up with their own teaching aids to attract learners' interest."* She however, observed that, *"... there are teachers, who are perhaps lazy to create teaching materials, their reliance is on the chalkboard and to wait for the school to provide teaching materials."*

In all five lessons I observed, teachers used teaching aids even though they differed in terms of creativity, quantity and how they were applied. Teacher Blue, for example, used many more teaching aids than the others did, such as worksheets instead of writing the activities on the chalkboard, posters with terminologies, and posters with computational strategies of doing mathematical problem solving and flash cards with pictures related to the word sums, physical materials for slow learners such as beads on the abacus and bottle tops. Teacher Orange, for example, only used a number line which she did not explain well to the learners and as a result caused a lot of confusion. Some of the learners in her class made lines, dots and circles to compute the word sums.

4.3.4 Learning support in mathematical problem solving skills

All eight participants in this study held the view that Mathematics is different from other subjects. The subject requires a lot of learning support mechanisms such as more practice until learners master a certain troubling competency by arranging extra classes with them. Teacher Green felt that "*... a lot of practice even during remedial teaching, maybe preparing more extra activities but practice! Practice! Practice! (Repeatedly)."*

Teacher Orange advised that "*remedial teaching should also be carried out and try to have it outside the classroom such as computer lab, library, etc. in order to increase learners' learning interest.* Teacher Red mentioned that *"there is afternoon study at the school compulsory from Grade 3-7, so that learners get extra time to revise what they learnt during teaching sessions.*

Teacher Orange, however, complained that "*since the allocation of Mathematics periods are not enough in a week, she normally robs either Arts or Physical Education lessons and utilizes them for Mathematics."*

Although the participants were aware of the significance of learning support, I observed very little of this aspect happening in most of the lessons. Except for Teacher Blue who I saw during my stay at the school giving more work to learners and who offered extra classes after normal teaching hours, for example taking them to the computer lab or elsewhere outside the usual classroom environment. I noted some of the teachers walked around tables to observe how learners were progressing with activities and rendered learning support in cases where learners were stuck in the process. However, some of the teachers for example, Teacher Red and Teacher Green sat at their desks while learners completed the activity. Further, none of the teachers were observed employing a differentiated instruction strategy which helps learners with different abilities to learn effectively. All learners did the same activities, the teachers used similar teaching aids, the same teaching methods and so on, irrespective of their individual learning needs.

4.3.5 Challenges of teaching mathematical problem solving skills in Grade 3

The participants for this study listed the challenges which they experienced when teaching mathematical problem solving skills in Grade 3. They felt that these challenges impeded their achievement of their performance targets. These challenges are divided into four sub-themes,

namely: (1) reading deficit; (2) lack of training workshops and Regional office support; (3) insufficient mathematics pedagogical knowledge; (4) lack of guidance from the home background. They are each presented individually below.

4.3.5.1 Reading deficit of mathematical problem solving skills

All eight participants in the study raised the issue of reading difficulties experienced by the learners. Teacher Green mentioned that, *"some of the learners can read but they do not understand what they read."* Ms. Purple, the HoD also agreed that *"most of the learners cannot read and comprehend the word sums."* She further expressed that, *"the reading challenge will remain as long as un- and underqualified teachers are in the teaching profession especially at lower grades."*

During the observation, I clearly detected that learners in Teacher Yellow's, Green's and Orange's classrooms struggled to read word sums and comprehend them. Teacher Green read the story problems to learners which encouraged a lack of effort on their behalf and also diminished their reading ability skills. Learners especially in Teacher Yellow's and Teacher Orange's classes mostly guessed the operation signs since they lacked the basic requisite reading skills and resulted in them to get wrong answers.

4.3.5.2 Lack of training workshops and Regional office support

Four out of 8 of the participants were concerned about the lack of training and general support from the regional office. Teacher Yellow said that, *"Senior Education Officers they come to schools but not so often. And when they come for classroom evaluation and observations, they tend more on criticizing instead of helping teachers on shortfalls."* Teacher Red also added that *"…hence they are at rural areas, there is no visiting from the region."* In the absence of Education officers, Teacher Red indicated that, *"we ask senior primary Mathematics teachers at the school to explain what is not clear to us, although they suggests some of the helpful activities which we may use."*

Teacher Green similarly said that, *"we have an expert in Mathematics although she is a senior primary teacher, I learnt a lot from her."*

Some of the participants revealed that there were no workshops geared specifically for Junior Primary teachers. Teacher Yellow shared that *"I have only attended the workshop once and this was in 2015 when we got training on how to teach the new curriculum." Another* teacher Mr. Green stated that *"I had attended a workshop, I think seven years back for English and Mathematics."* Ms. Brown, the HoD, however, shared that, *"there is an Annual National Mathematics Congress which is attended by Mathematics teachers. This congress is helpful but it is not attended by all teachers, at least one representative from each circuit should be selected instead of these few representatives which are normally nominated from each region to attend and come back to report to other teachers they are not enough to report back to the masses of teachers in the region."*

Cluster meetings to discuss teaching and learning activities were another concern raised by the participants. Teacher Red indicated that, *"at the beginning cluster meetings were very helpful but now if you go there is just the same previous minutes being discussed over and over.* Finally, there are very few HoD's who have Junior Primary background knowledge. Teacher Yellow expressed that, *"HoD's which are guiding them did not specialize in Junior Primary in most cases, and therefore they don't get proper required guidance."*

4.3.5.3 Insufficient mathematics pedagogical knowledge

Participants agreed that the Junior Primary phase as a foundation phase is one that requires specialised knowledge and skills to teach more effectively. It is vital to ensure that the foundational skills for young children are well taught as they carry that knowledge throughout their schooling. However, participants observed that some of the teachers at this level are unqualified. For example,

Teacher Yellow mentioned that, *"there are too many un- and underqualified teaching staff in the phase who do not have sufficient teaching skills."* Ms. Green, a qualified Grade 3 teacher, expressed that, *"when they receive learners taught by a un/under qualified teacher they realise that multiple of skills have not been developed."* Teacher Blue expressed her concern that *"when I receive learners from my colleague, a Grade 2 teacher who is still studying through distance mode, I suffer a lot especially during first term. These learners lack basic skills which they could have acquired in Grade 2."* Ms. Purple, a HoD, also said *"due to the fact that there are teachers who are not qualified in the teaching fraternity, the challenge of literacy and numeracy skills will remain as such."*

Some participants stated that teachers lacked information about the best strategies to approach word sums, and this included qualified teachers. HoD Brown observed that, *"what one of the teachers has been doing is to read the story sum to the learners and instruct them to do it. This is done without any guidance from the teacher, not even sharing a strategy where learners maybe derive their own strategies and come up with their own computational strategies."* Teacher Blue noted that *"sometimes poor performance comes from us teachers, like myself I struggle to teach this topic. I do not know the strategies to teach the learners so that they can do problem solving. "*

It was observed that Teacher Green, Teacher Orange and Teacher Yellow had both limited teaching skills as well as subject content knowledge. Their lesson preparations were not comprehensive enough and they could not formulate appropriate lesson objectives. When I looked at the assessment sheets, I observed that Teacher Orange and Teacher Yellow, for example, had a high failure rate in problem solving over all 3 school terms (see Appendix 8). Further, I observed that these teachers struggled to teach the procedures involved in mathematical problem solving.

4.3.5.4 Lack of guidance from home

According to four out of eight participants, education should not only happen in the classroom but also at home where learning activities are reinforced. However, this poses a major challenge for the mostly illiterate parents of these children. Teacher Orange mentioned that, *"this is one of the challenging factors because majority of these parents neither read nor they write."* Teacher Red similarly highlighted that *"since most of these learners come from a marginalised background, it is difficult for parents to guide learner with homework."* HoD Purple added that, *"the environment where these learners are living, it is not privilege to support learners to learn from other sources apart from the school."* Ms. Brown, the HoD, remarked that book reviews are not done at school because parents are not literate.

4.3.6 Mitigating the challenges of teaching mathematical problem solving skills in Grade 3 The majority of the participants suggested ways to handle the challenges of mathematical problem solving skills in Grade 3. For example, Teacher Green said *"let learners practice as many times as possible*." Further, Teacher Orange advised that *"... problem solving should be integrated across all Mathematics components."* Meanwhile, Ms. Pink, the HoD, mentioned that *"...identifying key words is one of the steps to do mathematical problem solving activities, therefore teachers should give a lot of reading activities on problem solving and pay more attention on learning terminologies as one of the obstacles to many learners."*

Almost all the participants requested more workshops and the opportunity of attending the National Mathematics Congress. Teacher Yellow specifically requested *"we want more workshops with Junior Primary experts, not only these cluster meetings."* Participants also emphasised that the Annual National Mathematics Congress held in Swakopmund in Erongo region over the past few years as an important congress where teachers and experts in subject areas could meet and share ideas regarding teaching. Specifically, HoD Brown said that, *"there is an Annual National*

Mathematics Congress which is attended by selected Mathematics teachers from all corners of life. This congress is helpful but it is not attended by all teachers. The congress can only reach its goals if the committee starts nominating at least one representative from each circuit instead of the current strategy of nominating very few representatives from each region to attend and come back to report to other teachers."

Two of the eight participants appealed to the region to support them by providing the same teaching aids as urban schools as they were trying their level best to improvise teaching and learning materials. For example, Teacher Green stated that *"all schools should receive equal support regardless of their conditions."*

Apart from training workshops, participants appealed to Education officers to be more professional and helpful when they visited the schools. For example, Teacher Orange said *"Junior Primary Se Education Officers should come out and help us on our shortfalls and I am also asking them to be good to us, they are usually very harsh on our mistakes."*

Interestingly, some of the participants suggested the use of social media to share teaching ideas. Teacher Blue and HoD Brown for example, said that *"since we are living in a 21st century where majority of us own smartphones, laptops and other ICT devices, teachers need to be connected to common social groups for example social media such as WhatsApp groups, facebook groups, panapto or Edumondo to share teaching ideas with one another."*

Some of the participants expressed a desire for the Ministry to revise the policy of recruiting un/under qualified teachers at the Junior Primary phase. Specifically, HoD Purple stated that, *"if I could have the mandate or the plan of the Ministry of Education, Arts & Culture, I will never appoint un/under qualified teachers to teach at a Junior Primary phase."*

4.4 Conclusion

In this chapter, the findings from interviews, observation and document analysis were presented to align with the main research questions. The presented findings described the obstacles that Grade 3 rural farm school teachers in the Kunene region experienced when teaching mathematical problem solving skills. From the observed lessons and teachers' responses, it was found that a lack of teaching aids and inadequate teaching skills are major factors that influenced the performance of mathematical problem solving skills at these rural farm schools. Lack of training support and limited support for learners at home were also highlighted as factors that Grade 3 teachers at rural farm schools experienced when teaching mathematical problem solving skills. In the next chapter, I discuss the findings.

CHAPTER 5

DISCUSSION OF FINDINGS

5.1 Introduction

In this chapter, I discuss the main findings of this study that investigated the challenges of teaching mathematical problem solving skills at rural farm schools in the Kunene region of Namibia. The discussion focuses on (a) teaching methods of mathematical problem solving skills, (b) teaching strategies for handling mathematical related problem solving activities and (c) challenges of teaching mathematical problem solving skills. I will also link these findings with the theory underpinning this study, that of social constructivism as described by Vygotsky.

5.2 Teaching methods for mathematical problem solving skills

In order to fulfil the tenets of social constructivism, learners should be taught in a social context (i.e. the classroom) how to move from the known to the unknown, thereby gaining understanding of the story problems. This is achieved in various ways, one of which is help from a more knowledgeable other such as a peer or a teacher. This occurs until the learner has achieved the ability to gain full understanding on his/her own.

The findings of this study revealed several teaching methods that teachers used when teaching mathematical story problems in an attempt to allow learners to progress and achieve in this field. These teaching methods included group work and whole class participation; demonstration; the guided method as well as integration.

Group work and whole class participation were supported by most teachers as promoting learning and interaction opportunities. This finding is in line with Tanveer (2008) who stressed that group work maximises the learners' participation of all group members and this allows group members to recognise how other learners think. The views of Vygotsky (1978) showed that the rich

interaction in the classroom allows learners to engage in reflective thinking and to internalize concepts that may be out of reach without the interaction and input from peers and their teacher. He further mentioned that social knowledge is only transferred when is being told (interaction between the teacher and learners or learners themselves) and being remembered. Teachers should then adopt the ideas of Vygotsky to employ social interaction to maximise the understanding of problem solving. Although the majority of teachers supported group work and whole class participation, only a few of them used this teaching method during their lessons. This finding is supported by Chiriac and Frykedal (2011) who stated that teachers are reluctant to employ group work when teaching mathematical problem solving skills.

The findings of this study further revealed that group work should consist of small groups of 3 learners per group which is a manageable number for teachers. Tanveer (2008) however, stated that the size of the group depends on how the teacher manages learners and engages with them. In this study, it was found that when grouping or pairing was implemented in class, there was no supervision of how learners completed the activities. If teachers do not move around the class with the purpose of monitoring and facilitating how learners are sharing ideas, then they will not be able to evaluate the optimal level of learners' understanding and collaboration.

According to the findings of this study, demonstration is considered an important teaching method that should be applied by all teachers when teaching mathematical problem solving skills in Grade 3. In Junior Primary grades, learners learn more effectively when they observe how things are done either by a teacher or their fellow class mates. Therefore, it is very important for teachers to show learners how to solve story problems using various strategies such as visual cues like drawing pictures, using physical objects or non-traditional strategies. The lack of sophisticated teaching materials at rural farm schools forces teachers to improvise their own materials which in most cases

are not of good quality. As a result, the lack of appropriate teaching materials made it difficult for both teachers and learners to utilise them effectively and learn from them. The findings of the study concurred with Motshoane (2006) who revealed that teachers find it difficult to use demonstration especially if the teaching materials are inadequate. The result of this is that some teachers opt to ignore the method because of its complexity to apply. Therefore, although the teachers agreed with Noah (2013) who asserted that teachers should use quality physical models when demonstrating concepts in order to ensure the involvement of all learners. The demonstration method was not effective in the rural context due to the lack of appropriate teaching materials. Noah (2013) emphasised that teachers should teach through the learning of demonstration methods with concrete objects as teaching media. This he believed would develop the potential skills of learners in the classroom learning process that requires them to participate actively in group discussions and find solutions to the problems posed. Further, it strengthens the interaction between friends and teachers and their exchange of ideas so that their insights and thinking process will develop. The participants in this study supported the use of demonstrating with physical objects in order to enable learners to compute correctly. There was agreement that learners would increase their understanding or ability in mastering mathematical concepts so that when they are faced with a question that demands a solution, they can do mathematical problem-solving skills effectively and develop their responses based on concepts that have been understood and mastering not only by memorizing without enriching and expanding their critical thinking. This is in line with Vygotsky's ideas and supported by the recommendation of Noah (2013) that teachers need to use demonstration more often in their lessons to maximise learners' comprehension.

In addition, learners' activities that arise during the lesson contributed positively to the increased ability to process and understand the concepts of mathematical problem solving skills. This is in

line with other studies which investigated that the demonstration method maximises the enthusiasm of learners and this keeps them alert and involved at all times during the lesson (Crouch, Fagen & Callan, 2004).

Despite the fact that demonstration was identified as an important method when teaching problem solving skills to small children, the teachers used the lecture method which has a negative impact on small children and leads to a low attention span and poor learning. The findings of the study concurred with Motshoane (2006) who stated that most of the teachers find it difficult to use the appropriate teaching methods in Junior Primary grades.

The guided method is another teaching technique which helps Grade 3 learners to be steered through the steps of solving story problems. Learners need a procedure to follow in order to solve story problems. The findings of this study show that the majority of participants guided learners when doing problem solving activities. The findings are in line with Polya (1957) who emphasized that teaching the required steps to learners can improve their ability to solve mathematical story problems The five steps that emerged from the findings such as reading the story problem and deciding on the operation; finding the number in the word sum; writing the number sentence using an operation place holder; doing the calculation; and writing the correct answer and unit are very helpful aides for learner when doing story problem activities without the guidance of teachers. This corroborates the position of Newton (2013) and Murray and Jorgensen (2007) who described the guided method as an opportunity for learners to explore story problems on their own in order to promote critical thinking and self-reliance. Participants felt that it was important to drill the steps of doing story problems to the whole class first until learners mastered it. Newton (2013) is in agreement that teachers should identify learners who have a common learning problem and place them in small groups so that they can be given the necessary learning support instead of whole

class teaching as implied by the findings of this study. In other words, the teacher is physically present to render support by guiding learners to do story problems and monitor the progress of the learners. The idea of Newton (2013) is in accordance with view of Vygotsky (1978) who believed that teachers should ensure that the learning is simplified and render more assistance (scaffolds), including the use of tools like manipulatives or more assistance from peers through social interaction.

Integration is one of the commonly used teaching methods specifically in Junior Primary grades although teachers find it quite difficult to make use of it in their lesson preparations. Each subject in Junior Primary phase has its own method of how to apply integration, for example in Mathematics, story problems should be integrated in every component to ensure that learners master the skills successfully. Many teachers do not integrate story problems across teaching Mathematics components due to a lack of time or sometimes ignorance, so they prefer teaching it in isolation. The findings of this study is in disagreement with Möller (2018) who pointed out that teachers should always introduce a Mathematics lesson with a good story problem so that learners can get used to them. By way of contrast, a study done by Perkins (2016) found that Mathematics skills should be taught in isolation to enhance the development of individual skills separately to avoid confusion among young learners.

The syllabus recommends that a topic from Environmental Studies should be used across all the story problems in order to connect learning to real-life situations. This study is in agreement with the ideas of Cromwell (2017) who highlighted that the advantage of integration is to help learners to connect what they are learning in the classroom to real life so that learning becomes meaningful to them. However, it was evident that the majority of the teachers did not incorporate the topics from Environmental Studies in the story problems which were given to learners because they felt

it was too time consuming. In addition, some of the participants had little understanding on how integration in Junior Primary occurs. This finding supported Perkins (2016) whose study found that teachers lack the necessary skills to incorporate ideas across the subject matter.

Integration across subject matter is considered vital to encourage learners to remember what they are taught especially when the issues relate to their environment where they live. Young children have short memories so it is necessary to ensure that the information which is processed in their brains is arranged in an organised manner. The findings of the study is in agreement with Cromwell (2017) and the Ministry of Education, Arts & Culture (2015) who support the practice of integration as holistic experiences are recalled quickly and easily if ideas are organized into patterns where learners search for meaning through these patterns.

5.3 Teaching strategies for handling mathematical related problem solving activities

In order to ensure that learners arrive at the correct answers when doing story problems, teachers play an important role of teaching the learners about strategies involved in doing story problems. The belief of social constructivism is that the teacher as a knowledgeable professional transfers social knowledge to the learners through instructions whereby learners remember what they have learnt and later apply it when doing activities. When proper instruction is provided within the ZPD, the child will be able to increase his or her understanding and do tasks with ease.

The teaching strategies which participants are aware of are: drawing and using pictures; teaching of terminologies related to operation signs as well as the use of manipulative. In addition, non-traditional strategies are also significant to learners when solving story problems.

The use of pictures plays a significant role in how Junior Primary learners learn since they learn by visualizing images. This focuses the interest of learners on the given activity and at the same time it assists learners to a better understanding of the story problems. All 8 participants for this study were of the view that story problems with pictures enhance learners' interest. Participants

further said that using pictures helps learners to visualize the situation of the story problem which enables them to act by drawing it out. The findings agreed with Van de Walle et al. (2010) who emphasized that learners should draw a picture first when doing story problem to represent the concept in a real interpretation of the problem situation which helps learners to arrive at the answer.

Teaching of terminologies about mathematical operation signs is another important teaching strategy when doing story problems. Therefore, the learning of the terminologies which are associated with mathematical operation signs is crucial to learners when doing story problems as it promotes reading comprehension. Polya (1957) said that learners perform poorly in story problem because teachers neglect to teach them the strategy of identifying key words. Therefore, learners need to master the English synonyms of addition, subtraction, multiplication and division. It is important to display a poster with these terminologies or synonyms in the classroom so that learners can be exposed to the terms.

A few of the participants of this study emphasised that they make learners read the terminologies on a poster displayed on the wall and ask them to identify those key words or terminologies which are used in the story problems. The same participants believed that this teaching technique aids understanding and enables them to choose the applicable operation signs rather than mere guesswork. The findings of this study supported Knifong and Holtan's (2015) suggestion that teachers should pay more attention to teaching learners how to look for key words which elicits the choice of operation signs. However, this was not the case for the majority of the participants. Terminologies were not displayed in the classroom and teachers did not teach learners about the terminologies which promote the required reading skills.

Since Junior Primary learners learn via their five body senses, manipulating objects by touching is one of the practices which teachers allow in the classroom especially when counting. Learners need to manipulate physical objects to find answers to the story problems specifically those who are operating at a pre numerical phase. The findings of this study have shown that the majority of the participants demonstrated the use of physical objects to arrive at the answer to the story problems. Learners look critically at the story problem and physically manipulate the materials to find the answer. The findings are in line with Manches, O'Malley and Benford (2010) who indicated that learners who have basic mathematical computing skills use manipulative to do calculations. This was evident during the classroom observation, I noted that that slow learners for example, used a collection of physical objects such as bottle tops, seeds, stones, abacus with beads, and sticks. Van de Walle et al. (2010) supported the use of models or physical objects as one of the best teaching strategies which learners can use to solve story problems.

Learners who are at level 3 of counting (breaking down and building up numbers) find the use of physical objects boring and a waste of time. The findings of this study are in line with Burmeister et al. (2018), for example, who pointed out that learners who think at an abstract level do not rely on manipulative objects to do story problems, but instead they prefer mental calculations. The findings of Burmeister et al. (2018) are in line with Van de Walle et al. (2010) who indicated that instead of making learners reliant on counting on their fingers, or using manipulatives or making marks on papers to find answers, teachers should teach them non-traditional strategies to do mental Mathematics in order to enhance their critical thinking skills.

Unfortunately, this group of learners are mostly ignored since teachers apply the one size fits all approach. This could be simply because teachers are not aware of the non-traditional strategies or

perhaps they do not know how to demonstrate them to the learners. Further, it is of great importance for teachers to be aware of a variety of teaching strategies to solve story problems including non-traditional strategies and be able to teach them to learners effectively. This group of learners uses a variety of non-traditional strategies such as 5 and 10 as anchor number, division as inverse of multiplication, using arrays, using empty number line, doubles and near doubles, up and over 10, down over 10, take from 10 and subtraction as think addition as discovered by (Van de Walle et al., 2010). However, during observation none of the teachers of this study were observed teaching about these non-traditional strategies and the learners relied on concrete objects as well as on diagrams and picture representations. During the interview session, I asked teachers about these strategies out of curiosity but I learnt that they are not aware of them. Some of the participants expressed that they use some the strategies but they do not know what they were called.

5.4 Challenges in teaching mathematical problem solving skills

This study has identified numerous and varied challenges that prohibit Grade 3 teachers from teaching mathematical problem solving skills more effectively at rural farm schools. The major component of story problems is the integration of language skills more especially reading. It is a common learning barrier in the Junior Primary phase especially to rural farm school learners who are not exposed to much print material both in the school and especially at home. This is in accordance with the view of social constructivism theory that children's cognitive development increases when exposed to information within the child's ZPD. Reading should not only be happening in the language subjects but it should be emphasised in Mathematics lessons as well. This includes reading number symbols, number names, story problems, etc. Unfortunately, learners who are weak at reading struggle to do story problems.

All the participants emphasised a reading deficit as a common learning barrier among Grade 3 learners attending school in rural farm schools. Participants mentioned that some learners could hardly read at all and this makes it very difficult for them to do story problems. This finding is in line with the findings of Silver and Thompson (2014) whose study noted that one common challenge that learners experience when doing story problems is a lack of reading ability. Further, Chase (2009); Lee (2009); Linville (2005) and Martin (2000) all confirmed that reading ability influences learners' performances in story problems. However, there are other studies Balow (2014) and Knifong and Holtan (2015) that argued that reading ability has a minor role in successful problem solving. Their findings further indicated that the majority of the learners who failed to solve story problems correctly could read the problems but they struggled to comprehend what they read. The findings of Knifong and Holtan (2015) also corroborate with the finding of this study which indicated that learners can read well enough but they do not understand what they read. This leads learners to guess mathematical operation signs which results in incorrect answers. Knifong and Holtan (2015) have conducted an assessment where all the story problems were read to the learners on an audiotape in an effort to control the effect of reading difficulty, but the performance was still quite poor.

Another challenge that emerged strongly in this study is the lack of training workshops and general support from the regional office. Although it is costly to host training workshops for teachers, the results are always positive. Teachers' knowledge, especially those serving in rural farm schools where there is no good network to access the internet for the current teaching knowledge, needs to be kept updated constantly through training workshops in order to meet the needs of the curriculum which is an advantage for the learners. The Education Regional Office consists of experts in different specialization areas so that they render support to teachers in the region. If teachers do not receive training support from the region, then they will not keep pace in terms of subject content

knowledge, pedagogical knowledge, etc. and as a result this will lead to poor performance by the learners. The Education Regional Office also has the responsibility of distributing teaching materials to all schools equally to ensure effective teaching and learning.

The majority of participants in this study were concerned that they received minimal support from the regional office. For example, Senior Education Officers do not visit the rural farm schools very often. Participants further complained that when Senior Education Officers did visit them, they criticised them instead of assisting them to make up their shortfalls. Boudersa (2016) pointed out that Senior Education Officers are responsible for providing further training to teachers which includes how to use effective strategies to introduce a lesson, how to use group activities in a lesson, using effective questioning techniques, using classroom aids and resources such as audio, visual teaching aids, etc.

The majority of the participants of this study expressed their concerns that the education regional office does not organise sufficient training workshops through which teachers can upgrade their knowledge and skills of teaching Mathematics especially in the Junior Primary phase. Participants mentioned that they only attended regional workshops occasionally. Furthermore, cluster meetings which are organized in the region do not work to meet the teachers' needs in terms of knowledge and skills upgrading. For example, participants of this study expressed that an expert in Junior Primary does not attend these cluster meetings. According to the Ministry of Education, Arts & Culture Manual Guide (2016), the role of the Education Regional office is to organise training workshops regularly to ensure that teachers are equipped with the necessary knowledge and skills. Lack of Mathematics pedagogical knowledge is also a challenge which the majority of participants of this study mentioned. A teacher who graduated from a university or college should be trained in the pedagogies of teaching mathematical problem solving skills. It is important to lay a strong foundation in numeracy skills in order to avoid future learning barriers in Mathematics. It is against

this background that learners perform poorly in mathematical problem solving skills because teachers lack sufficient knowledge and training in how to teach the subject.

The findings of this study revealed that when learners move class from the underqualified to the qualified teachers they invariably lack the necessary foundational skills of numeracy and literacy. This finding is in agreement with the study conducted by Matlala (2015) which indicated that un- and under qualified teachers mostly lack the general pedagogical knowledge, subject matter knowledge, curriculum knowledge and pedagogical content knowledge to teach Mathematics. The study of Ball and Wilson (2010) revealed that teacher's pedagogical knowledge has a real influence on learners' performance.

There were, however, a few participants in this study who disagreed that teaching qualifications make a difference. Participants mentioned that even qualified teachers struggle to teach mathematical problem solving skills because they lack the know-how of teaching strategies as well as the subject content knowledge which they did not receive in their tertiary training. The findings of this study are supported by Ball and Wilson (2010) whose study discovered that the type of training programmes that Mathematics primary teachers receive at their tertiary institutions is the reason they lack sufficient subject knowledge to help them teach effectively.

5.5 Conclusion

In this chapter, I discussed the major findings which are significant to the research questions of this study. The findings confirmed the widely acknowledged view that the way teachers teach, interpret and implement the curriculum, is influenced by aspects such as learners' and teachers' knowledge, level of teaching qualifications, subject content knowledge, teaching pedagogical, the type of

teaching aids available and the contribution from education officers. I also discussed the challenges which Grade 3 teachers experience such as a reading deficit among learners and the lack of professional training workshop by the Ministry of Education, Arts & Culture. In the next chapter, I summarize and conclude the study and provide recommendations for further studies.

CHAPTER 6

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter provides the summary and conclusions of the study, as well as the recommendations that derived from the findings of this study. The chapter also identifies possible areas for further research.

6.2 Summary of the study

The purpose of this study was to establish what challenges Grade 3 teachers face when teaching mathematical problem solving skills in 5 selected rural farm schools in the great Kunene region. The purpose of this study was to find out (1) the teaching methods and strategies used to teach mathematical problem solving skills; (2) the challenges experienced by Junior Primary teachers at selected rural farm schools in teaching this area; and (3) to suggest possible ways to minimize these challenges

The study adopted a qualitative approach. It elicited the views of Grade 3 teachers and HoD's experiences of teaching mathematical problem solving skills in rural farm schools. Purposive sampling was used to select 5 public and from those schools 5 Grade 3 teachers and 3 Junior Primary Head of Departments were selected to participate in the study. The study used interview questions comprising both open ended and close ended questions for both the teachers and HoD's. The study also used an observation schedule as well as document analysis guide to collect data.

The findings established that teachers face many difficulties when attempting to teach mathematical problem solving skills. This is in line with Tanveer (2008) and Noah (2017) who indicated that using teaching methods such as group discussion and demonstration increase learners' engagement in the lesson which leads to improved learning. The findings further revealed

that identifying key words in the story problems as well as the use of manipulatives are the most profoundly useful teaching strategies which teachers should consider when teaching mathematical problem solving skills. Holtan (2015) recommended that teachers should teach learners how to identify key words from the story problems to enable them in choose the right operation sign, a vital ingredient to arriving at the correct answer. The study also revealed major challenges experienced by Grade 3 teachers at rural farm schools including learners' low reading ability, lack of proper teaching materials, lack of support from the Education Regional Office, lack of pedagogical knowledge and the local environment and home life of these mostly impoverished households.

6.3 Conclusions

Teaching problem solving skills to young children is complex and challenging since it demands expertise in both language and mathematical elements. Learners should have good reading skills as well as knowledge of computing numbers in order for them to solve story problems effectively. Problem solving is regarded as one of the high ranking skills in the Grade 3 mathematics syllabus which significantly contributes to the development and enhancement of higher order thinking and logical reasoning skills among learners. Therefore, the study concludes that as reading is a barrier to good performance, and in turn hampers learners' ability to succeed in story problems teachers should place more emphasis on reading skills. In addition, in order to meet their target lesson objectives, teachers should give the learners as many problem solving activities as possible in order for learners to be able to practice them and achieve success. Here, the study notes that learners should be taught how to look for key words from the story problems to enhance reading comprehension. Other results that arose from the study include the lack of professional workshops and lack of appropriate teaching aids provided for use when teaching mathematical problem

solving skills at rural farm schools. The unsympathetic conduct of Senior Education Officers during school visits was also raised.

6.4 Recommendations

In the light of the findings of this study, the study made the following recommendations under two different levels namely, the teachers and Ministry of Education Regional office.

6.4.1 The teachers

1. Teachers should emphasise reading skills and provide many mathematical problem solving activities for learners to practice and get used to them. More reading activities should be given to learners.
2. It was further recommended that teachers should teach learners how to identify the terminologies which relate to the operation signs in order to enhance the reading comprehension of learners.
3. Teachers should integrate story problems across other mathematics components to learners get boost learners' critical thinking skills.
4. More delegates from a wider area should be send to the Annual National Mathematics Congress. Some teachers do not receive any feedback from the workshops, most especially those who are teaching in rural farm schools who are already at a disadvantage. Therefore, the congress needs to provide more funds to meet these demands.
5. The study recommends that since we are living in the 21st century where the majority of teachers own smartphones, laptops and other ICT devices, teachers need to be connected to social groups for example social media such as WhatsApp groups, Facebook groups, panapto platform or edmodo platform to share teaching ideas with one another as far as mathematical problem solving skills is concerned.

6.4.2 The Ministry of Education Regional Office

1. The Education Regional Offices in Namibia should consider providing Grade 3 teachers in the regions with professional development training workshops at least twice every year in teaching mathematical problem solving skills. This would serve as an advantage to both the teachers and their learners.
2. The Senior Education Officers should visit rural farm schools' Grade 3 teachers more often and provide professional support in any shortfall which teachers might experience.
3. The study recommend that Senior Education Officers should conduct themselves in a professional manner when they undertake school visits. Their aim should be to help teachers improve their teaching methods and make them to feel at ease instead of criticising and censuring them.
4. The Education Regional Office should supply the same teaching materials to both rural and urban schools for use by both teachers and learners in mathematical problem solving lessons.
5. The Ministry of Education, Arts & Culture should revise its policy of recruiting teachers and discontinue staffing un- and underqualified teachers in the Junior Primary phase since this is a very sensitive phase where literacy and numeracy skills need to be developed by qualified Junior Primary teachers.

6.5 Recommendations for future research

The study recommends the following for future research:

1. This study was done in 5 purposively selected rural-farm schools in the Kunene education region; therefore, future studies need to be done among the non-farm schools of Kunene region in order to compare the findings and establish a better understanding of the implications of both farm setting and fixed rural school setting.

2. The study should consider using mixed method in order to allow for the generalization of the findings.
3. The study was done at schools where English is the medium of instruction in the Junior Primary phase; therefore, future studies should be carried out at schools that use mother tongue as a medium of instruction in order to compare the findings generated from the two different media of instruction used.
4. Future studies should also look at how the institutions of higher learning curriculum prepares student teachers in the area of mathematical problem solving skills.

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APPENDIX 1: PERMISSION OFFER LETTER KUNENE REGIONAL COUNCIL

REPUBLIC OF NAMIBIA
KUNENE REGIONAL COUNCIL
DIRECTORATE: EDUCATION
DIRECTOR'S OFFICE

Tel: 09264 67 - 335000
Fax: 09 264 67 -332226
Ref: 13/2/9/1

Private Bag 2007
KHORIXAS
31 October 2018

Mr. E. Kleopas
P. O. Box 4254
Ongwendiva

Dear Sir

RE: PERMISSION TO CONDUCT AN EDUCATIONAL RESEARCH STUDY IN THE KUNENE EDUCATION REGION

Your letter dated 30 October 2018, bears reference.

Permission is granted to carry out your research for your Master's Degree (M.Ed) on "**Challenges of teaching mathematical problem solving skills: A case of Junior Primary schools in Kunene Region Rural farms- Namibia**" at the indicated schools.

You have to consult plus present the approval to the respective principals. This activity should not interrupt the normal curriculum activities.

We humbly request you to share your research findings with the Directorate.

Thank you for your understanding in this regard.

Yours faithfully,

31/10/2018

MS. ANGELINE A. JANTZE
DIRECTOR OF EDUCATION, ARTS AND CULTURE
KUNENE REGION

"Securing that every child has access to quality inclusive Education, promoting and preserving Arts and Culture"

APPENDIX 2: MINISTRY OF EDUCATION ARTS AND CULTURE

REPUBLIC OF NAMIBIA

MINISTRY OF EDUCATION, ARTS AND CULTURE

Tel: +264 61 -2933200
Fax: +264 61- 2933922
Enquiries: C. Muchila
Email: Cavin.Muchila@moe.gov.na

Luther Street, Govt. Office Park
Private Bag 13186
Windhoek
Namibia

File no: 11/1/1

Mr Erastus Kleopas
P O Box 4254
Ongwediva, Namibia
Cell: +264812826222
ekleopas@unam.na

Dear Mr Kleopas

SUBJECT: REQUEST FOR PERMISSION TO UNDERTAKE AN EDUCATIONAL RESEARCH IN KUNENE REGION

Kindly be informed that permission to conduct research entitled "Challenges of teaching mathematical problem solving skills: A case of junior primary schools in Kunene Region arms" for your Master Degree in Kunene region is herewith granted. You are further requested to present the letter of approval to the Regional Director to ensure that research ethics are adhered to and disruption of curriculum delivery is avoided.

Furthermore, we humbly request you to share your research findings with the ministry. You may contact Mr C. Muchila at the Directorate: Programmes and Quality Assurance (PQA) for provision of summary of your research findings.

I wish you the best in conducting your research and I look forward to hearing from you soon.

Sincerely yours

SANET L. STEENKAMP
PERMANENT SECRETARY

APPENDIX 3: INFORMED CONSENT

University of Namibia

Faculty of Education

Consent form for Grade 3 teachers and HoDs

Research title: CHALLENGES OF TEACHING MATHEMATICAL PROBLEM SOLVING SKILLS: A CASE OF JUNIOR PRIMARY SCHOOLS IN KUNENE REGION RURAL FARMS –NAMIBIA

I ..... agree to participate in the above mentioned study. The researcher explained to me the process and steps of the research process. I understand that my participation in this study is voluntary and I can withdraw from the study at any time. I understand that during the interview I will be asked several questions regarding my experiences of teaching Mathematical problem solving skills in Grade 3. All the interview sessions will be tape recorded and transcribed later. I also understand that my involvement in this study will be kept confidential and will only be used for this study.

If you agree to participate in this study, please answer the interview questions as best you can. It should take approximately an hour to complete. If you have any questions about this study, feel free to contact Mr. E. Kleopas at ekleopas@unam.na or cell phone number: 0812826222/065-2323152 or my supervisor at smiipinge@unam.na .

Name of Participant .....

Signature of Participant ..... Date .....

This is to certify that I have explained the procedures to the above mentioned participant.

Researcher E. Kleopas.....

Signature ..... Date 25/10/2018

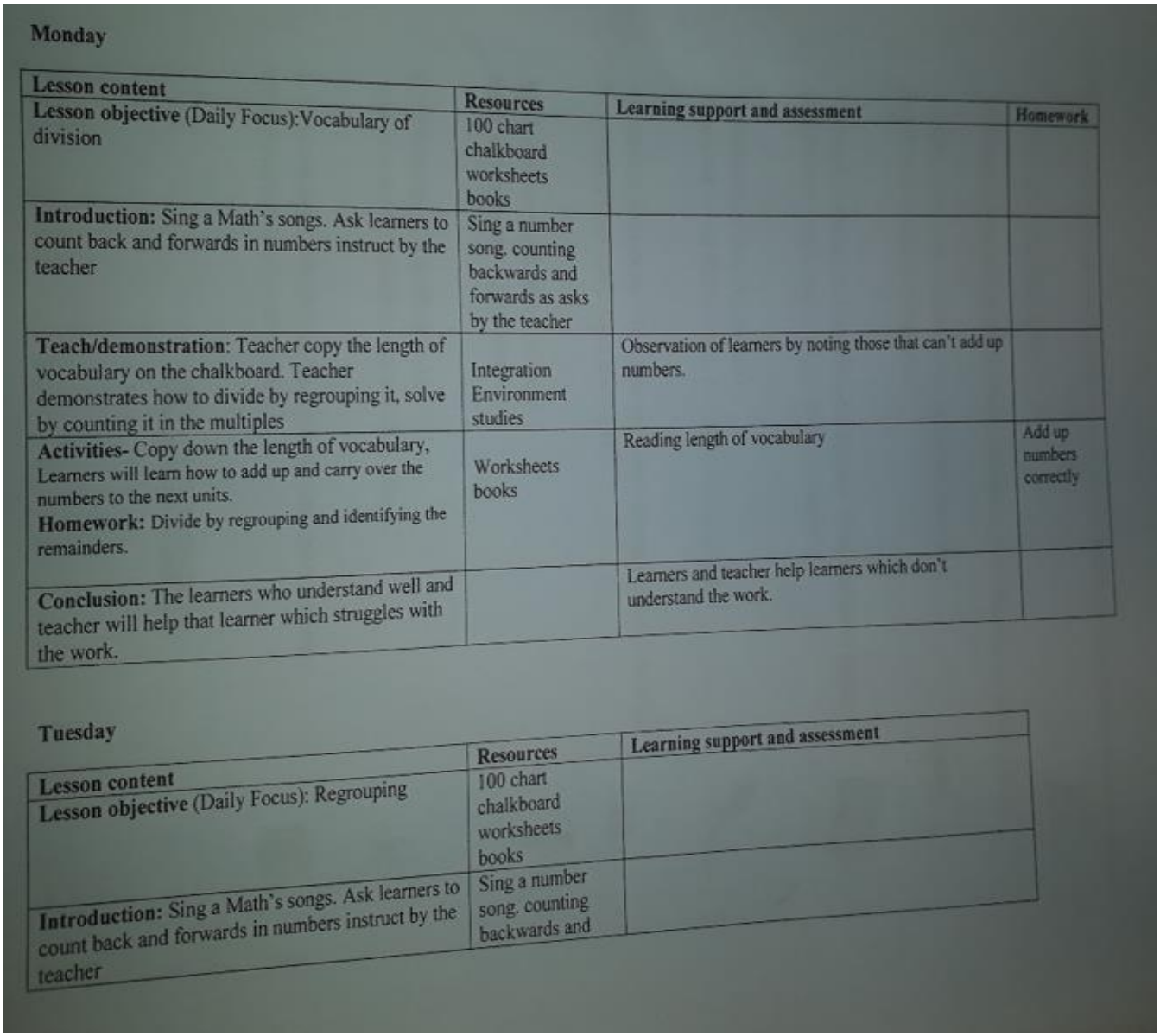
APPENDIX 4: HODs INTERVIEW PROTOCOL

1. How do you support your Grade 3 teachers to plan and teach mathematical problem solving skills?
2. How do your Grade 3 teachers teach mathematical problem solving skills?
3. How does your department address the challenges of teaching Mathematical problem solving skills?
4. What are your suggestions in ensuring that Mathematical problem solving skill is taught effectively in Grade 3 at your school?

APPENDIX 5: TEACHERS INTERVIEW QUESTIONS

1. What teaching methods do you apply in teaching problem solving skills to Grade 3 learners?
2. What teaching strategies do you use when teaching problem solving skills to Grade 3 learners?
3. How often do you teach problem solving skills?
4. What types of teaching and learning media do you use when teaching problem solving?
5. What challenges do you encounter when teaching problem solving skills to Grade 3?
6. How do you overcome the challenges of teaching Mathematical problem solving skills?
7. How do learners perform in problem solving comparing to other Mathematical skills?
8. Do you get any support from the subject experts such as HoD or Education officer? If yes, how often?
9. What are your suggestions to ensure that problem solving skills is taught effectively in Grade 3?

APPENDIX 6: LESSON PLANS



Monday

Lesson content	Resources	Learning support and assessment	Homework
Lesson objective (Daily Focus):Vocabulary of division	100 chart chalkboard worksheets books		
Introduction: Sing a Math's songs. Ask learners to count back and forwards in numbers instruct by the teacher	Sing a number song. counting backwards and forwards as asks by the teacher		
Teach/demonstration: Teacher copy the length of vocabulary on the chalkboard. Teacher demonstrates how to divide by regrouping it, solve by counting it in the multiples	Integration Environment studies	Observation of learners by noting those that can't add up numbers.	
Activities- Copy down the length of vocabulary, Learners will learn how to add up and carry over the numbers to the next units. **Homework:** Divide by regrouping and identifying the remainders.	Worksheets books	Reading length of vocabulary	Add up numbers correctly
Conclusion: The learners who understand well and teacher will help that learner which struggles with the work.		Learners and teacher help learners which don't understand the work.	

Tuesday

Lesson content	Resources	Learning support and assessment
Lesson objective (Daily Focus): Regrouping	100 chart chalkboard worksheets books	
Introduction: Sing a Math's songs. Ask learners to count back and forwards in numbers instruct by the teacher	Sing a number song. counting backwards and	

APPENDIX 7: OBSERVATION CHECKLIST

Name of the observer: …….Date: ……

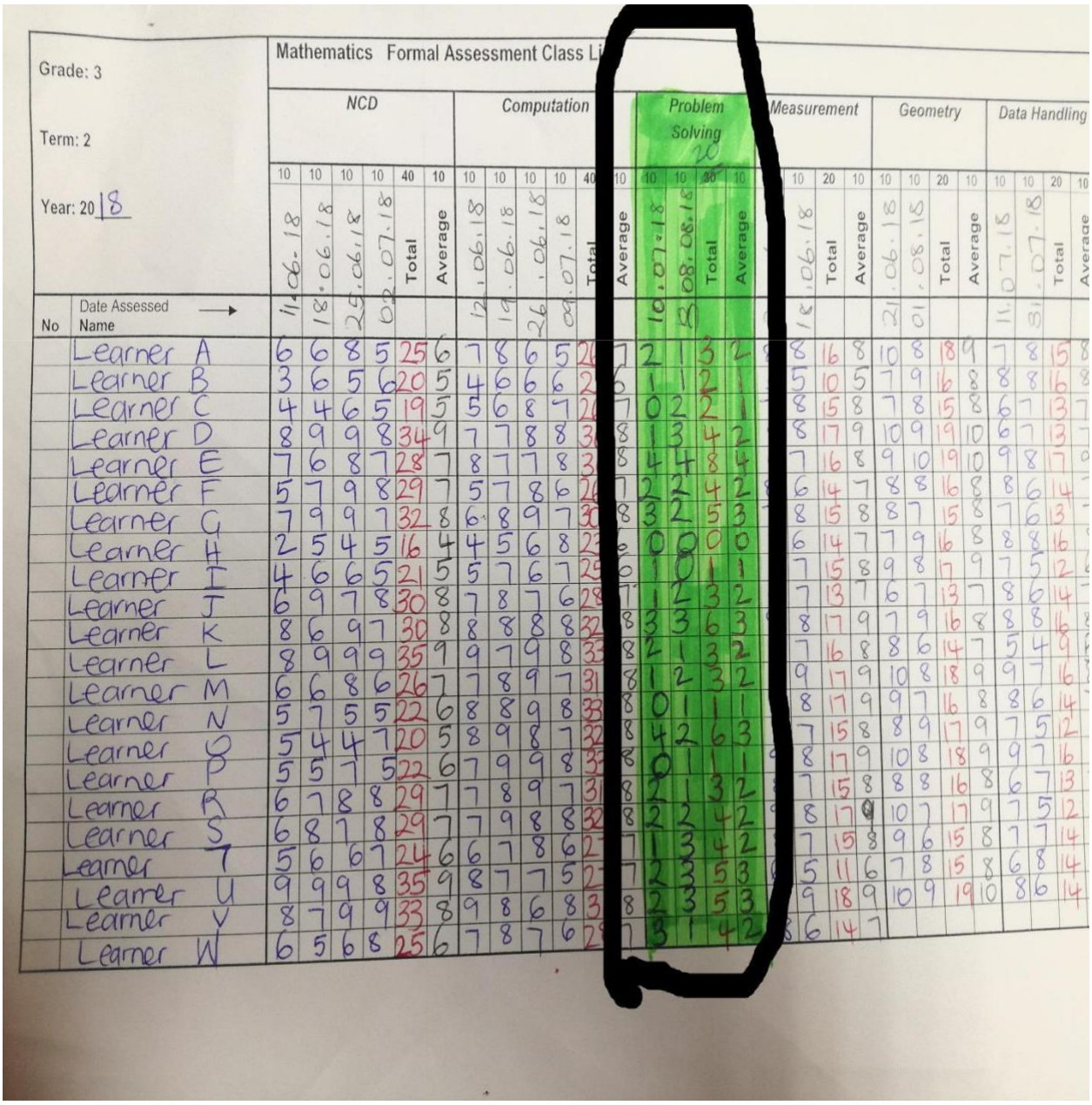
Criteria

1=Not observed 2=More emphasis recommended 3=Accomplished very well

Lesson introduction				**Summary notes**
Introduction arousing learners' interest in Mathematical problem solving skills	1	2	3	
Introduction activity has built in concept of problem solving	1	2	3	
Teaching and learning media are used to promote problem solving skills	1	2	3	
Both the teacher and learners are actively involved in the introduction activity	1	2	3	
The teacher has introduced the topic	1	2	3	
Lesson Presentation				
The teacher explains the topic to the learners and demonstrate good subject knowledge	1	2	3	
Terminologies used in problem solving are well defined	1	2	3	
Variety of teaching strategies used to promote problem solving skills	1	2	3	
Learners are engaged in meaningful learning	1	2	3	
The teacher combines a variety of different problem solving methods	1	2	3	
Learners create their own word sums	1	2	3	
The teacher responds appropriately to learners' questions and concerns	1	2	3	
Learners are allowed to use their own problem solving methods	1	2	3	
Learners are allowed to reason after completing problem solving activities and they are listened carefully	1	2	3	

Differentiated instructions are employed in problem solving related activities	1	2	3	
Learner support is considered	1	2	3	
Lesson conclusion				
The teacher concludes the lesson, emphasising key ideas related to problem solving skills	1	2	3	
The teacher gives homework on problem solving activities	1	2	3	

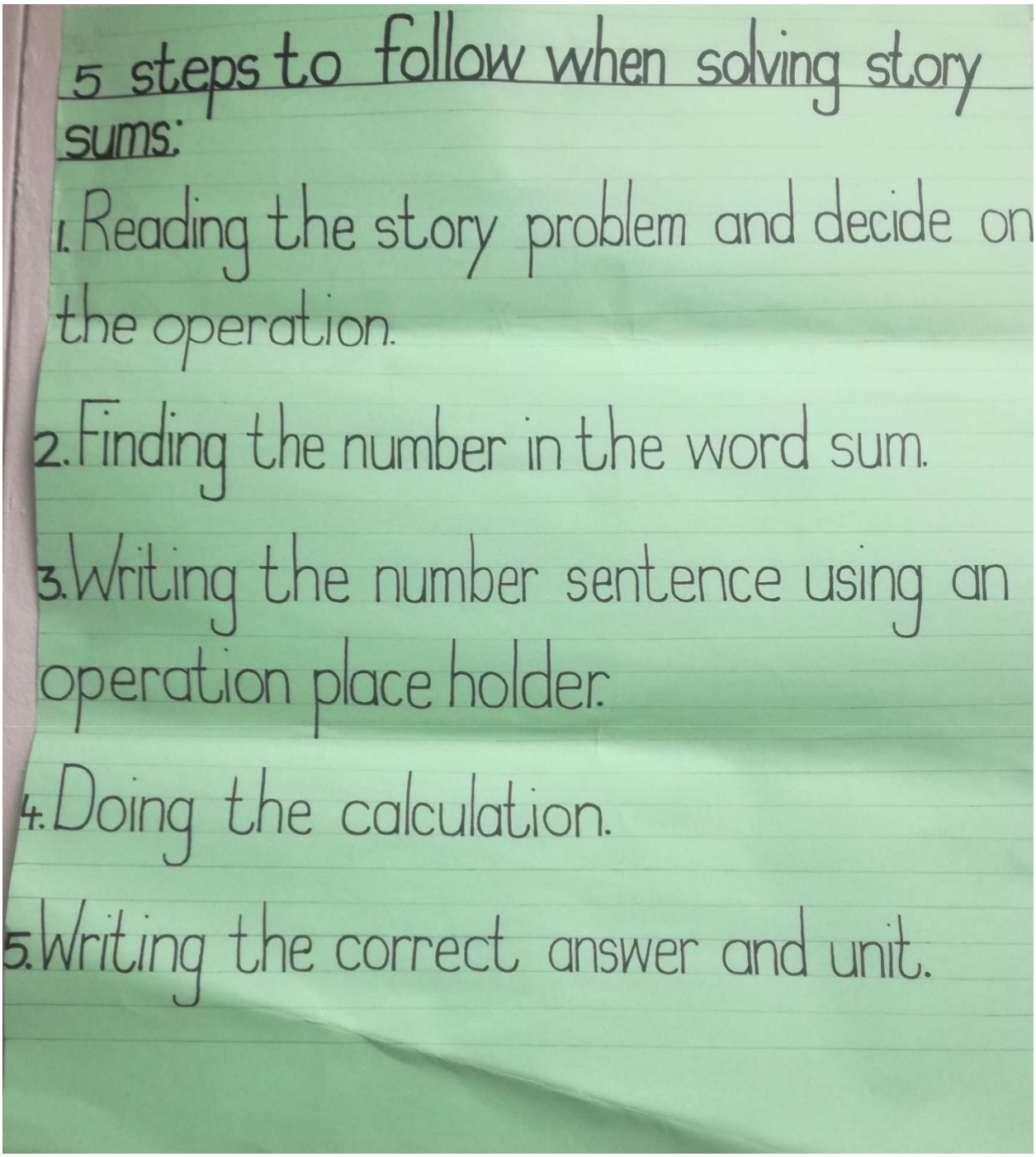
APPENDIX 8: ASSESSMENT FORM



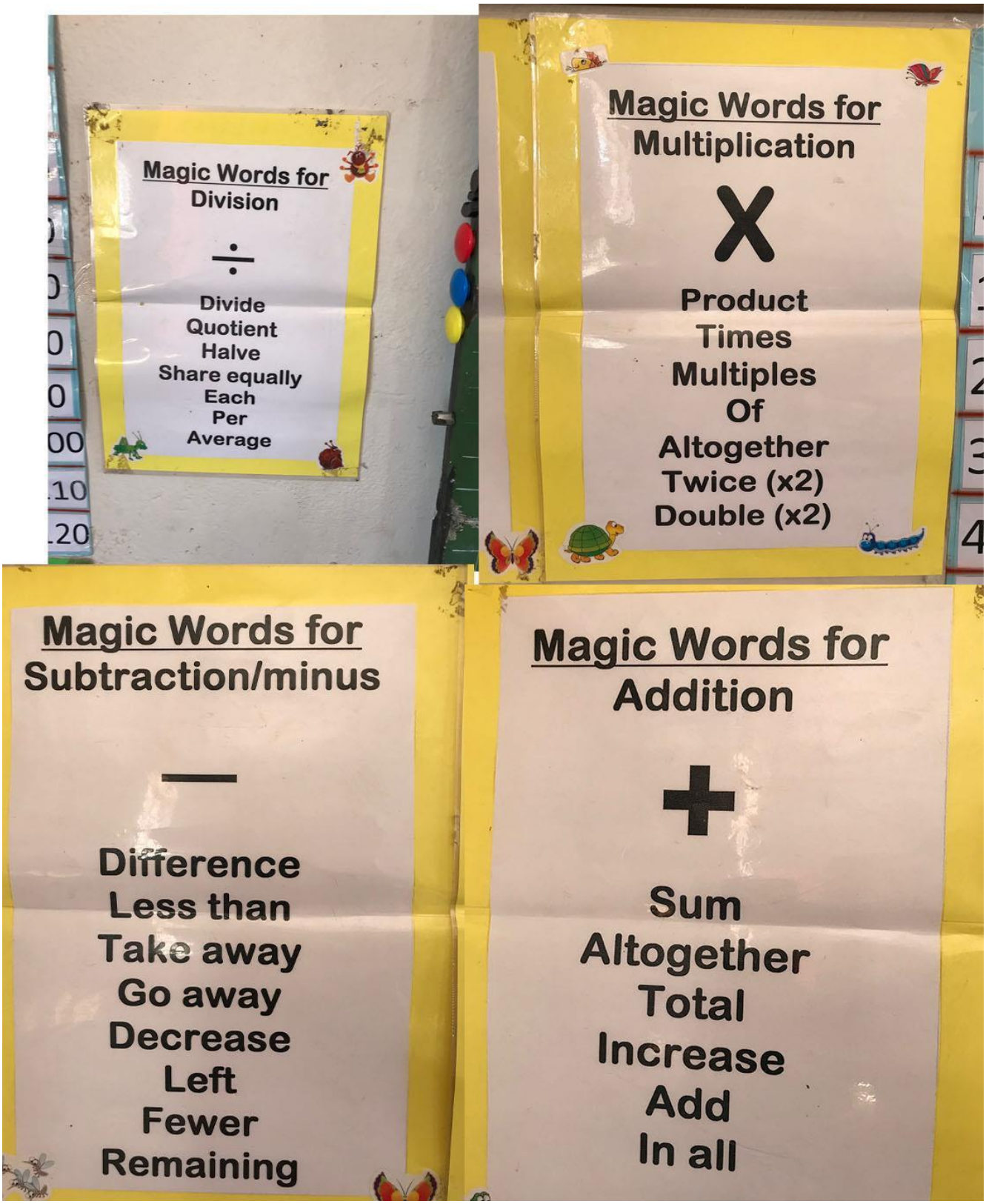
APPENDIX 9: GROUP WORK TASK

APPENDIX 10: KUNENE REGION MAP

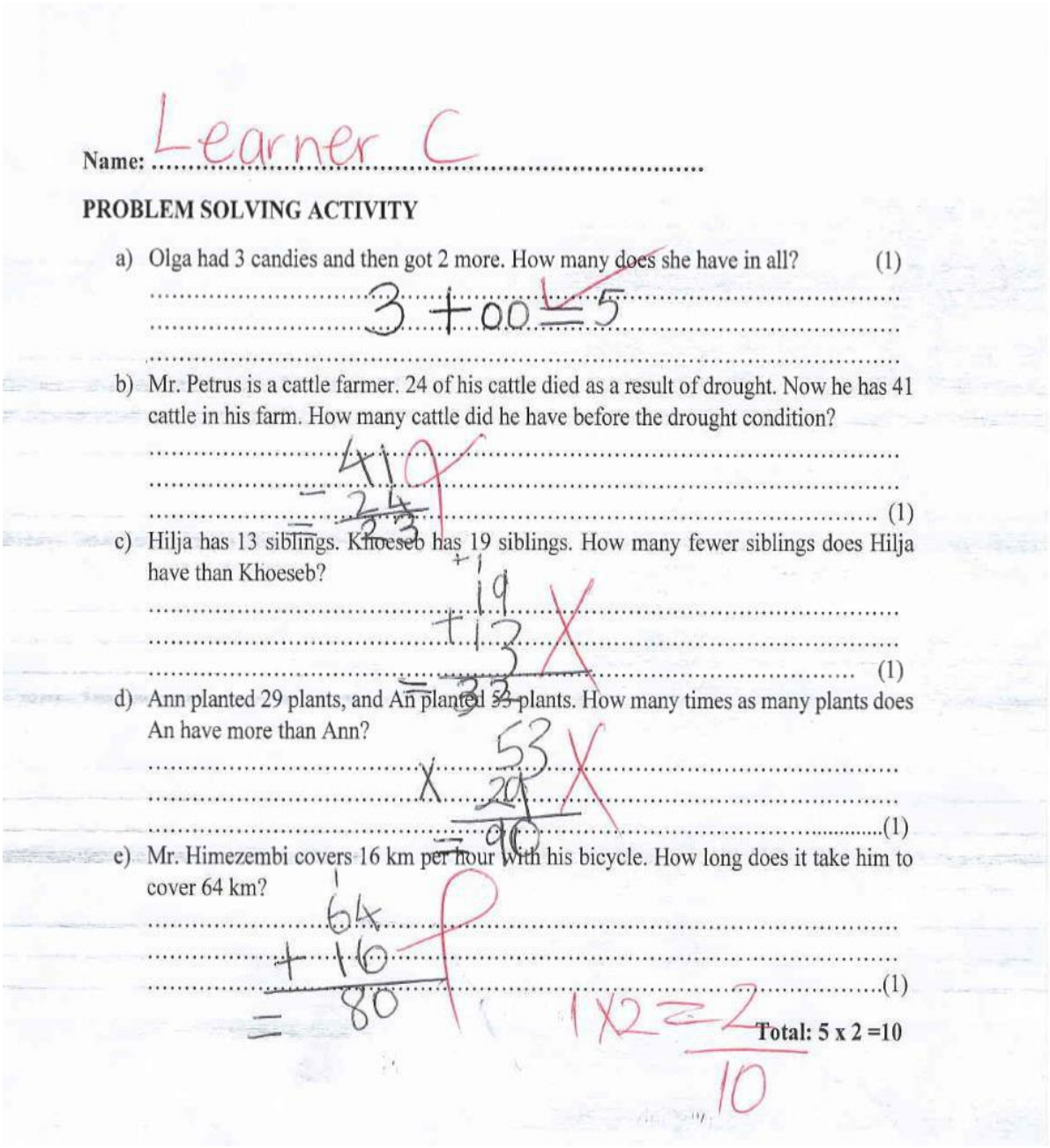
APPENDIX 11: STEPS OF SOLVING STORY SUMS



APPENDIX 12: POSTER WITH TERMINOLOGIES



APPENDIX 13: PROBLEM SOLVING ACTIVITY



Name: Learner C

PROBLEM SOLVING ACTIVITY

a) Olga had 3 candies and then got 2 more. How many does she have in all? (1)

3 + 00 = 5

b) Mr. Petrus is a cattle farmer. 24 of his cattle died as a result of drought. Now he has 41 cattle in his farm. How many cattle did he have before the drought condition?

41 − 24 = 23 (1)

c) Hilja has 13 siblings. Khoeseb has 19 siblings. How many fewer siblings does Hilja have than Khoeseb?

19 − 13 = 3 (1)

d) Ann planted 29 plants, and An planted 53 plants. How many times as many plants does An have more than Ann?

53 × 20 = 90 (1)

e) Mr. Himezembi covers 16 km per hour with his bicycle. How long does it take him to cover 64 km?

64 + 16 = 80 (1)

1 X 2 = 2

Total: 5 x 2 =10

10

APPENDIX 14: PERMISSION LETTER FROM UNAM

CENTRE FOR POSTGRADUATE STUDIES

University of Namibia, Private Bag 13301, Windhoek, Namibia
340 Mandume Ndemufayo Avenue, Pioneers Park
☎ +264 61 206 3275/4662; Fax +264 61 206 3290; URL: http//www.unam.edu.na

UNAM
UNIVERSITY OF NAMIBIA

RESEARCH PERMISSION LETTER

Student Name: Mr Erastus Kleopas

Student number: 200915401

Programme: MASTER OF EDUCATION (EARLY CHILDHOOD DEVELOPMENT)

Approved research title: Challenges of teaching mathematical problem solving skills: A case of junior primary schools in the Kunene region rural farms, Namibia

TO WHOM IT MAY CONCERN

I hereby confirm that the above mentioned student is registered at the University of Namibia for the programme indicated. The proposed study met all the requirements as stipulated in the University guidelines and has been approved by the relevant committees.

The proposal adheres to ethical principles as per attached Ethical Clearance Certificate. Permission is hereby granted to carry out the research as described in the approved proposal.

Best Regards

10 October 2018

Prof. Marius Hedimbi

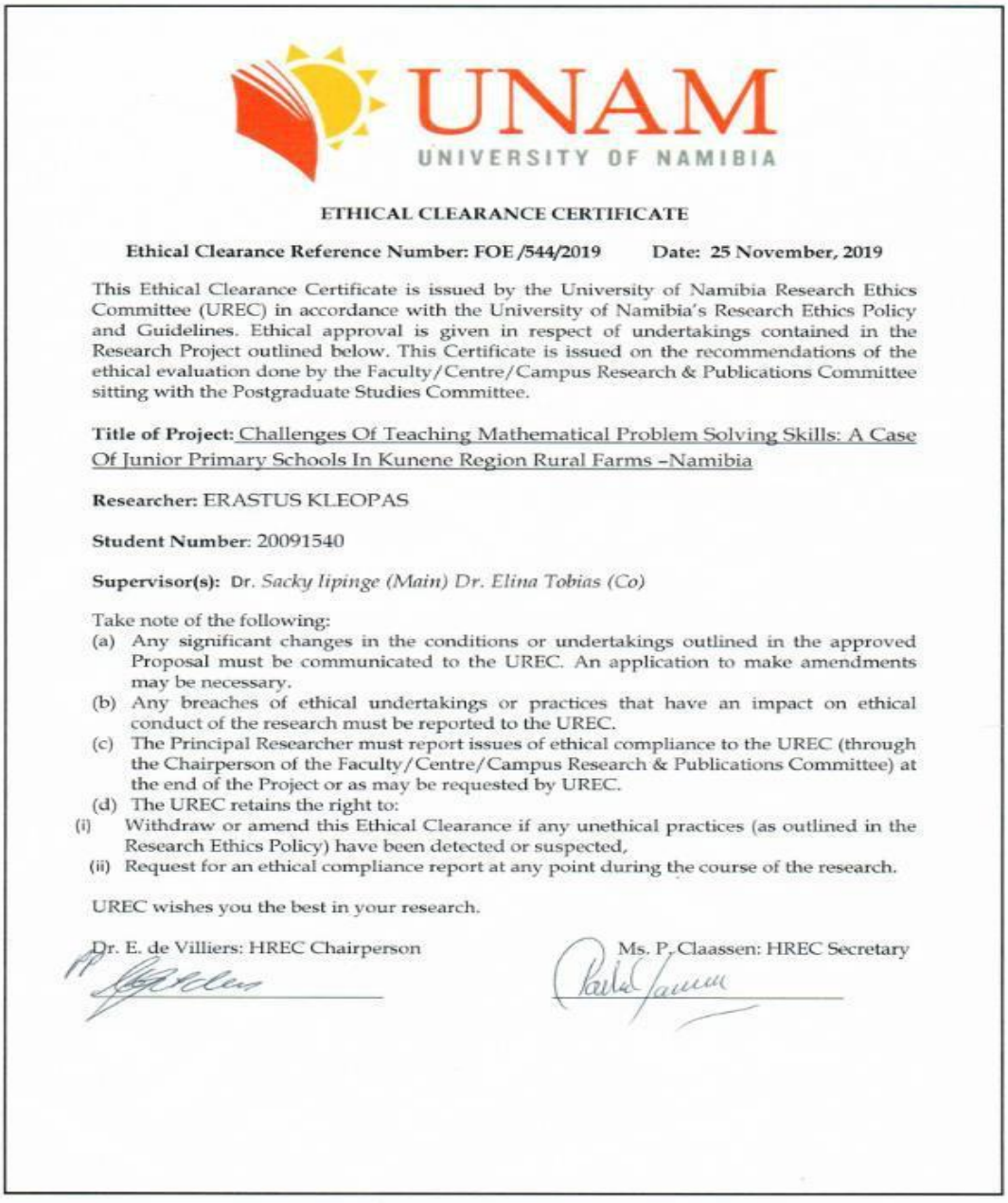
Director: Centre for Postgraduate Studies

Tel: +264 61 2063275

E-mail: directorpgs@unam.na

Centre for Postgraduate Studies
Office of the Director
2018 -10- 09
University of Namibia
UNAM

APPENDIX 15: ETHICAL CLEARENCE CERTIFICATE



UNAM
UNIVERSITY OF NAMIBIA

ETHICAL CLEARANCE CERTIFICATE

Ethical Clearance Reference Number: FOE /544/2019 **Date: 25 November, 2019**

This Ethical Clearance Certificate is issued by the University of Namibia Research Ethics Committee (UREC) in accordance with the University of Namibia's Research Ethics Policy and Guidelines. Ethical approval is given in respect of undertakings contained in the Research Project outlined below. This Certificate is issued on the recommendations of the ethical evaluation done by the Faculty/Centre/Campus Research & Publications Committee sitting with the Postgraduate Studies Committee.

Title of Project: Challenges Of Teaching Mathematical Problem Solving Skills: A Case Of Junior Primary Schools In Kunene Region Rural Farms –Namibia

Researcher: ERASTUS KLEOPAS

Student Number: 20091540

Supervisor(s): Dr. *Sacky Iipinge (Main) Dr. Elina Tobias (Co)*

Take note of the following:

(a) Any significant changes in the conditions or undertakings outlined in the approved Proposal must be communicated to the UREC. An application to make amendments may be necessary.
(b) Any breaches of ethical undertakings or practices that have an impact on ethical conduct of the research must be reported to the UREC.
(c) The Principal Researcher must report issues of ethical compliance to the UREC (through the Chairperson of the Faculty/Centre/Campus Research & Publications Committee) at the end of the Project or as may be requested by UREC.
(d) The UREC retains the right to:
(i) Withdraw or amend this Ethical Clearance if any unethical practices (as outlined in the Research Ethics Policy) have been detected or suspected,
(ii) Request for an ethical compliance report at any point during the course of the research.

UREC wishes you the best in your research.

Dr. E. de Villiers: HREC Chairperson

Ms. P. Claassen: HREC Secretary