EXPLORING THE TEACHING OF GRADE 4 MATHEMATICAL WORD PROBLEMS IN THE THABO MOFUTSNAYNA DISTRICT

By

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ABSTRACT

For Grade 4 learners, mathematical word problems (MWPs) are a concept that is challenging as it requires for them to be proficient in the language of learning and teaching. The challenge of teaching MWPs in the Thabo Mofutsanyana is mostly intensified by the fact that majority of the schools in the district are multilingual and English is not a home language for the learners. This study sought to answer the research question that reads as *How do Grade 4 mathematics educators teach mathematical word problems in mathematics lessons?* The Vygotsky's sociocultural theory is the theory that was adopted. This theory argues that learners develop knowledge through social interaction with others. The mixed methods methodology was implemented in this study, where a survey questionnaire was administered to 129 educators and two educators were observed and interviewed. Four major themes emerged from the analysis of the data showcasing what affects the teaching of MWPs in Grade 4 mathematics. Firstly, the research findings suggest that educators perceive MWPs as hard to teach. Secondly, the use of English to teach MWPs, makes it difficult for the educators to teach and for the learners to understand it. Thirdly, MWPs tasks are cognitively demanding. Lastly, the correct use of learner-teacher support material (LTSM), teaching aids and manipulatives might strengthen the content being taught by creating visual representations of the MWPs, therefore, creating a better understanding for the learners. The study suggests that the teaching of Grade 4 mathematical word problems is a concept that is challenging but can be easily taught provided that recommended strategies are implemented to assist learners in developing their own knowledge and understanding when doing mathematical word problems.

Key words: mathematical word problems, translanguaging, language of learning and teaching, home languages.

DECLARATION

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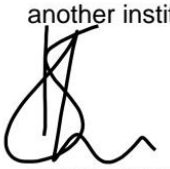
Declaration_Masters Student

I , MPHO MOKHATHI declare that the Master's Degree research dissertation or interrelated, publishable manuscripts/published articles, or coursework Master's Degree mini-dissertation that I herewith submit for the Master's Degree qualification MASTERS IN EDUCATION at the University of the Free State is my independent work, and that I have not previously submitted it for a qualification at another institution of higher education.



---------- 01 JULY 2024 ----------

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LISTS OF ACRONYMS

HL	Home language
LTSM	Learning and teaching support material
MMD	Mixed methods design
MMR	Mixed methods research
MWP	Mathematical word problems
TMD	Thabo Mofutsanyana District
TMED	Thabo Mofutsanyana Education District

CHAPTER 1: BACKGROUND TO THE STUDY

1.1. Introduction

Ginsburg (2022) defines mathematical word problems (MWPs) as verbal descriptions of problem situations presented within a scholastic setting, where one or more questions are raised. MWPs use a lot of words drawn for the language of learning and teaching (LoLT). Such word problems might be presented in learners' home languages (HL) as well (Essien, 2024; Mpalami, 2022). When exploring the notion of 'mathematical word problems' in South Africa, Sepeng (2012) defines mathematical word problems as a process, whereby learners experience the power and usefulness of mathematics in the world around them. Furthermore, in his study of exploring MWPs, Sepeng (2012:01) established that researchers define word problems as "textual descriptions of situations assumed to be comprehensive to the reader within which mathematical questions can be contextualised".

A study done by Edoho et al. (2022) in Nigeria, revealed that the crucial component for learners' low performance in word problems is their inability to understand mathematics symbols. Internationally, the debate about the challenges and opportunities associated with the topic have been discussed. For example, Guo (2022) in Australia argues that pre-service educators have difficulty in teaching triangle word problems, as they are challenged by having a full understanding of the laws needed to teach the concept. A study conducted in Lithuania by Kiliene and Norvaisa (2022) indicated that solving problems with reasoned judgements provides an unlimited source of reason and proving activities. Furthermore, their study shows that to successfully solve word problems, ones must be able to construct a deductive argument.

Moleko (2018) states that in one of major challenges of teaching MWPs in South Africa has to do with educators who restrict learners from implementing their HL as a resource to assist them to ken mathematical concepts. This might be the case for Grade 4 learners at schools, which are in rural areas and townships. The use of learners' home languages in instruction is key. Nhongo and Tshotsho (2019) state that a learner kens better when concepts are edified in their home language (HL). These learners seek understanding

in their home language (HL). Mathematical Word Problems (MWPs) is a challenge for learners, who do not have English as their HL, making the concept linguistically challenging. In this study, the researcher studied the teaching of Grade 4 mathematics, focusing on mathematical word problems.

As an experienced Grade 4 mathematics educator for five years in one of the schools in the Thabo Mofutsanyana District, the researcher noticed that the concept of mathematical word problems was challenging for learners, especially the language element of it. Therefore, this peaked an interest in the researcher to explore the teaching of Grade 4 mathematical word problems in the TMD.

1.2. Research Problem

Owen-Smith (2010) states that in the first three years of schooling, learners are taught in their Home Language (HL), and as they progress onto the intermediate phase, the language of learning and teaching (LoLT) changes to English. This means word problems stated in English might be harder to learners, who are used to learning mathematics in their mother tongue. Mathematical word problems (MWPs) is a mathematical concept that is a challenge for Grade 4 multilingual learners as it requires them to have a proficient level of understanding in the LoLT, which is English. The analysis of the November 2021 mathematics examinations written at primary schools in the Thabo Mofutsanyana(TMD) by the Free State Department of Education (FSDoE) (2022) indicate that there were 1 846 Grade 4 learners in the district that are at risk. Some 7,8% of Grade 4 learners in the district are under-performing in mathematics. The under-performance of the Grade 4 learners in the Thabo Mofutsanyana should call for the attention of Grade 4 mathematics educators to intervene. In a study done by Edoho et al. (2022), it was found that the percentage achievement of learners, who failed or scored low in mathematics in the past 18 years, is exceptionally high; 72.6%, compared to learners who scored credit and above, which is just 27.31%. Furthermore, the chief examiner, in Edoho et al (2022:01), found that one of the challenges that learners face is that they have difficulty in “translating

word problems into mathematical statements". Mpalami (2022) states that mathematics tasks that are normally used are accessed easily in English. Therefore, mathematics educators must assist learners in understanding mathematical tasks as they are readily available in English. It might be considered the duty of every educator to assist learners in understanding these tasks. As MWPs is linguistically demanding, it is the duty of an educator to assist learners by implementing strategies that assist learners in understanding the concept and successfully interpreting the requirements. Mathematical Word Problems (MWPs) is a challenge for learners, who do not have English as their HL, making the concept linguistically challenging. Therefore, in this study, the researcher sought to explore the teaching of mathematical word problems in Grade 4 mathematics, however, the focus was on schools in the Thabo
Mofutsanyana District.

1.3. Research Questions

The following critical questions and sub-questions guided the study:

1.3.1. Main question

How do Grade 4 mathematics educators teach mathematical word problems in mathematics lessons?

1.3.2. Sub-questions

1. What are educators' perceptions about teaching Grade 4 learners mathematical word problems?
2. What are educators' experiences of teaching mathematical word problems in Grade 4 mathematics?
3. What type of mathematics tasks do Grade 4 educators use when teaching mathematical word problems?
4. How do educators use learning and teaching support materials?

1.4. Aim and Objectives

1.4.1. Aim

To explore the teaching of mathematical word problems in Grade 4 mathematics in the Thabo Mofutsanyana District.

1.4.2. Objectives

1. To investigate educators' experiences and perceptions of teaching mathematical word problems in Grade 4 mathematics lessons.
2. To determine the teaching strategies used by mathematics educators to teach mathematical word problems.
3. To classify the type of tasks used by educators when teaching mathematical word problems in Grade 4 mathematics.

4. To identify the teaching resources that Grade 4 educators use when teaching mathematical word problems.

1.5. Ontological and Epistemological Beliefs

Tsao (2015) states that ontological beliefs play a crucial role in shaping individuals' behaviour and performance when engaged in mathematical problem-solving tasks. Hidayatullah and Csikos (2023) derive a definition on ontological beliefs from Schoenfeld (1985) (1989) as someone's world-view regarding the nature of mathematics, problem-solving, and teaching mathematics. According to Akin, Erşen and Karakuş (2021), these beliefs encompass individuals' perceptions of what mathematics is, how it should be learned, the roles of educators in facilitating learning, and the social context in which mathematics is situated. Ontological beliefs, according to Tsao (2015), play a crucial role in shaping individuals' behaviour and performance when engaged in mathematical problem-solving tasks. Blanton, Despina, Rotou and Stylianou (2015) state that these beliefs are not fixed but develop gradually over time, shaped by personal experiences and influenced by larger

cultural factors. Research conducted by McLeod (1988) has shown that ontological beliefs about mathematics can be examined in four dimensions: beliefs about the nature of mathematics, beliefs about learning mathematics, beliefs about educators' roles in learning mathematics, and beliefs in the social context.

Ontological beliefs about the nature of mathematics encompass views on whether mathematics primarily involves memorizing rules and procedures or if it is more about problem-solving and critical thinking. Additionally, individuals may hold beliefs about the complexity or simplicity of mathematical problems, with some believing that problems can be solved in just a few minutes while others believe that certain problems are unsolvable. These ontological beliefs are not trivial, as they can significantly impact an individuals' problem-solving performance. Tsao (2015) derived from research conducted by Schoenfeld in 1985 states that learners' problem-solving performance is often undermined by their beliefs about mathematics. For example, if a learner holds the belief that mathematics is solely about memorizing rules and procedures, then he/she may approach a word problem by trying to recall relevant formulas or algorithms rather than engaging in a deeper understanding of the problem and applying problem-solving strategies.

Furthermore, ontological beliefs about learning mathematics can also influence problem-solving behaviours.The researcher believes that mathematics learning requires constant practice. Memorising rules and procedures is only half of what is required. However, knowing when and how to apply these rules and procedures requires learners to practice mathematics daily and the educator to guide learners in understanding and applying the rules and procedures.

Epistemological beliefs play a significant role in mathematical problem-solving processes, as they can be influenced by various factors such as cultural background and past educational experiences. According to Gonzalez and Kuenzi (2012), individuals with strong epistemological beliefs

tend to approach mathematical word problems in a more exploratory manner, making conjectures and testing hypotheses before arriving at a final solution. On the other hand, those with weak or narrow epistemological beliefs may rely solely on memorized procedures without fully understanding their underlying concepts. Additionally, research has shown that fostering learners' epistemic views through instruction can lead to improved learning outcomes, particularly in complex problem-solving tasks (Hofer and Pintrich, 1997).

Therefore, understanding and addressing learners' individual epistemological beliefs is critical for promoting effective mathematics education. Epistemological beliefs are an individual's ideas and understanding of knowledge acquisition, and they have a variety of implications when it comes to mathematical word problems. Depending on one's cultural background or educational experiences, their attitudes towards estimation, conjecture-making or hypothesis testing in problem solving processes may differ. Furthermore, perceptions about the relationship between different types of information and problem-solving strategies can also influence one's epistemological beliefs regarding mathematics-related issues. Understanding these beliefs is crucial for educators, who want to help learners develop their critical thinking skills related to mathematical concepts and encourage coherent explanations based on sound reasoning.

Epistemological beliefs refer to an individual's ideas and understanding of knowledge and how it is acquired. When applied to mathematical word problems, this can include perceptions of the relationship between problem-solving strategies and various types of information, attitudes towards estimation, conjecture-making, or testing hypotheses in problem-solving processes. These beliefs can vary depending on a person's cultural background or educational experiences. The learners’ mathematical prior knowledge sets the tone of how they approach mathematics and MWPs. If a learner does not have a strong background on mathematical concepts such as MWPs, then it becomes difficult for the educator to develop their knowledge by building on what they already have. The researcher’ epistemological belief on mathematical word problems is that educators should utilise the learners’ prior knowledge so that they are able to aid the

learners in developing their kenning of the rules and procedures that are to be applied.

1.6. Value of the Proposed Study

The research is aimed at exploring the teaching of Grade 4 mathematical word problems in the TMD. As an educator, one is expected to guide and assist learners in successfully developing and gaining knowledge. Therefore, this implies that educators are well-informed about ways to improve their teaching and help learners develop. These strategies will give educators more understanding of how they can teach word problems and assist the learners in successfully performing well in mathematics and the concept of mathematical word problems. From this research project, the researcher is hoping to provide Grade 4 mathematics educators (and those of other subjects) with different strategies from other educators and scholars. This study will thus benefit educators and learners. Furthermore, this study will inform the Free State Department of Basic Education of the many strategies that can be used to assist in bettering the problem that Grade 4 learners and educators have when it comes to the teaching and learning of mathematical word problems.

1.7. Ethical Clearance

Ethical clearance was sought from the University of the Free State and the Free State Department of Basic Education, which were both successfully granted. The ethical clearance number for this study is UFS-HSD2023/0887. However, due to the late granting of ethical clearance from the university, the researcher could not collect qualitative data as it was already the fourth term. Data collection is not allowed in the fourth term.

1.8. Chapter Outline

Chapter 1: This chapter is the introduction chapter that provides overview of the whole study. It consists of the background of the study, research interest, research questions, aim and objectives, the ontological and the

epistemological orientations, value of the proposed study and the ethical clearance.

Chapter 2: This chapter coversthe literature reviewand the theoretical frameworks.

Chapter 3: This is the research methodology chapter. It consists of the paradigm, research approach, research design, sampling methods and procedure, data collection, data analysis, validity and reliability, and ethical considerations.

Chapter 4: This chapter is the data presentation, and analysis.

Chapter 5: This chapter covers the discussion of the findings and recommendations.

1.9. Conclusion

This chapter addressed issues pertaining to the research problem, research questions guiding the study, and the aim of the study. Finally, the chapter focussed on ontological and epistemological orientations and outlines of the subsequent chapters. In the next chapter the focus is on reviewed literature and theoretical frameworks.

CHAPTER 2: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1. Literature Review

2.1.1. Introduction

Botes and Mji (2010) state that language and education are connected because all teaching and learning is done through the medium of language. Furthermore, they state that language influences the extent to which a child's acumen is portrayed. Owen-Smith (2010:37) states that the three-year language policy that is being implemented, is negatively conceded by weak pedagogy and a "lack of learning materials" that is in the learners' home language (HL). Upon observation, one can understand that this indeed is a challenge that is greatly faced at township schools as majority of the learners do not have English as their home language, therefore, resulting in difficulty of understanding the content of the materials written. Majority of the primary schools in townships have English as a medium of instruction although, it is a first additional language subject. In the mathematics classroom, most educators have shown that they mostly use the learners' HL to teach as it assists the learners in understanding concepts and being able to apply the terminology used in the subject.

Owen-Smith (2010) states that the Department of Education (DoE) is currently implementing a policy that entails that children should be taught in their HL in the Foundation Phase and be introduced to subjects in English from their fourth year of school. This policy, however, proves to be a difficulty for township school learners as English is not their HL. They are now faced with the challenge of understanding the taught content and understanding the new language they are introduced to. In this review, the researcher discussed teaching multilingual classrooms with a discussion of using translanguaging in a multilingual classroom; mathematical tasks used in classrooms, and the use of learning and teaching support material to teach mathematical word problems (MWPs), and the teaching of word problems, which is divided into three sections namely; the challenges faced in teaching mathematical word problems; the strategies suggested to teach Grade 4 mathematical word problems. Lastly, advantages of mathematical word problems.

2.1.2. Teaching multilingual classrooms

Owen-Smith (2010) states that the DoE is currently implementing a policy that entails that children should have the first three years of schooling in their HL and be introduced to subjects in English from their fourth year of school. This has a great impact on the language of learning and teaching in South African schools. Furthermore, for multilingual Grade 4 classrooms, this presents a challenge whereby the children must adapt to a new language while they were taught in their HL from the Grade R – 3. Learners at township schools face many challenges in mathematics due to many factors. According to Mabena et al. (2021) part of the leading contributing factors to their low performance in mathematics caused by the language of instruction used. Grade 4 learners struggle mostly with the shift from being taught in their HL, for three years in the foundation phase, to being taught in English. In this section, the researcher discussed how teaching mathematics in English is a challenge at rural schools. In addition, a discussion on the use of translanguaging in a multilingual classroom was done.

Setati and Moschkovich (2010) expressed that the greatest struggle she experienced as a learner was being taught mathematics in a language that is not her mother tongue. This is one of the major struggles that learners at township primary schools experience, especially those in Grade 4. Furthermore, she adds that due to not being self-assured, most of the learning was done through memorisation. Botes and Mji (2010) assert that learners struggling with simple mathematics vocabulary and having scarce knowledge of simple vocabulary are big contributors to the challenges faced by the learners in multilingual mathematics classrooms. In addition, Mpalami (2022) states that translating learners' tasks into their home language is a positive move towards assisting African learners, whose mother tongue is not the same as the prescribed language of learning and teaching in South Africa to gain a better cognisance of mathematics.

Essien (2024) expresses that multilingualism is a resource for mathematics and mathematics education. In this study, the researcher found that prior

knowledge of the LoLT and learning deals a big factor of successful teaching in a multilingual classroom. This is however, a challenge in majority of the schools in the Thabo Mofutsanyana as the learners have different home languages that do not relate to English. Therefore, as Mpalami (2022) has stated, the translation of tasks into learners' HL will bring about a successful teaching and learning environment. For example, when teaching MWPs in a multilingual classroom, using the learners' HL in the questions, will simplify the understanding for the learners and make it easier for the educators to conduct this lesson.
Furthermore, this allows for a positive flow of participation during the lesson.

Botes and Mji (2010) states that the medium of instruction (English), which is utilised by educators to present and deliver concepts and procedures through which texts are read and problems are solved, affects the learners' understanding of mathematics. Chronaki and Planas (2018) further add that bilingualism is very detrimental to learners' intellectual and educational growth in mathematics, and this promotes a deficit perspective for the learner. Furthermore, it does not matter how many languages a learner knows but the essential elements in mathematics with regards to language, presently, is the cultural and social circumstances of how language is used in the pedagogy of mathematics.
McDonald (2021) alludes that a second additional language in the classroom is only suitable for non-curriculum activities that have no emphasis on culture. However, she further adds that using the learners' HL assists in translating for the learners, who are not English speakers and are still in early acquisition and passing it along as the LoLT. In the context of majority of township schools in the Thabo Mofutsanyana District, the use a second language (the learners' HL cannot only be limited to non-curriculum activities, it should also be used in the classroom. As much as learners' HL is advocated for and can be seen as, according to Mpalami (2022: 1), a "linguistic resource" one must understand that there are practical challenges that can hinder with the successful implementation of the use of the learners' HL during a lesson. Such a challenge, according to Dockrell, Donau, Knudsen, Mifsud and

Papadopoulus (2021) is the lack of teaching materials and testing materials available in the second language. The researcher further adds that another challenge to this implementation is that educators in the intermediate phase were not taught to carry out lessons in the learners' HL but instead, in the language of learning and teaching, which is English. Such a challenge tends to lead to the lesson being lost in understanding for both the educator and learners.

2.1.2.1 The use of translanguaging in a multilingual classroom

Translanguaging is a form of strategy used in the classroom that can be easily mistaken for code switching. EarlyEdU Alliance (2019) states that code switching is a behaviour that is done intentionally to create a particular social impact. In contrast, they define translanguaging as a means, where both languages (HL and language of teaching and learning) are used in a strategic way that creates a new meaning with no direct translation in either of the two languages. Park (2013: 50) adds that translanguaging is con-natural to code-switching, where multilingual speakers interchange between languages in a natural manner.

Both the educator and learner play an important role in the use of translanguaging in a multilingual classroom. Omidire and Sameera (2022) emphasizes that the educator plays an intricate role in the multilingual classroom, and they should adopt translanguaging as a means to alter their teaching methods and scaffold the process of learning. This means that as an educator, one must allow for flexibility in the classroom to allow the learners to develop knowledge and understanding by freely communicating in a mixture of their HL and the LoLT, which is English. In a mathematical word problems lesson, the educator facilitates the flow of communication in guiding the learners to be able to understand what is expected of them from the task given. The role of the learner is to engage without feeling limited to express themselves. Majority of learners in the Thabo Mofutsanyana District (TMD) schools have Sesotho as their HL, therefore, they can sometimes feel limited to engage during a lesson as they cannot fully communicate in English as it is

the expected language mode of learning. However, when the educator adopts translanguaging as a pedagogical method, then it delimits the learner from part-taking in the lesson, especially a MWP lesson that has linguistic demands for understanding.

The use of HL in translanguaging benefits the learner. Omidire in Omidire and Sameera (2022) states that HL is considered as a good way to compensate for the challenges experienced by multilingual learners. Ittner et al. (2019) add that when learners are encouraged to use their HL, they are able to explicitly discuss topics with greater depth as they are not limited to one language. Multilingual learners struggle with understanding mathematical concepts as they are in English. When their HL is used to build understanding, it benefits them as they are able to make sense of mathematical terminology and concepts. For example, a question which states “The difference between 2 345 and another number is 345. What is that second number?” The first step is to understand that “difference” translates to “phapang” in the learners HL. Therefore, they already understand that they have to find a number that is different from 2 345 by 345. The question will be restated as “phapang ya 2 345 le nomoro efe e refa 345?” (the difference of 2 345 and which number is equal to 345).

Utilising translanguaging in the classroom gives the learners the freedom to successfully develop and acquire a new language by mixing their HL and the LoLT. In the mathematics classroom, when learners are given the freedom to communicate using translanguaging, it is encourages them to express their understanding of the terminology and the task given without being linguistically restricted.

2.1.3. Mathematical tasks used in the classroom

In this section of the review, the researcher discussed the type of mathematical tasks that mathematics educators utilize in the classroom. This section also includes a discussion on the use of learning and teaching support material to teach MWPs.

2.1.3.1. Types of mathematical tasks used in the classroom

Mathematical tasks are the staple resources that mathematics educators can use to evaluate learners on their comprehension of the content. Grover *et al.* (1996) further state that the analysis of instruction and thinking processes was outlined by the concept of mathematical tasks. Furthermore, mathematical tasks are utilized to study the connections between teaching and learning in the mathematics classroom. Hsu (2013: 397) further adds that mathematical tasks include problems and practice activities that educators can utilize in the mathematics classroom. Grover *et al.* (1996: 459) suggest that the task approach in the classroom promotes a theory that accounts for how learners learn from teaching.

There are multiple mathematical tasks that educators can use in the classroom to promote the successful content learning by learners. Grover *et al.* (1996: 460) define mathematical tasks as a classroom activity, whose role is to focus learners' attention on a particular mathematical idea. He states that these tasks influence how the learners learn by directing learners focus to specific parts of the content and by clarifying the ways of processing information. Furthermore, according to the said definitions, Hsu (2013), states that mathematical tasks can range from, for example, simple equations, word problems, or measurement tasks.

Mathematical tasks have a certain cognitive demand of the learners when they are required to solve tasks. Hsu (2013), states that the cognitive demands can be classified into four levels. They are- *memorisation, procedures without connections, procedures with connections, and doing mathematics.* For mathematical tasks that rely on memorisation or procedures without connections, the learner, according to Hsu (2013: 397), needs to only employ "rote memorisation or mechanical use of rules to successfully solve the task. For example, $2/4$ is the equivalent fraction of $1/2$. Convert this fraction into a percentage. To possibly answer these questions, the learners need to only remember and recall equal fractions to ½

also remember that to get a percentage of a fraction you must multiply by 100. These types of tasks are considered low cognitive demand tasks as they emphasise recalling basic facts and making use of computational techniques. In addition, tasks that involve procedures with connections or doing mathematics require for real understanding of mathematical concepts and ideas as well as the selecting of suitable strategies when solving tasks. Furthermore, these tasks are classified as high cognitive demand tasks.

Learners' capacity to comprehend how to solve the problems that are given to them is impacted by the vocabulary employed in mathematics word problems. Therefore, with the vast options of tasks that can be used in the mathematics classroom, it is imperative that the educator implements the correct tasks and strategies that will guide the learners to successful comprehending and solving the word problems activities given to them. In a study done by Kurshumilia and Vula (2015), they observed that to provide learners with more opportunities to know which steps to take, educators are required to take time to discourse over words related to MWPs and their meanings in the context of the problem. Additionally, this task can be coupled with a strategy that de Oliveira, Enriquez and Valencia (2018:119 -120) identify as "co-instructional teaching strategies" using "alternate questions". According to de Oliveira, Enriquez and Valencia (2018), this strategy assists the learners by guiding them with their reasoning and building the solution of their given task. The successful marriage of the aforementioned task and method can make it easier for learners to comprehend what is expected of them when they must solve mathematical word problems.

There are multiple mathematical tasks that educators can use in the classroom. However, these tasks must be strategically implemented through by guiding the learners. Moreover, the tasks must be chosen in such a way that they create an environment, where the learner will be able to understand concepts.

2.1.3.2. The use of learning and teaching support material to teach mathematical word problems

When teaching MWPs, the educator has to keep in mind that the learners' classrooms are faced with different learning barriers. Therefore, due to these barriers, the mathematics educator is pushed to use alternative learning and teaching support material (LTSM) to aid in the successful teaching and learning of MWPs.

In a study conducted by Hannula-Sormunes et al. (2016), the researchers developed a Word Problem Enrichment program (WPE). This program is used to inspire educators to use original self-created MWPs to improve learners' mathematical modelling and problem-solving skills. One can say that the WPE encourages educators to create MWPs that focus on the environment of their learners. Furthermore, this makes it easier for the learners to be able to identify with word problem they have to solve. The majority of the schools in the TMD can benefit greatly from this program as the educators will be addressing problems that their learners can relate to. Relying only on the textbook creates a general picture for the learners, therefore, resulting in them not being able to understand the problem they have to solve.

There are many other excellent LTSM that can be used to aid in the learning and teaching of MWPs, however, a sad reality is that many schools have to create their own LTSM as they are under-resourced. One of these resources that can be made readily available are called "manipulatives". In Adendorff et al. (2018), manipulatives are defined as "objects designed to represent explicitly and concretely mathematical ideas that are abstract". They further add that they have "both visual and tactile appeal and can be manipulated by learners through hands-on experiences." With manipulatives, the learners are able to visually see the problem given and derive how it can be solved. In addition, Moleko (2018: 159) states that bringing manipulatives into the classroom assists learners to develop a more in-depth comprehension of the concepts by "seeing them in reality". For example: Thando and Mpho buy

pizza for the school trip. Thando eats two eighths of the pizza and Mpho eats one eighth of the pizza. How much pizza is left after they give Tshepiso one eighth of the pizza?

The above word problem requires two calculations, but for the learners struggling with mathematics, they will not be able to see that at first glance. Therefore, the use of fraction manipulatives will assist the learner in firstly, understanding the word problem and secondly, to derive which calculations have to be done.

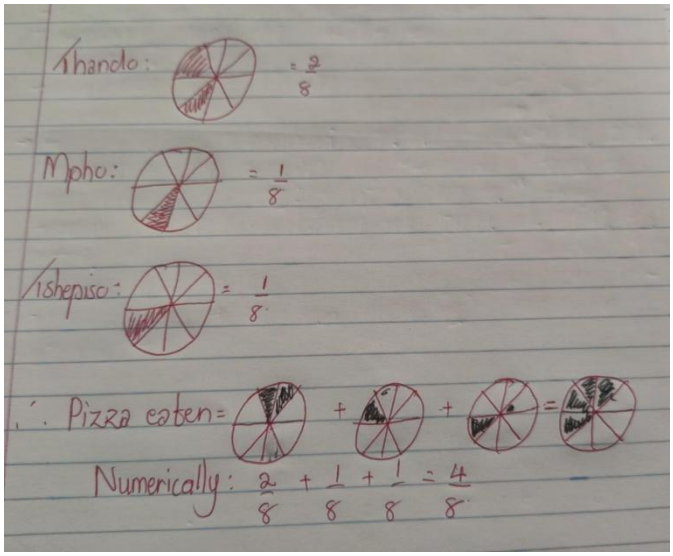


Image 2.1: Sample of how fraction diagrams can be used as a manipulative.

From the image above, we can see that Thando's two eighths, Mpho's one eighth and Tshepiso's one eighth have been represented in diagram form. From this, the learner is able to see that the three learners ate four eights of the pizza when they count the shaded pieces. Numerically, it is $\frac{2}{8}; \frac{1}{8}$ and $\frac{1}{8}$. Now the learner(s) knows that they have to add the fractions to get how much pizza was eaten, I.e. $\frac{2}{8} + \frac{1}{8} + \frac{1}{8} = \frac{4}{8}$

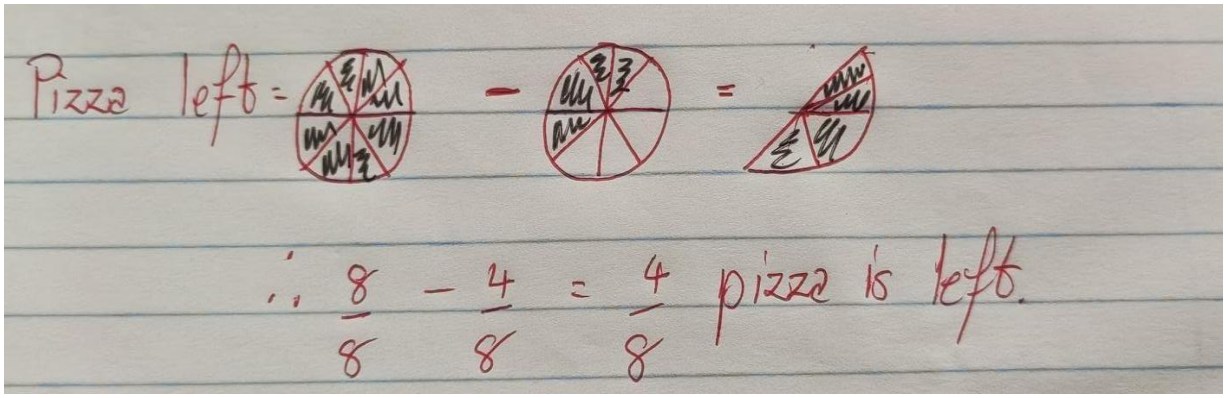


Image 2.2: Calculating what fraction of the pizza is left.

After the learners have derived that the fraction of the pizza eaten is four eighths, they are now able to calculate how much pizza is left. In MWPs, learners should be able to know that the word “left” means that you subtract. Therefore, the learners will subtract the four pieces from the eight pieces as indicated in the image above.

The use of manipulatives requires for mathematics educators to be active in the usage of the Maths Labs available at schools as they are equipped for different types of manipulatives that the learners can use. However, there are still schools that do not have Maths Labs, therefore, they have to rely on making their own manipulatives and LTSM.

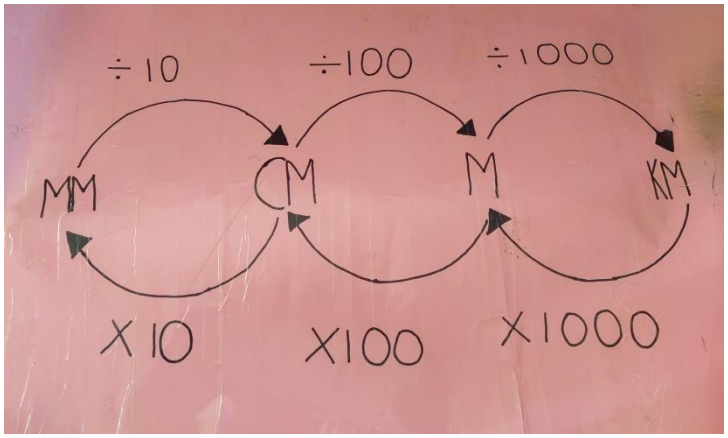


Image 2.3: Sample of conversion chart that can be used as a manipulative for MWPs that require conversion.

2.1.3.3. Barriers of using teaching aids and manipulatives

Although teaching aids and manipulatives offer an effective strategy into simplifying the teaching and learning of MWPs, there are some barriers with

their implementation in the classroom. Cekiso and Smith (2023) define teaching aids as the tools, accessories and items that educators use to assist learners in developing a kenning of the concepts of a lesson. Dinsmoor (2022) defines manipulatives as concrete objects that encourage learners to have hands on experience while engaged in learning. Privy to teaching aids and manipulatives being a sort of assistance, for teaching and learning, one should also consider that there are some barriers to using them.

Cekiso and Smith (2023) and Chaturika and Rajapaksha (2015) deduced from their studies that the main challenges that the educators faced in using teaching aids was them having limited knowledge of teaching aids and not being trained to use them. Having lack of knowledge and training debunks the whole notion of how successful they are when implemented into a lesson. Furthermore, having no knowledge or training results in the educator not using them or finding the importance of having them in a lesson. Therefore, it is important for the department and schools to offer trainings for educators to be more knowledgeable of teaching aids. Dinsmoor (2022) states that a challenges of using manipulatives is that when learners use them too much it prevents them learning imperative problem-solving and having difficulty in transferring new knowledge to new contexts. Majority of schools in the country are not financially well. Teaching aids and manipulatives are expensive, therefore the reality is that most schools do not have them unless the educator makes their own or buys their own.

2.1.4. The teaching of mathematical word problems

“Word problems” is a mathematical concept that requires for learners to be proficient in mathematical language and English. For Grade 4 learners, this concept is challenging as they are encountering it for the first time in English, which is a language they are being taught in for the first time. This section discusses the teaching of MWPs by exploring the challenges faced in teaching mathematics word problems and the strategies used to teach MWPs.

2.1.4.1. The challenges faced in teaching mathematical word problems

Moleko (2018) states that MWPs is a problem for both learners and educators. She further explains that the challenge of this concept is intensified by the fact that majority of schools in South Africa are multilingual, and this complicates teaching in the prescribed LoLT. Fatmanissa and Noviantri (2022) note that a word problem is a problem that is situated in real-life context. Furthermore, they indicate that a word problem is constructed from three components, which are: set-up components, information, and question. mathematics word problems present challenges for both educators and learners, especially in multilingual schools. Moleko (2018) states that the challenge that intensifies the teaching of word problems is that majority of the educators at multilingual schools are not proficient in English. Moleko (2018: 51, 117, 124) highlights some challenges that multilingual mathematics classrooms faced. They are firstly, “lack of reading skills; secondly, lack of mathematical vocabulary; and thirdly, educators’ lack of development of skills in terms of teaching MWPs in multilingual classrooms.

Firstly, Moleko (2018) noted that the intricate amalgamation of words, numbers, letters and symbols has made it challenging to read and comprehend the language of context of MWPs. This statement argues that in order for learners to be able to solve MWPs, they have to develop skills, whereby they are able to have an understanding of what they are reading in MWPs questions. Langa (2006) further adds that learners that are not proficient in the English language, are challenged with mastering mathematical terms, therefore, these learners must acquire excellent reading skills in unison with acquiring excellent mathematical skills. Learners’ lack of reading skills amounts to this challenge being a difficult one as it makes it difficult for the learners to give correct solutions to word problems. However, Moleko (2018) notes that most educators have concluded that learners are able to solve word problems, easily, when they have been expressed numerically.

Secondly, mathematics has its own vocabulary and register, in Moleko (2018: 42) quotes from Ni Riordain *et al.* (2015) that “a mathematical register is more than just vocabulary and technical terms” as it also includes “words, phrases and methods of arguing…” When learners lack a mathematical vocabulary and register, it tends to hinder their successful understanding of mathematical concepts, especially in a language that is possibly their second or third.

The vocabulary in word problems represents certain mathematical operations that guide the learners on how they should be solving the MWPs presented to them. Words such as *quotient, difference, altogether, the product of, increased by, decreased by, left after* and many others, represent a mathematical basic operation function such as addition, subtraction, division, or multiplication. Therefore, the learners are required to be able to identify the word to its operation, so they are able to solve the word problem and avoid the misapplication of appropriate mathematical operations.

Thirdly, educators should possess the means to develop the learners’ skills in terms of teaching MWPs in multilingual classrooms. However, educators seem to be lacking when it comes to developing the skills for learners due to multiple reasons. From a conclusion of a study done by Sepeng *et al.* (2012), Moleko (2018) was able to derive that the educators’ inability to nurture the abilities of problem solving, was what made it difficult for learners to develop personal connections and understanding of the mathematical concepts within the word problems. Strategies are there to assist in solving challenges that hinder the successful completion of tasks.

Some of the strategies that can be used by the educators when teaching word problems are firstly, reading skills employed to enhance understanding; secondly, strategies to improve learners’ mathematical vocabulary and register; thirdly, empowering strategies to enhance educators’ ability to assist learners in developing effective word problem-solving skills; and lastly, translanguaging and code switching in the classroom.

Firstly, Moleko (2018) states that the ability to read is key in mathematics education, especially concerning the concept of MWPs. Moleko (2018), found in a study done by Franz in 2015 that learners could not understand what they were reading when reading through word problems. He also further suggests that the learners must be provided with multiple reading and opportunities so as to grow their knowledge on the understanding of words. Reading will also assist the learners in being able to understand the expectations of each question and how they should solve the word problem.

Secondly, studies have concluded that many of the learners at multilingual primary schools had difficulties with understanding mathematical vocabulary and register. Moleko (2018), in agreement with Moore-Harris (2005), advocates that for learners to successfully develop their mathematical vocabulary, the focus should be put on reading strategies. Learners struggle with commonly used terms in mathematics such as *combine*; *differentiate*, and others, because they are not able to differentiate between the meanings in English and mathematics. In addition, educators should assist learners in developing their mathematical vocabulary and register as it will assist them in solving MWPs.

Thirdly, according to Moleko (2018), one of the roles that the educators in multilingual mathematics classrooms are expected to perform, is to support second language learners' acquisition of the LoLT through language-orientated teaching. The first thing that educators must be sure of before assisting the learners in developing effective problem-solving skills, is to develop their own skills. Assuming that educators are already knowledgeable of these skills is a very dangerous assumption as it can lead the learners astray.

2.1.4.2. The strategies suggested to teach Grade 4 mathematical word problems

Grade 4 mathematics is a challenge for the educators and the learners due to multiple reasons and therefore, teaching strategies have to be implemented for the successful teaching and learning of the said topic. In this section, a discussion of suggested strategies is given.

Nhongo and Tshotsho (2019) define translanguaging as a reality in the use of a language in multilingual settings, while Martinez and Ji-Yeong (2020) define it as the implementation of speakers' full linguistic range and to equalize the position of learners. Furthermore, Nhongo and Tshotsho (2019) and Martinez and Ji-Yeong (2020) all agree that translanguaging is a strategy that is reality based, as it is a way that allows for bilingual individuals to use a holistic selection of language resources to communicate with each other. During translanguaging in the mathematics classroom, code switching takes place. Maluleke (2019), concluded in his study from the evidence gathered that the use of code-switching in the classroom has assisted educators in encouraging learners to be positive towards the learning of mathematics. Furthermore, Martinez and Ji-Yeong (2019 add that the approach provides a richer and safer environment for bilingual or multilingual learners to not be overwhelmed by the linguistic demands.

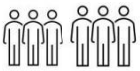
The successful use of translanguaging and code switching during a word problem lesson can assist the learners in understanding the mathematical terms in their HL. This will assist them in being able to pick a procedure or operation they can use to solve the word problems. For this implementation, Martinez and Ji-Yeong (2019) introduce "translanguaging pedagogy", which is an implementation of the learners' full language range. Moreover, the translanguaging pedagogy encourages the learners to take time to discuss and analyse and come up with solutions in their own language.

MWPs comprehension in multilingual schools is more reliant on the concept being made accessible to the learners. By doing so, the educator is providing

learners a way to construct knowledge in MWPs. This can be done by using de Oliviera's model of *Translanguaging Framework of Analyzing Word Problems*. The goal of this model is for educators to encourage bilingual/multilingual learners to understand that their use of their language(s) can structure mathematical knowledge. This is firstly done by separating the MWP into clauses, secondly, one translates these clauses into the language of choice and mathematical procedures (Martinez and Ji-Yeong, 2019).

The following is an example of how the *Translanguaging Framework of Analysing Word Problems* will be implemented in a Grade 4 MWPs activity:
Activity question:" On Monday, 23 patients made appointments with each doctor. However, 6 of the patients did not show up. How many patients visited the clinic on Monday?
Clause 1: *23 patients made appointments with each doctor.*
Clause 2: *However, 6 of the patients did not show up.*
Clause 3: *How many patients visited the clinic on Monday?*

Table 2.1: Translanguaging framework of analysing word problems

Information provided in English	**Information in a language of choice**	**Mathematical concept in a language of choice**	**Mathematical representation and procedure**
Clause 1: *On Monday, 23 patients made appointments with each doctor*	Ka Mantaha, bakudi ba 23 ba entse le di ngaka ka nngwe.	The number of patients: 23 Bakudi ba e 23	 = 23 patients
Clause 2: *However, 6 of the patients did not show up*	Le ha hole jwalo, bakudi ba 6 ha baaka ba hlaha	Number of patients that did not show up from the 23 is 6. Bakudi ba 6 hotswa ho 23 ha	 - 6 patients did not show up

		baaka ba hlaha	
Clause 3: *How many patients visited the clinic on Monday?*	Ke bakudi ba bakae ba etetseng tleliniki ka	Number of expected patients – number of patients that did not show up: 23 – 6 = __ Palo ya bakudi ba lebeletsweng – palo ya bakudi ba sa hlahellang: 23 – 6 = ___	23 – 6 = 17 patients visited the clinic

As seen in the above table, the task given was that learners had to calculate the number of patients that had visited the clinic on Monday after 6 of the appointments did not show up. In the context of this research study being done in the TMD, the researcher chose Southern Sotho as the language of choice, because majority of the schools in that district have Southern Sotho as the HL. From this model, the learners are able to identify those 23 patients that had made an appointment for Monday (clause 1), 6 of the patients did not show up (clause 2) and they must calculate how many patients actually showed up that day (clause 3). The translanguaging element is utilized by learners by means of translating what they understand from the clauses to their HL so that they understand the mathematical linguistic demands expected by the question to arrive at the solution.

2.1.4.3. Advantages of mathematical word problems

MWPs are seen as a challenge for the learners as it requires for them to apply their mathematical knowledge in translating their understanding of words into numerical representation. However, MWPs also provide some advantages for both learner and the educator.

In their study of Fijian primary school educators, Chandra and Dayal (2016: 34) stated that MWPs provide a special means for developing “conceptual understanding, strategic thinking and adaptive reasoning”, which are the three strands of mathematical proficiency. They furthermore indicate that MWPs advance the earners’ general problem-solving skills and construct a a grasp of mathematical procedures conceptually. This also encourages educators to assist learners in developing the skill of *mathematical modelling*. Mathematical modelling is defined by Haylock and Manning in Chandra and Dayal (2016) as “a process whereby we use the abstractions of mathematics to solve problems in the real world”. MWPs are seen as a challenge for the learners as it requires for them to apply their mathematical knowledge in translating their understanding of words into numerical representation. However, MWPs also provides some advantages for both learners and the educators.

Bayarcal and Tan (2023), state that when learners learn problem solving, they develop new traits such as: thinking habits of persistence and curiosity, and confidence in novel situations. These habits further assist them in navigating life inside and outside the mathematics classroom.

2.2. Theoretical Framework

2.2.1. Vygotsky's sociocultural theory

According to Adom, Agyem and Kamil (2018), a theoretical framework is a structure founded on an established theory within an academic discipline that relates to and considers the hypotheses of the study. Additionally, Nhan (2020) states that the theoretical framework provides support and reasoning for research objectives, problem statements, significance, and research questions; it also constitutes an essential basis for conducting literature reviews. Thus, one could argue that researchers adopt existing theoretical frameworks as guidelines to develop their investigation studies. In this study, the theoretical framework that guided the study is Vygotsky's sociocultural theory. One of the main components of the theory, according to Bux, Khoso, Memon, Memon and Pathan (2018), is the zone of proximal development (ZPD). They further state that the ZPD shows that a child's successful development is enhanced by social interaction. Additionally, research implies that learning happens quickly and actively when an educator guides a child. Within the ZPD, Vygotsky states that the "mediation, scaffolding and internalization" are elements of the ZPD that are implemented in the ZPD. Furthermore, Adendorff et al. (2018) states that the ZPD can be divided into four stages.According to Adendorff (2028:4), these stages are: stage 1- "where learning is assisted by a more knowledgeable other"; stage 2- "self-assisted"; stage 3- "where performance is developed and atomised"; and stage 4 – "where de-automisation of performance leads to going back through the ZPD and starting from stage 1 again". In this study, the researcher focused on mediation used by Grade 4 educators when teaching mathematical word problems. Furthermore, the researcher observed how the learner is scaffolded in the classroom.

2.2.2. Mediation in the Grade 4 mathematics classroom

Chauke and Tabane (2021: 2) define mediation as a process, whereby the learner "takes possession of the cognitive tools" that makes construction of knowledge possible. In addition, this can be done through systematic

explanation, demonstration, guided questioning and feedback. By being the mediator, the educator assists the learners in transforming their skills from lower to higher cognitive functions as they progress from prior to new knowledge. It is important to remember that mediation can only be done with assistance from someone, the educator or more knowledgeable learners, that has already acquired the skills to actively mediate the process of aiding learners in acquiring new knowledge.

In the four stages of ZPD, mediation is done at stage 1. As stated in the introduction, stage 1 is where learning is assisted by a more knowledgeable other. During a MWP lesson, the educator can mediate by doing an introduction lesson for the learners, whereby he or she can access the learners' pre-knowledge on MWPs. This is also where, the introduction of new terminology such as, difference of states subtract; sum of states add, altogether states add, and other multiple terminology that is used in the different tasks.

2.2.3. Scaffolding in the Grade 4 mathematics classroom

The Indeed Editorial Team (2023) define scaffolding as a technique of teaching that assists learners with understanding educational content by working with an educator or another learner with a better understanding of the content. Furthermore, they state that the material of the content is scaffolded into smaller chunks so the learner can expand their understanding of the material of the content. In mathematical word problems, scaffolding can be done by teaching MWP by sticking to one topic at a time and not including everything in one lesson and task, i.e., addition word problems, subtraction word problems and all the other mathematics topics' word problems.

In the initial stage of scaffolding, the educator presents the work and explains to the learner how and why they do things. Scaffolding occurs from stage 1 to stage 3 of the ZPD stages.

It is well acknowledged in the field of education that word problems are the most challenging and complex maths problems for learners to solve. One problem that makes this a particularly thorny issue is that word problems require the learners to carry out two distinct intellectual processes. They must first understand the problem and only then proceed to carry out the mathematics that will solve it. This can often be too much for learner, who is still struggling with the mathematics involved. This can result in the learner just “having a go” at the mathematics without a full understanding of the problem. Having been successful at the mathematics involved, the learner is likely to believe that he has correctly understood the question. If he then looks at the solution as he surely will, he is not likely to realize that he has made an error. He now understands that the problem is to solve the mathematical question that he has just answered because he believes that this is what the question is asking. This prevents the teacher from diagnosing the learners’ learning impediments for the given mathematics.

A model for overcoming these problems revolve around the idea of a teaching sequence that provides a guided cognitive apprenticeship in problem solving. A more simplified version of this model in the context of word problems is to commence with several lessons of educator’s interpretation, where a skilled educator models thinking processes and problem solution on the series of problems the whole class. The educator will firstly, provide a direct instruction to the learners by explaining the word problems. After the educator has done this, he or she will ask the learners whether they understood what was being explained. Furthermore, this will indicate to the educator whether he/she needs to further explain or do more examples for the learners. Secondly, the educator will construct another example that will be done step-by-step with the learners. By doing so, the educator is placing more learning responsibility on the learners and getting them to understand how to solve the task given on their own. Lastly, as the educator has completed the examples with the learners, he or she allows the learners to do another example on their own, before attempting to do the classwork task given. This will then be followed by a similar sequence of lessons, where the teacher is coaching learners, who are working in small groups on similar

problems. Over time, the teacher would release the responsibility of problem solution to the learners until they are working independently.

2.2.4. Internalization in the sociocultural theory

Abtahi (2021) defines internalization, as the process on an individual basis from experiences that are shared in society by which knowledge constructed. Turner and Sarama (2020) state that, in context with MWPs, that internalization entails assimilating knowledge or information into one's thought processes, with the ultimate objective being the use of problem-solving techniques by learners on their own. Furthermore, internalization refers to the process of absorbing knowledge or information and integrating it into one's mental processes. In the context of mathematical problem-solving, internalization involves learners moving from external guidance and support to independently applying problem-solving strategies.

Internalization occurs through social interactions and collaborative learning experiences. By means of social interactions and cooperative learning opportunities led by educators, who offer scaffolding support, learners eventually acquire the abilities required to independently solve issues and acquire a more profound comprehension of the processes involved in problem-solving. In the classroom, teachers can facilitate internalization by providing scaffolding and support to help learners develop their problem-solving skills. As learners engage in solving maths problems with guidance from their teacher or peers, they gradually internalize the strategies and techniques needed to solve problems independently. Through internalization, learners not only acquire mathematical knowledge and skills but also develop a deeper understanding of problem-solving processes. By internalizing problem-solving strategies, learners become more proficient problem solvers and are better equipped to tackle complex mathematical problems on their own.

As learners continue to internalize problem-solving strategies, they also become more confident in their abilities to solve maths problems. This

confidence can lead to increased motivation and engagement in mathematics, as learners see themselves as capable problem solvers. Additionally, internalization allows for the transfer of knowledge and skills to new situations, as learners are able to apply what they have learned to different mathematical contexts. Overall, the Vygotsky's theory of internalization provides a valuable framework for understanding how learners develop mathematical problem-solving skills and how teachers can support this development through scaffolding and collaborative learning experiences.

2.2.5. Conclusion

This chapter covered the literature review and the theoretical framework that guided the study. The literature review section consisted of a discourse on firstly; the teaching of multilingual classrooms, which is further extended by a discussion of the use of translanguaging in a multilingual classroom. Secondly, a discussion of the mathematical tasks used in the classroom, which is extended by a discussion on the types of mathematical tasks used in the classroom and the use of learning and teaching support material to teach MWPs, which further explains how manipulatives are used to assist in teaching MWPs. Lastly, a discourse on the teaching of MWPs was done. This is a sub-topic that explored the challenges faced in teaching MWPs, the strategies suggested to teach Grade 4 MWPs and the advantages of MWPs.

The theoretical framework adopted for this study is Vygotsky’s sociocultural theory. Palincsar and Scott (2013) defines the sociocultural theory as a theory that focuses on how social interactions and culturally organised activities plays an influential role in psychological development. This section also gave a discussion on the three elements from the ZPD, which is the main component of the sociocultural theory. These three elements are mediation that is done by the educator as the knowledgeable person, how learners are scaffolded in the classroom and how knowledge is internalized. The next chapter focuses on the research methodology of the study.

CHAPTER 3: RESEARCH METHODOLOGY

3.1. Introduction

Research methodology describes the methods, which were used to proceed with the study. In addition, it also involves the conducting of experiments, tests, survey, etc. When one does research, they can opt to use quantitative research methodologies, qualitative research methodologies or mixed methods research (MMR) which combines quantitative and qualitative). Moreover, Goundar (2019) adds that it involves the learning of various techniques that can be utilised in conducting research and conducting tests, experiments, surveys, and critical studies. For this study, the researcher adopted the MMR methodology. In this section, the researcher defined the mixed methods methodology, discussing the advantages and the disadvantages of using the approach in context with the study.

3.1.1. Defining the mixed methods methodology

Denscombe (2007: 107), defines mixed methods as a “research strategy that crosses the boundaries of conventional paradigms of research by deliberately combining methods…” He and Johnson and Schoonenboom (2017) further simplify the definition as a research strategy that combines both quantitative and qualitative methods. LinkedIn (2023) further defines the mixed methods approach as the methodology that is used to enhance the validity and credibility of the study or expands the scope of the research project. In this study, the researcher used the quantitative data, collected from the questionnaire to enhance the results from the post lesson interviews and lesson observations. By doing so, the researcher triangulated the findings from both data sets so that the quantitative results supports the findings of the qualitative results.

Using the MMR approach, presents multiple advantages that benefit the study. Dawadi et al. (2021) highlight that using mixed methods enables the researcher to answer the research questions with sufficient depth and breadth. In addition, they add that using MMR approaches supports the researcher in developing an in-depth and comprehensive understanding of

the research phenomenon. Hafsa (2019) adds that adopting MMR creates expansion, whereby the findings derived from the initial phase of the investigation, is expanded. Furthermore, blending two diverse but related answers to a single research question using approaches from quantitative and qualitative creates a complementarity results discussion.

In this study, the use of the survey questionnaire coupled with the lesson observations and the post lesson interviews, enabled the researcher to triangulate between the two data sets. The emerging themes from the qualitative data were supported by the responses from the survey questionnaire. For the qualitative data, there were only two participants that took part in the qualitative data collection, therefore, to validate what was observed and said in the interviews, the responses of the 129 educator participants of the survey questionnaire gave more insight to the conclusions derived from the qualitative data sets. For instance, Educator A and Educator B both identified the language used in MWPs as a challenge for the learners. However, this was only an observation made by two educators, therefore, the 59 educators that participated in the survey questionnaire, agreed that the language used is what that makes MWPs harder. This result indicates, indeed, that the language used makes MWPs harder and it is a challenge that is identified by a lot of educators.

3.2. Paradigm

3.2.1. Introduction

Paradigm, according to Kivunja and Kuyini (2017), is defined as the conceptual lens through which researchers inspect the methodological aspects of their research study to determine their choice of research methods that are utilised and how the analysis of data will be done. Chilisa and Kawulich (2011: 1) state that a paradigm is a way of describing the world view that is “informed by the nature of social reality, ways of knowing and the ethics and value systems.” Alharthi and Rehman (2016: 51) further add that a paradigm can be defined as “a belief system and the theoretical framework with the assumptions about: a) ontology, b) epistemology, c) methodology

and d) methods". Therefore, it is a way that researchers choose to understand the reality of the world and study it. The research paradigm that the researcher employed is **pragmatism**.

3.2.2. Defining pragmatism

Johnson in Maarouf (2019), defines pragmatism as an advanced philosophy that provides the logic for combining the quantitative and qualitative approaches and methods. Furthermore, Brierley (2017) states that pragmatism addresses the notion of "what works?" Therefore, the pragmatism approach guided the researcher in employing quantitative and qualitative methods that guided the proposed study in answering the research questions at hand. Furthermore, this study intended to solve a practical problem of mathematical word problems (MWPs) that is faced by Grade 4 learners when doing the tasks, therefore, pragmatism encouraged the researcher to not be restricted to only employing one research approach.

3.3. Research Approach

For the undertaken study the researcher adopted the mixed methods approach. Denscombe (2007: 107), defines mixed methods as a "research strategy that crosses the boundaries of conventional paradigms of research by deliberately combining methods…". He and Johnson and Schoonenboom (2017) further simplify the definition as a research strategy that combines both quantitative and qualitative methods. For this study, the researcher mainly utilised the qualitative approach, however, a quantitative approach was employed to support the qualitative approach of the study.

3.4. Research Design

3.4.1. Introduction

Daniel (2016) points out that research designs can be classified as qualitative, quantitative, or mixed methods. Morse and Niehaus (2016) adds that in mixed methods design (MMD), one set of data findings confirms the other set of findings.

The research design that the researcher used is the MMD.

3.4.2. Defining mixed methods design and its benefits for this study

Bidari et al. (2023) and Dawadi et al. (2021) define MMD as a research design that combines qualitative and quantitative methods. They further state that this combination of data sets allows for the researcher to answer the research questions with greater certainty and gives a more complete picture of the problem the research seeks to solve. There are six types of research designs that form the mixed methods. However, for this study the approach that was used is the embedded design.

Johnson and Schoonenboom (2017) define the embedded design as the research design, whereby one type of design is used in order to enhance the overall design. In addition, Hesse-Biber and Leavy (2017) refer to the embedded design as nesting design. They further define nesting design as a design, whereby one method is used as a primary method and additional data collected using the secondary method.

Bidari et al. (2023) and Sharma (2023) state that there are multiple purposes for using MMD. However, for this study, the purpose for the chosen research design was to firstly, triangulate data by using the questionnaire (quantitative) and the lesson observation and post-lesson interview (qualitative) to confirm and clarify the results of the study; secondly, to enrich the findings of the study, which would give allowance for the researcher and the readers to gain a better understanding of the teaching of Grade 4 MWPs in the Thabo Mofutsanyana District; and lastly, to increase the validity and reliability, as the data sets provided multiple points of views on the research problem.

Therefore, the questionnaire distributed, to collect the quantitative data, allowed the researcher to collect data from a large number of participants, while the qualitative data, collected from the lesson observation and the post-lesson interview, was only limited to the two teachers that were observed. In addition, the quantitative data enhanced that qualitative data in order to answer the research questions in a way that could be explicitly understood.

3.5. Sampling Method for Research Participants

3.5.1. Introduction

The sampling procedures that was used for both the qualitative and quantitative methods were **non-probability** sampling. Radhakrishnan (2014) states that non-probability sampling is unlikely to produce accurate and representative samples like probability sampling. Non-probability sampling is when the researcher cannot predict that each population element will be represented.

3.5.2. Research participants for the questionnaire

The Thabo Mofutsanyana District consists of 13 circuits with approximately more than 10 000 educators altogether (Kagiso Trust, 2023). The researcher implemented the stratified sampling, to collect quantitative data, as a means of choosing the interest group of the study. Thomas (2022) states that in a stratified sample, the researcher divides a population into strata, based on their specific characteristics such as race, gender, location, and others. The Thabo Mofutsanyana District circuits was divided into strata based on location and availability; however, the survey questionnaire was distributed amongst the Circuit 9 Grade 4 educators. The circuit 9 Grade 4 educators were chosen as the interest group of the study as they are conveniently located. Therefore, 129 Circuit 9 educators took part in the questionnaire.The questionnaire was used to gather information on the perceptions and experiences that multiple educators in the Circuit 9 have with teaching MWPs.

3.5.3. Research participants for the lesson observations and post lesson observation interviews

For the qualitative research section, the researcher used purposive sampling. Radhakrishnan (2014) defines this sampling technique as the sampling in which the participants will be purposefully picked to benefit the study. Therefore, the participants for the interview and post lesson observations were two Grade 4 mathematics educators. These educators were purposefully picked based on participating in the survey questionnaire and

being Grade 4 mathematics educators within Circuit 9. Then a deliberate effort was made to work with the two chosen educators.

3.6. Data Collection

3.6.1. Introduction

Data collection methods or strategies are used to help the researcher collect data that will aid in building the study. In the MMR, the researcher used a combination of qualitative and quantitative data collection strategies. The quantitative data was collected through a survey questionnaire. Furthermore, the qualitative data was collected implementing: firstly, lesson observations and secondly, post lesson interviews, which acted as a lesson reflection.

3.6.2. Collection of quantitative data

The quantitative data was collected through a survey questionnaire. Denscombe (2007:7) defines a survey as “obtaining data for mapping”. The survey questionnaire consisted of questions, investigating the challenges that Grade 4 educators face in the classroom and what strategies they use. The researcher constructed a survey questionnaire, that she distributed to the Circuit 9 Grade 4 educators.There were 129 participants from various Circuit 9 schools in the district that took part in the questionnaire. The Likert scale that was used to answer the questions, ranged the possible responses from *strongly disagree* to *strongly agree*. The purpose of this questionnaire was to gather information about Grade 4 educators’ experiences and perceptions on the teaching of MWPs. The quantitative data was collected first to get the perceptions of educators about about teaching Grade 4.

The researcher was able to collect quantitative data from 129 participants. From these questionnaires, the researcher was able to get educators’ perceptions on teaching Grade 4 MWPs and teaching Grade 4s in general. For the questionnaire, the participants answered a questionnaire that consisted of the following 15 questions:

a) I am a qualified educator

b) I enjoy teaching mathematics
c) I am confident to teach mathematics
d) I am not competent to teach mathematics
e) Mathematical word problems are hard to teach
f) I like to teach Mathematical word problems
g) I use Teaching Aids to teach word problems
h) I take word problems from textbook(s)
i) I create my own word problems
j) Learning mathematics in English in Grade 4 makes it hard for learners
k) Grade 4 learners fail word problems
l) Mathematical word problems are hard because of the language used
m) Mathematical word problems are hard because of the high cognitive demands of the tasks
n) Mathematical word problems must be taught in home languages
o) Mathematical word problems must be taken out of the syllabus

3.6.3. Qualitative data instrumentation

For the collection of qualitative data, the researcher employed two strategies; firstly, lesson observation and secondly, post lesson observation interviews (lesson reflection). Firstly, Ferrare and Hota (2013) define lesson observation as a method, whereby an observer is directly observing a teaching practice as it unfolds in real time. Furthermore, the observer or analyst takes notes of the instructional behaviours in the classroom or from videoed lessons. The researcher did four lesson observations of two Grade 4 mathematics educators were conducting lessons on MMR. These educators were chosen from two Circuit 9 schools and each educator conducted two lessons. During the lesson observation, the researcher used a “lesson observation instrument”, which guided the observer on what she should focus on during the lesson. The focus areas on the lesson instrument were as follows:

- Focus topic of the observation
- Types of strategies used in the lesson
- The types of tasks used during the lesson

- Effectiveness of learning and teaching support material
- Additional notes and comments (including the use of language)

After the observations were done, the researcher conducted post lesson observation interviews, which can be referred to as lesson reflections for the two observed educators. The aim of this interview as a lesson reflection, was to assist the educator to reflect on their lesson and practice, and for the researcher to be able to fact check on the observation made. Furthermore, Gutierez (2015) states that reflection is the best method for personal development for educators. Therefore, the post lesson observation interview that was conducted acted as a follow-up of the lesson observations to further discuss “how?” the lessons were taught and “why?” the educators taught word problems the way they did. After the lesson observation was done, the researcher conducted a post lesson observation interview. The post lesson interview served as a reflection of the lessons that were observed. In this interview, the educator that was observed was answering the following questions:

- How many years have you been teaching Grade 4 mathematics?
- What would you consider as the successes in lesson 1?
- What would you consider as the successes in lesson 2?
- What would you consider as the challenges in lesson 1?
- What would you consider as the challenges in lesson 2?
- What influenced your choice of learner educator support material? **OR -** Why did you not use any learner educator support material?
- Do you deem it necessary to use teaching aids?
- In your opinion, what challenges do educators encounter when teaching mathematical word problems?
- Besides getting mathematical word problems from textbooks, are there any other platforms (such as workshops) where they are discussed? If not, would you suggest that it be discussed?
- Which strategies, would you recommend to other mathematics educators to use during a mathematical word problems lesson?

The observation instrument and the post lesson interview instrument were thematically analysed to get the main emergent themes from both data sets.

3.7. Data Analysis

3.7.1. Defining data analysis

Ashirwadam (2014) defines data analysis as a method, whereby research problems are solved using collected data. In this study, the researcher did a thematic analysis on the lesson observation and the post lesson interview data collected and used excel to present and analyse the questionnaire.

3.7.2. Questionnaire analysis

Initially, the the researcher initially decided to use the Statistical Package for Social Sciences (SPSS) to analyse the questionnaire results. However, after continuous attempts to install the SPSS software program, nothing materialized. The researcher then made a request to the University's Information and Communication Technology (ICT) team but there was no response even from follow-up emails. Therefore, the researcher had opted to use Excel spreadsheet to analyse the questionnaire responses. Berk and Carey (2009) state that the implementation of Excel for analysis of data harnesses an understanding of the subtleties and complexities of analysis, which becomes an imperative part of understanding our world. Therefore, the results of the data collected from the questionnaires in this study were entered onto a spreadsheet on Excel so that it could be analysed to get a all-inclusive kenning of educators' perceptions and experiences of teaching MWPs. The data was further analysed by comparing the percentages and numbers per answer to gather where the educators have common perceptions and differences in teaching MWPs.

3.7.3. Analysis of lesson observation and post lesson interview

The researcher chose to do a thematic analysis of the observation and post lesson interview. Thematic analysis is defined by Moules, Norris, and Nowell (2017) as a qualitative method that can be utilised to analyse large qualitative

sets. Castleberry and Nolen (2018) add that thematic analysis is a method that consists of “identifying, analyzing and reporting patterns (themes) within data” Furthermore, Bowen (2009) states that the researcher reviews and rereads data carefully in order to form codes and construct categories. Examples of thematic analyses include interview transcripts, questionnaire responses and field observations. The themes that emerged linked to the research questions.

3.8. Validity and Reliability

Golafshani in Goes and Simon (2016), states that validity, in qualitative research, specifies the consistency and trustworthiness regarding activities and events situated with the phenomenon that is being studied in the research. He further adds that it increases transparency and decreases the opportunity for the researcher to be biased.

To show validity, the researcher gave the participants a copy of the transcribe from the interviews to confirm that what the researcher had transcribed was exactly their words and that the researcher had not added some of her opinion and made it theirs. By doing so, the researcher did **member checking.**

3.9. Ethical Considerations

For ethical considerations, the researcher used the strategy of **informed consent**, where she informed the participants about all the details of the study.

The researcher also kept **anonymity and confidentiality**, where the identity of the participants was not be revealed in the study (unless the participant requests for their identity to not remain anonymous). Fleming and Zegwaard (2018), define ethical considerations as the approval that is given by participants before the start of data gathering from human participants as the data will be taken from the opinions of people.

Ethical clearance was sought from and successfully granted by the University of the Free State. The ethical clearance number for this research study is **UFSHSD2023/0887** (**See Appendix A**). Furthermore, ethical clearance was applied for from the Free State Department of Basic Education and was granted (**See Appendix C).** However, as the approval of ethical clearance from the university took time to be approved, the researcher had to apply for an extension from the Free State Department of Education so that she would be able to collect the qualitative data from the two schools.

3.9.1. Informed consent

HREC (2021) defines informed consent as a process, whereby an informed competent individual voluntarily opts to be a human participant in a research study. Furthermore, they state that as the process is ongoing, a consent form is required to be filled in by the participant before the study starts. Prior to the collection of data. A **request for permission to conduct research (see Appendix D)** letter was submitted to the principal. The purpose of this letter was to inform the school of the type of research that was going to be conducted, the purpose, potential benefits and other important elements of the study. After, the principal and educator participant gave permission, then a consent form (**see Appendix E)** was given to the participant. The consent form gives details on the research study so that the participant is knowledgeable about the study they will be voluntarily participating in, before they sign and give consent. Furthermore, the form clearly states that the identity of the participant will be kept anonymous unless he/she prefer otherwise.

3.9.2. Anonymity and confidentiality

Anonymity and confidentiality is defined as keeping the participants' identity anonymous to protect them from potential harm. Confidentiality refers to the researcher being the only one knowledgeable about the participants' identities. The researcher states that she explicitly informed participants, who agreed to partake in the research project, through consent forms, that no

pressure or coercion was applied during recruitment. She also guaranteed anonymity regarding the information provided and emphasized that participation was entirely voluntary. Additionally, the author reassured participants of their basic human rights protection throughout all stages of the study while ensuring confidentiality and non-disclosure of personal identities or information except as required by law. Furthermore, to ensure data privacy, rights were upheld and respected, data would be maintained for six months before being destroyed.

3.10. Conclusion

This chapter employed the MMR methodology as the research methodology. It defined the research methodology and highlighted the benefits it had on the study. The paradigm the researcher employed for the chapter was pragmatism. Since the researcher collected both qualitative and quantitative data, there were two sampling procedures employed. For the survey questionnaire, stratified sampling was implemented while purposive sampling was employed for selecting the participants for lesson observations and post lesson interviews. The data collection instruments used to collect the data were also explained. Furthermore, the use of thematic analysis and Excel was highlighted as the analytical tools. This chapter also outlined how validity and reliability were kept while providing the relevance of the ethical process for the study. The next chapter focuses on the presentation and analysis of the data collected.

CHAPTER 4: DATA PRESENTATION , ANALYSIS AND DISCUSSION

4.1. Introduction

Chapter 4 is divided into two sections, which is the analysis of the quantitative and the qualitative data. 129 Circuit 9 educators took part in the survey questionnaire. The two participants that were observed and interviewed were invited from the 129 educators that took part in the survey questionnaire. The two educators were chosen based on the location of their schools as they were easily accessible. The study aimed at exploring the teaching of mathematical word problems (MWPs) in Grade 4 mathematics at the Thabo Mofutsanyana District. This chapter, in accordance to the objectives of the study, presents an analyses of the data sets that were generated. The objectives allude to an investigation of the educators' experiences and perceptions of teaching MWPs in Grade 4 mathematics and to determine the strategies used by mathematics educators to teach MWPs, moreover, to classify the type of tasks used by educators when teaching mathematical word problems. Lastly, the final objective was to identify the teaching resources that Grade 4 educators use when teaching MWPs.

As this was a mixed method study, an in-depth discussion of the quantitative data collected was done, whereby the results of the questionnaire were presented and followed by an analysis of the results. In addition, the qualitative data collected was thematically analysed, where a discussion of the themes occurring from data was done while also triangulating it with the quantitative data set.

4.2. Analyses of the Survey Questionnaire

Table 4.1: Survey Results

Score / Questions	1	%	2	%	3	%	4	%	5	%
a. I am a mathematics qualified educator.	0	0%	0	0%	03	2,3 %	09	7%	117	90, 1%
b. I enjoy teaching mathematics.	0	0%	02	1,6 %	06	4,7 %	13	10, 1%	108	83, 7%

c. I am confident to teach mathematics.	0	0%	02	1,6 %	11	8,5 %	14	10, 9%	10 2	79, 1%
d. I am not competent to teach mathematics.	16	12, 4%	66	51, 2%	26	20, 2%	17	13, 2%	4	3,1 %
e. Mathematical word problems are hard to teach.	01	0,8 %	35	27, 1%	52	40, 3%	33	47, 3%	08	3,8 %
f. I like to teach Mathematical word problems.	0	05	07	5,4 %	56	43, 4%	61	47, 3%	05	7,8 %
g. I use teaching aids to teach word problems.	01	0,8 %	02	1,6 %	60	46, 5%	56	43, 4%	10	7,8 %
h. I take word problems from textbook(s).	01	0,8 %	06	4,7 %	44	34, 1%	62	48, 1%	16	12, 4%
i. I create my own word problems.	04	3,1 %	07	5,4 %	51	39, 5%	60	46, 5%	07	5,4 %
j. Learning mathematics in English in Grade 4 makes it hard for learners.	0	0%	05	3,9 %	65	50, 4%	48	37, 2%	11	8,5 %
k. Grade 4 learners fail word problems.	01	0,8 %	06	4,7 %	69	53, 5%	46	35, 7%	07	5,4 %
l. Mathematical word problems are hard because of the language used.	01	0,8 %	09	7%	60	46, 5%	50	38, 8%	09	7%
m. Mathematical word problems are hard because of the high cognitive demands of the task.	07	5,4 %	36	27, 9%	37	28, 7%	41	31, 8%	08	6,2 %
n. Mathematical word problems must be taught in home languages.	12	9,3 %	50	38, 8%	31	24 %	29	22, 5%	07	5,4 %
o. Mathematical word problems must be taken out of the syllabus.	16	12, 4%	50	38, 8%	31	24 %	26	20, 2%	06	4,6 %

Table 4.1 above presents the results for the questionnaire, which was distributed amongst the Circuit 9 primary school educators in the Thabo Mofutsanyana District. There were 129 participants from various Circuit 9 schools in the district that took part in the questionnaire. The Likert scale that was used, ranged the possible responses from *strongly disagree* to *strongly*

agree. The purpose of this questionnaire was to gather information about Grade 4 educators' experiences on the teaching of MWPs.

Statements a-d of the questionnaire were used to analyse whether the participants of the study are qualified mathematics educators that are confident and were competent in teaching mathematics. Statements e-i, focused on the educator's perception on MWPs and how they teach MWPs. Statements j-l, focused on the educators' observations on Grade 4 learners when it comes to their challenges of learning mathematics in English and whether they fail MWPs. Statements m-o, was centred on the level of difficulty of MWPs and whether the educators consider it to be a relevant concept in the mathematics syllabus.

From statements a-d, it states that 91% of the educators believe that they are strongly qualified to teach mathematics, however, the remaining 9% range from neutral and agree. There are multiple reasons that could contribute to these 12 participants' choice. These possibilities could range from some having not major in mathematics in university, and another is that they are still busy with getting their qualifications. However, it is startling to see that there are educators that are not competent to teach mathematics. This is an alarming discovery that can be explored in another study.

In statement (e), which states "mathematical word problems are hard to teach", there are 47,3% educators that agree and 3,8% that strongly agree with the statement, however, 27,9% disagree and strongly disagree with the statement, which shows that they do not agree with the notion that MWPs are hard to teach. One can derive that the 51,1% educators, who do not find that MWPs are hard to teach are the ones that have found successful strategies that can be used in the classroom that benefits the learners. In contrast, the 56 educators that are neutral show that there is still a need to develop more strategies that can be successfully used. One of the successful strategies, according to Martinez and Ji-Yeong (2023), is the successful use of translanguaging, which provides a conducive learning environment for bilingual and multilingual learners so that they are not pressured by the

linguistic demands of MWPs. In conclusion, 40,3% (which is the highest in statement (e) are neutral about MWPs being hard to teach. Educator A in the interview stated that educators not understanding the concept correctly is a contributing factor as to why it is difficult to teach MWPs, while Educator B alluded that using English which is not the learners' Home Language makes it difficult to teach the concept. Making use of "mediation" which is one of Vygotsky's elements of the Zone of Proximal Development (ZPD). By using mediation, the educator uses the learners prior knowledge to aid them in developing a kenning of the questions asked in the task.

From statement (f), the researcher observed that 3,8% of the participants like to teach MWPs, while 43,4% are neutral. One can deduce that, as much as MWPs are challenging to teach, there are still educators that enjoy the teaching of the topic. Educators that enjoy teaching MWPs are the ones that understand that MWPs provides a speciality such as a means for developing "conceptual understanding, strategic thinking and adaptive reasoning" (Chandra and Dayal, 2016). The use of teaching aids in mathematics assists in strengthening the content taught. Statement (g) refers to the use of teaching aids to teach word problems. 2,4% of the participants do not agree with the use of teaching aids during the lesson. This brings about a concern as it can conclude that these educators generalise the learning needs of the learners. However, 97,7% of the participants agree with the use of teaching aids. Fortunately, this shows that there are educators, who go above and beyond to "represent explicitly and concretely mathematical ideas that are abstract" (Adendorff et al. 2018:1). As an educator, one has to remember that the learners need guidance when it comes to understanding abstract mathematical ideas and MWPs can be identified as such. In addition, Moleko (2018: 159) states that bringing manipulatives into the classroom assists learners to develop a more in-depth comprehension of the concepts by "seeing them in reality". educator A and Educator B both agree that the use of teaching aids assists greatly with the guidance of getting the learner to have a more refined understanding of the MWPs.

Relying only on the textbook creates a general picture for the learners, therefore, resulting in them not being able to understand the problem they have to solve. In statement (h), the researcher observed the perception that educators have on taking word problems from the textbook. 60,5% of educators agree with taking word problems from textbook(s). However, these educators have to be careful to not only use MWPs from the textbook as these are general problems and not ones that learners can identify with. When educators create their own MWPs, it allows them the chance to create ones that learners can identify with. In statement (i), 8,5% of educators disagree with creating their own word problems, while 91,4% agree with creating their own word problems. The 8,5% that does not agree with creating their own MWPs, raise a question as to whether these educators do not find the need to assist the learners in relating mathematical content to the learners' surroundings. Furthermore, it implies that they are not applying the general aim from RSA DBE (2011:4) which states that the "curriculum aims to ensure that children acquire and apply skills in ways that are meaningful to their own lives."

In the Thabo Mofutsanyana District, most of the schools have Sesotho as their home language (HL), therefore this implies that English is a first additional language. However, the Department of Basic Education has instructed that mathematics be taught in the language of learning and teaching - which is English. In statement (j), the focus is on how English makes it difficult to learn maths in Grade 4. 3,9% of the educators disagree that English makes it difficult to learn maths in Grade 4. Owen-Smith (2010) states that in the first three years of schooling, learners are taught in their HL, and as they progress onto the intermediate phase, the language of learning and teaching (LoLT) changes to English. The progression of language change makes it challenging for Grade 4 learners to comprehend the subject content being taught in English, therefore, one can agree with the perception of the 96,1% that agree with English making it "hard" for Grade 4 learners to learn mathematics in English. MWPs are considered as complex questions; therefore, they fall under the "complex procedure" cognitive level in mathematics. This cognitive level counts for only 20% of a formal task. In

statement (k), the researcher has observed that 53,5% of educators are neutral about Grade 4 learners failing word problems. This can be due to multiple reasons. Bhengu (2020) states that the contributing factors to Grade 4s failing MWPs are the transition of being taught in English in the Intermediate Phase from being taught in their HL in the Foundation Phase, and the lack of teaching methods in South Africa.

MWPs requires for the learner and educator to be proficient in the LoLT, which is English. If learners and educators are not proficient in English, then it makes MWPs challenging to teach and learn. Statement (l) states that MWPs are hard because of the language used. 7,8% of educators disagree with the statement while 92,3% of educators agree that the challenge of MWPs is the language used. In her interview, Educator B further states that the use of English in a MWP s task is one of the challenges that mathematics educators are faced with. Nkambule (2009) in Moleko (2018), states that the restriction for learners to use their HL as a resource for comprehending mathematical concepts restricted learners from developing a deeper comprehension of the word problems. In addition, Essien (2013) and Bhengu (2020), adds that educators are faced with having to balance mathematical language and LoLT so that learners are able to perform better in solving word sums. Moleko (2018) states that problem solving requires both cognitive and affective processes as one needs to select the best mutually exclusive ways and apply it in order to solve the problem. This requires for both the learner and educator to develop “cognitive and affective” skills in solving mathematical word problems.

In statement (m), 33,3% of the educator participants disagree with the notion that MWPs are hard because of the high cognitive demands of the task. Mathematical tasks have a certain cognitive demand of the learners when they are required to solve tasks. Hsu (2013) states that cognitive demands, according to a study by Stein et al. (2000), can be classified into four levels. They are memorisation, procedures without connections, procedures with connections, and doing mathematics. 38% agree with the notion while 28,7% remain neutral. Hsu (2013) highlights that tasks that involve procedures with connections or doing mathematics require for real understanding of

mathematical concepts and ideas as well as the selecting of suitable strategies when solving tasks. Furthermore, these tasks are classified as high cognitive demand tasks. The reality of most schools is that they have multilingual learners. Restricting learners to use their HL during a MWP lesson increases the chances of few interactions between the learner and educator in the classroom.

From the survey, in statement (n), we observe that 48,1% of educators disagree that MWPs should be taught in the learners' HL. In Setati and Moschkovich (2010), one of the authors expressed that her greatest struggle, as a scholar, was being taught mathematics in a language that she was not self-assured in. This is a reality faced by most learners in township and rural schools. Molotja in Moleko (2018) states that the use of "previously disadvantaged" languages elevates them to their rightful status. Molotja further adds that using learners' HL assists in creating "meaning making" where the LoLT, which is English, disappoints in facilitating the process of meaning making. This statement supports the 27,9% of educators that agree with MWPs being in home languages.

However, the researcher agrees with the neutral 24% as using HLs to teach MWPs can be an advantage and a disadvantage. The advantage is that the use of home languages can assist African learners, whose mother tongue is not the same as the prescribed language (Mpalami, 2022). In contrast, the disadvantage is that, according to Dockrell, Donau, Knudsen, Misfud and Papadopoulus (2021), there is a lack of teaching materials available in the second language.

RSA DBE (2011: 9) lists "learn to investigate, analyse, represent and interpret information; learn to pose and solve problems and build an awareness of the important role that mathematics plays in real life situations including the personal development of the learner" as some of the specific skills that learners should learn and build in mathematics. The 24,8% of educator participants in statement (o) that agree with the removal of MWPs in the syllabus, do not see the need for learners to develop the above-mentioned skills. This should make the educators aware that they are depriving learners

of learning and building specific skills that they can apply to their everyday lives.

4.3. Presentation and Analysis of the Qualitative Data

4.3.1. Emperical settings

School A is one of the public combined schools in Circuit 9 that is situated approximately 13 kilometres from the central Phuthaditjhaba. The school ranges from Grade R up to Grade 7. The school roll sits at approximately 780 learners and has 30 educators. The researcher chose the educator from this school as it is within the Circuit 9 schools that took part in the questionnaire.

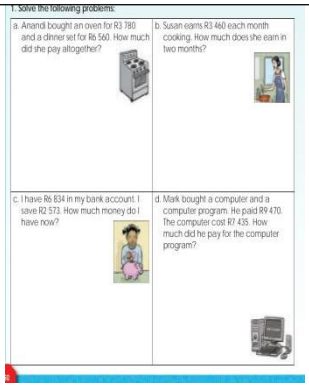
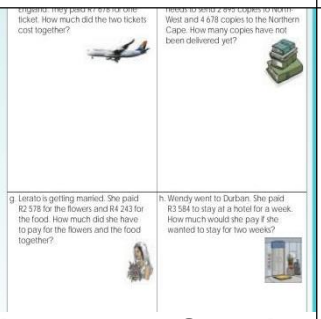
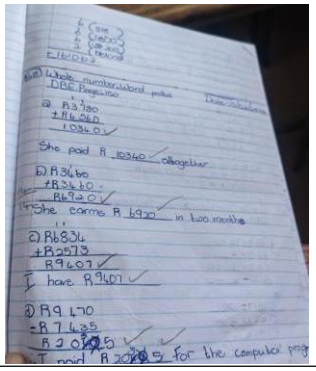
School B is one of the public primary schools in Circuit 9 that is situated approximately 7 kilometres from the central Phuthaditjhaba. The school ranges from Grade R up to Grade 7. The school roll sits at approximately 661 learners and has 18 educators (excluding Grade R educators). The researcher chose educator from this school as it is within the Circuit 9 schools that took part in the questionnaire.

4.3.3. Lesson synopses

Study.com (2024) defines a lesson synopsis, which can also be called a lesson summary, as a learning report, which the observer fills in to give structured feedback. In addition, it describes the flow of the lesson to give the report reader context of the lesson. In Table 4.2. the researcher did the lesson synopses for Educator A and in Table 4.3, it was the lesson synopses for Educator B.

Table 4.2: Lesson Synopses for Educator A

EDUCATOR A				
LESSON	**TIME**	**LESSON TOPIC**	**CONTENT**	**DESCRIPTION**
1	1 hour	Introduction to word problems (addition).	Mental maths questions: 1. *Count:* *a. Backwards in two's from 64 to 56* *Answer: 64; 62; 60; 58; 56* *b. Backwards in tens from 630 to 580.* *Answer: 630; 620; 610; 600; 590; 580* I have R400. Computer games cost R75 each. How many games could I buy? **Image 4.1: word problem question used in the introduction.**	The educator began by doing a Mental maths task for the first 10 minutes of the lesson. The learners were then asked to take out their DBE workbook (Department of Basic education Workbook) and open on page 162 (refer to image 4.1). When the introduction lesson part of the lesson was complete, the educator told the learners to open in page 150 in their DBE workbook. The learners answered the questions a-d as the classwork task and completed the rest of the questions (e-h) for homework.

			 1. Solve the following problems: a. Anandi bought an oven for R3 780 and a dinner set for R6 560. How much did she pay altogether? b. Susan earns R3 460 each month cooking. How much does she earn in two months? c. I have R6 834 in my bank account. I save R2 573. How much money do I have now? d. Mark bought a computer and a computer program. He paid R9 470. The computer cost R7 435. How much did he pay for the computer program? **Image 4.2.: Sample of classwork task questions showing the types of tasks used by educators for MWPs.**	
2	30 min.	Homework corrections.	 ticket. How much did the two tickets cost together? West and 4 678 copies to the Northern Cape. How many copies have not been delivered yet? g. Lerato is getting married. She paid R2 578 for the flowers and R4 243 for the food. How much did she have to pay for the flowers and the food together? h. Wendy went to Durban. She paid R3 584 to stay at a hotel for a week. How much would she pay if she wanted to stay for two weeks? **Image 4.3.: Sample of Homework task questions used by educator during the lesson.**  She paid R 10340 altogether She earns R 1930 in two months I have R 9407 for the computer	On day one, the educator gave the learners a homework task, whereby they would be solving four-word problems. The lesson for day was quite short, therefore, the educator started with five minutes of mental maths before continuing with the questions.

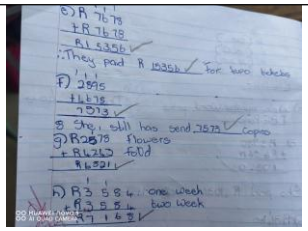
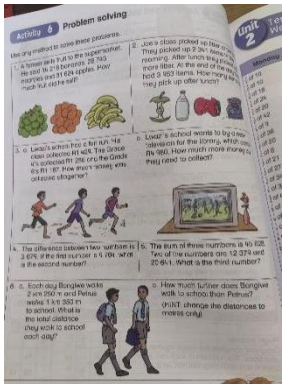
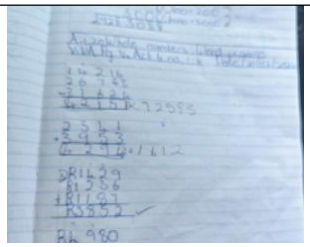
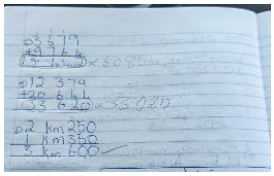
			 **Image 4.4.: Sample of learner's work.**	

Table 4.3: Lesson Synopses for Educator B.

EDUCATOR B				
LESSON	**TIME**	**LESSON TOPIC**	**CONTENT**	**DESCRIPTION**
1	1 hour 30 minutes	Whole numbers: Addition word problems	 **Image 4.5: Handout taken by the Educator from VIVA Grade 5 mathematics textbook that will**	The educator began the lesson by addressing the learners and instructing them to take out their task books and handed copies of the questions they will be answering as she has taken the question from a different textbook. The educator decided to take the task from the Grade 5 mathematics VIVA textbook on page 74, as it offered more

			be used for the Grade 4 classwork task. The questions are written in English as it is the LoLt Educator B also stated that she preferred using the task from the Grade 5 textbook as the activity was more challenging for the learners as it had more MWP key words.	variety of MWP keywords. The task consisted of 6-word problem questions. Before the learners could answer the questions, the educator read through and discussed each question. Furthermore, during the discussion, she highlighted the key parts of each question in the task. These key parts were the ones that the learners used to solve the word problems.
2	1 hour	Corrections of addition word problems	 **Image 4.6: Sample of learner's work**  **Image 4.7: sample**	On day one, the learners were given the previous days task to complete at home as homework. Therefore, day two was when the educator did the corrections with the learners. Instead of just writing the correct answers, she treated it as if it

			of learner's work  **Image 4.8: Sample of corrections done by learner.**  **Image 4.9: Sample of learner's work**	was a new lesson which required for the learners to participate and understand how and why their answers are correct or incorrect.

4.4. Themes Emerging from the Qualitative Data

Jones (2022) states that a theme captures something important about the data in relation to the purpose of the research. Therefore, one can conclude that emergent themes from data are used to give insight into the data. In this section, an analysis of the themes emerging from the lesson observation and the interviews are discussed. In this chapter, the researcher followed the following key:

Edu. A : Educator A
Edu. B : Educator B
R I. : Research interviewer
(*italics)*: Translation to English
---- : Pauses or interruption during the lesson

4.4.2. Theme 1: The use of language

Botes and Mji (2010) state that language and education are connected, because all teaching is done through the medium of language. In Setati and Moschkovich (2010), one of the authors expressed that the greatest struggle she experienced as a scholar was being taught mathematics in a language that she was not self-assured in. This is a common struggle that Grade 4s and other scholars are still experiencing. Theme 1 focuses on the analysis of the use of language.

From the interview conducted, Educator A expressed that the challenge faced in lesson 1 was the use of English.

> **Research Interviewer (R I.): What would you consider as the challenges in lesson 1?**
>
> **Educator A (Edu. A):** Word problems are a new topic for Grade 4 learners and the use of English makes more challenging as it is a language they are still getting used to being taught with. This meant that I had to use their Home Language during the lesson so they could participate. The terminology used was a challenge.

From the questionnaire, 59 educators out of 129 participants agree that "*Learning mathematics in English in Grade 4 makes it hard for learners",* while 65 participants remained neutral. The use of English being a challenge to teach in Grade 4 makes it difficult for the educators and the learners during a MWP lesson.

> **R I.: In your opinion, what challenges do educators encounter when teaching mathematical word problems?**
>
> **Educator B (Edu. B):** The one problem that educators encounter is the language used for teaching and learning, which is English. Majority of the learners in my classroom are Sotho speaking and in the Foundation Phase they were taught mathematics in SeSotho, therefore I find it somewhat difficult to teach the whole lesson in English. The only basic mathematical language I can use with them is "plus

and minus" when it comes to saying the "difference between so and so..." then e ba mathata a maholo (*it becomes a challenge).*

MWPs are linguistically demanding and when a learner struggles with the language he/she is meant to acquire, then it opens up a means for the educator to incorporate translanguaging or code-switching into the lesson. During the lesson, the researcher observed that the educator used code switching as a means to successfully communicate with the learners and to give them feedback. From the lesson transcript below, we are able to see how the use of code switching between English and the learners' HL has created a platform for the learners to be able to fathom the MWPs presented to them.

Edu. A.: Let us go to the next question. Turn to page 150.

Make sure you are on page 150. Supa question B. (Point at question B).

Edu. A.: Bala 1b (Read 1b).

Learners: Susan earns R3 460 each month cooking. How much does she earn in two months? (repeated).

Edu. A.: Ke mang a ka re jwetsang hothweng ? (Who can tell us what is being said?).

"Earns". Susan earns R3 460.

Lentswe leo (that word) "earns". Le bolella hore o etsang? (What does it tell us?).

Susan earns R3 460 each month. Mantswe ao a bolelang(What does those words tell us?).

Lentswe earns le bolela eng? (What does the word earn mean?).

Learner 9: Ho kgola.

Edu. A.: Ho kgola. O fumana R3 460. Oe fumana neng? (She earns R3 460. When does she get it?).

O kgola neng? (When does she get paid).

Ke lentswe lefe le re bontshang o kgola neng (Which word tells us when she's getting paid?).

Learners: Each month.

In conclusion, the use of language in the classroom, during a MWPs lesson results in the using code-switching in the classroom. This gave learners a platform to express themselves without being limited by the language they

can use as they are able to use their HL to voice out their understanding. While only 10 educators disagree that MWPs are hard because of the language use, 59 of the educators agree that the use of language is part of the challenge that is faced during a MWP lesson. Considering that majority of the schools in the TMED district favour Sesotho (and IsiZulu) as their HL, it is understandable why 59 of the educators that participated in the survey questionnaire and the educators observed and interviewed agree that MWPs are hard because of the language use.

4.4.3. *Theme 2: The use of teaching aids*

Ordu (2021) highlights that the use of teaching aids enhances classroom instruction, extract learners' attention and create a motivation to learn. Ordu further states that the use of teaching aids enables the learners to use their hearing or seeing abilities an actively perform something while learning. Teaching aids make it possible for the learners to be able to generate knowledge from abstract ideas.

Theme 2 focuses on the analysis of the use of teaching aids.

> **R I.: Why did you not use any learner-teacher support material?**
>
> **Edu. A:** *The only teaching aid I used was the DBE workbook. However, I did not use any other form of teaching aids as the questions I was treating did not require teaching aids.*
>
> **R I.: Do you deem it necessary to use teaching aids?**
>
> **Edu. A.:** No.
>
> **R I.: Why did you not use any learner-teacher support material?**
>
> **Edu. B.:** This lesson did not require any physical LTSM.
>
> **R I.: Do you deem it necessary to use teaching aids?**
>
> **Edu. B**: It is very important to use teaching aids as it helps to bring abstract Ideas to life. For example, when doing addition, the children can use the abacus to help them with their counting.

In the interview transcripts, Educator A expressed that teaching aids are not necessary to use, while Educator B has stated the importance of teaching

aids as they bring life to abstract ideas. However, both of the educators did not use any teaching aids during the lessons as they felt there was no need for them. 66 participants of the questionnaire agree that using teaching aids to teach word problems is necessary. However, only 3 disagree and this shows that there is a big number of educators, who find that the use of teaching aids is necessary. One of the factors that could be a contributor to why some of the educators do not find them necessary is that they are not easily available at their schools or the MWPs tasks being done at that moment do not require them.

The majority of the schools in the TMED are Section 21 schools, which implies that they are responsible for the purchasing of the resources need. Unfortunately, this means that schools have to prioritise what they purchase as they could possibly be underfunded, and teaching aids are not really prioritised.

In conclusion, educators find it necessary to use teaching aids when teaching word problems and other topics in mathematics, however, they do not prioritise using them due to multiple reasons. With the multiple learning incompetences that the learners go through and difficulties experienced in the mathematics classroom in TMD schools it is recommended that the use of teaching aids be a norm in the classroom as some mathematical terminology and topics are abstract and make it difficult for the learners to numerically translate and understand what they are being taught in the classroom.

4.4.4. Theme 3: The use of textbooks to get mathematical word problems

Relying on only textbooks creates a general picture for the learners, therefore, resulting in them not being able to fully understand the problems they have to solve as it is only sentence questions without further explanation. Textbooks are the main resource that educators use when planning tasks, therefore, it is expected that educators use textbooks to get MWPs. Theme 3 focuses on the analysis of the use of textbooks to get MWPs.

During the lesson observations, both of the educators used textbooks to get MWP tasks. Educator A used the Grade 4 mathematics Department of Basic Education workbook (DBE Workbook) for the task as shown in Image 4.10, while Educator B used the Grade 5 VIVA mathematics textbook as shown in Image 4.11.

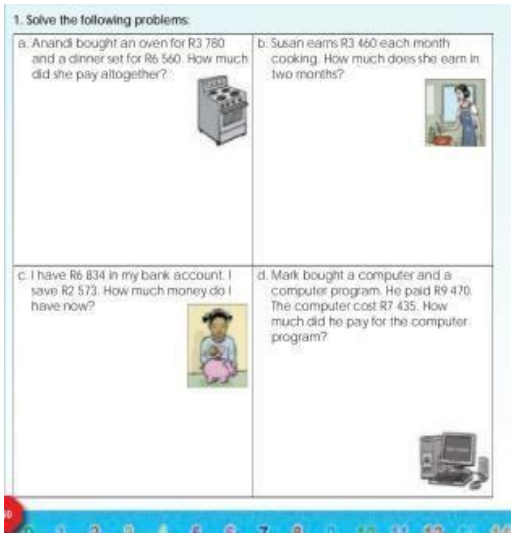


Image 4.10: Sample of the task from the DBE workbook used by Educator A

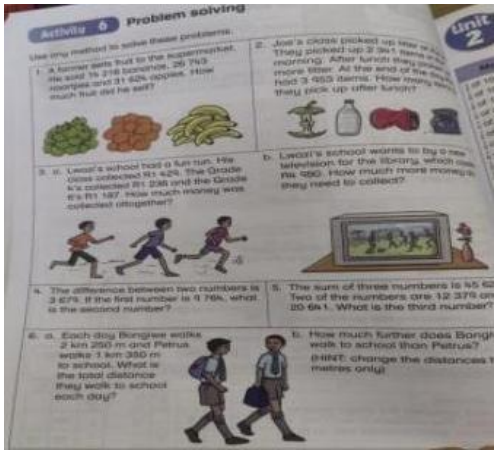


Image 4.11: Sample of the task from VIVA textbook used by Educator B

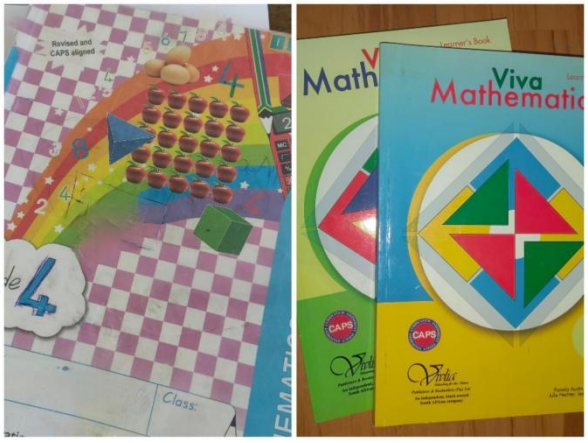


Image 4.12: Sample of the textbooks that the educators used to get their MWPs

Educator B expressed that although she uses other resources such as the internet to get MWPs, she still refers to textbooks to get the MWPs.

> **R I.: Besides getting mathematical word problems from textbooks, are there any other platforms (such as workshops) where they are discussed? If not, would you suggest that it be discussed?**
>
> **Edu. B:** *Most of the time I get them from the textbook or I go onto Google and search for word problems worksheets. It would be really nice to have word problems discussed in workshops, maybe ke mo ba tla re thusa hore re di etsa jwang le bana ba ma-Grade 4. (maybe that is where they will help us with ways on how to do them with Grade 4s)*

78 of the survey participants showed that they take word problems from the textbook, while only 7 disagreed. This was in union with Educator B's answer, which shows that the primary source for MWPs is textbooks. However, Hannula-Sormunes et al. (2016) suggest that it is important that the educators remember that they must also incorporate different styles of word problems. Furthermore, it is of importance that they create word problems that their learners can relate to as one of the main objectives of mathematics is for the learners to be armed with the needed competencies so they are able to solve problems within their surroundings.

In conclusion, the use of textbooks to get MWPs is highly favoured by educators as it is a primary resource for them. However, it is highly important

that educators have self-created word problems (Hannula-Sormunes et al. 2016) that place focus onto the learners' environment, which will in turn, make it easier for them to identify with the word problem they have to solve.

4.4.5. Theme 4: The challenges faced when teaching mathematical word problems

A study done by Edoho et al. (2022) in Nigeria, revealed that the crucial component for learners' low performance in word problems is their inability to understand mathematics symbols. Guo (2022) further adds that in Australia, preservice educators have difficulty in teaching triangle word problems, as they are challenged by having a full understanding of the laws needed to teach the concept. This can also be further related to educators in South Africa as there are those that do not have a full understanding of some laws needed to teach some concepts. Theme 4 focuses on the analysis of the challenges faced when teaching mathematical word problems.

Moleko (2018) states that one of the leading challenges of teaching MWPs in South Africa has to do with educators that restrict learners from using their HL as a resource to aid them to deduce mathematical concepts. However, during the lessons, the researcher observed that both educators encouraged the learners to use their HL to express their understanding in their HL.

> **R I.: What would you consider as the challenges in lesson 1?**
> **Edu. A:** *Word problems are a new topic for Grade 4 learners and the use of English makes more challenging as it is a language they are still getting used to being taught with. This meant that I had to use their Home Language during the lesson so they could participate. The terminology used was a challenge.*
>
> **R I.: What would you consider as the challenges in lesson 2?**
> **Edu. B.** *Calculation of long numbers.*

Educator A expressed that in lesson 1, the challenge that her learners experienced during the MWP lesson was the use of English as they are still

getting used to being taught in it. In addition, Educator B expressed that the challenge the learners faced was the calculation of long numbers. 49 participants of the survey agreed that MWPs are hard because of the high cognitive demands of the task. The observation made from the survey questionnaire in combination with the challenge expressed by Educator B, shows that the high cognitive demand that is required from mathematical word problems is a big challenge that affects the learners. As the learners' progress to the next grade, the number of digits increases, and with this change, it means that the difficulty of calculations becomes apparent.

4.5 Conclusion

This chapter focused on the presentation, analysis, and discussion of the collected data. The analyses from both the quantitative and qualitative data sets points to the objectives of the research project, which were stated in Chapter One. Through the survey questionnaire, the researcher was able to highlight the perceptions and experiences that the Grade 4 mathematics educators have with regards to teaching MWPs. Statements a to d highlighted that majority of the educator participants are educators that are competent and confident to teach mathematics. Furthermore, statements e to i highlighted the perceptions that educators have when it comes to teaching MWPs. Statements j to l were centred on the observations that the participants made on the challenges that the Grade 4 learners face in the use of English in mathematics and how they fail MWPs. In addition, statements m to o gave the educators' perception on the difficulty of MWPs and whether they consider it to be a relevant concept in the mathematics syllabus.

Through the qualitative data presented, the use of language, the use of teaching aids, the use of textbooks to get MWPs and the challenges faced when teaching MWPs, were identified as themes emerging from the data collected. A triangulation of the two data sets was done in order solidify the discourse of the emergent themes. In the following chapter, the researcher did an in-depth discourse of the findings, recommendations.

CHAPTER 5: SUMMARY FINDINGS AND RECOMMENDATIONS

5.1. Introduction

This chapter is structured on the basis of the research questions mentioned in Chapter One. The main research question reads as: *How do Grade 4 mathematics educators teach mathematical word problems* (MWPs) *in mathematics lessons?* The sub-questions are: *What are educators' perceptions about teaching Grade 4 learners' mathematical word problems?; What are educators' experiences of teaching mathematical word problems?; What type of mathematical tasks do Grade 4 educators use when teaching mathematical word problems?;* and *How do educators use learner-teacher support materials?* In this chapter, the researcher did an in-depth discussion of the joint findings from the literature review and the collected data, while giving recommendations.

5.2. The Educators' Perceptions about Teaching Grade 4 Learners Mathematical Word Problems

According to the questionnaire, 41 educators out of the 129 educator participants view MWPs as hard to teach, while 36 educators disagree with the said statement. Having almost a third of the educators finding it hard to teach the concept is alarming, as it indicates that there is a negative mindset towards MWPs from the educators themselves. During the post-lesson interview, Educator A stated that s*ometimes educators also do not understand the concepts clearly. Most mathematics educators do not enjoy word sentences (word problems) rather they prefer numbers*. This is an indication of the notion behind educators finding the concept hard to teach. An educator cannot successfully deliver a lesson when he/she does not have a good understanding of what he/she is teaching. During the lesson observation, it was clear at the beginning that the learners did not comprehend what was expected, as they saw more words and less numbers. In addition to that, these sentences were written in English, which added on to the difficulty of the concept. Educator B stated that the *one problem that educators encounter is the language used for teaching and learning, which is*

English. Majority of the learners in my classroom are Sotho speaking and in the Foundation Phase, they were taught mathematics in SeSotho, therefore, I find it somewhat difficult to teach the whole lesson in English.

Furthermore, Educator A also identified that word problems are a new topic for Grade 4 learners and the use of English makes it more challenging as it is a language they are still getting used to being taught with. This meant that the educator had to use their home language (HL) during the lesson so that they could participate. The terminology used was a challenge. 59 educator participants further agree that MWPs are hard because of the language used, which is English. The back and forth play on words between the learners' HL and English also presents a difficulty for educators as it is not a norm that they were previously taught to do while teaching. The perception that educators have about teaching MWPs is deeply rooted in their lack of better understanding of the concept and how MWPs is a new mathematics concept taught in English for the Grade 4 learners and it is linguistically demanding.

5.2.1. Recommendations on educators' perceptions about teaching Grade 4 mathematical word problems

The study recommends that educators should, firstly, acquaint themselves positively with the MWPs. Bhengu (2020) highlights that teachers should be fully prepared when they come to the mathematics classroom. Being well-prepared before coming to class downplays the "MWPs are hard to teach" perception that teachers have. Preparation results in being more knowledgeable and positive about the mathematical concept of MWPs. For instance, in the first lesson conducted by Educator A, the introduction to MWPs question, she was able to show three different techniques that the learners can use to solve the problem of the number of computer games that can be bought with R400 when one costs R75. The first solution was to simply divide R400 by R75; secondly, they could continuously subtract R75 from the R400 until they get R0 and count the number of R75; and lastly, they could continuously add R75 until they get R400 or close to R400 and count the number of R75s all these resulted in there being 5 computer games that

were bought. Being able to derive a variety of ways to solve the MWP showed how prepared and knowledgeable the educator was about the given task. Additionally, a study done by Abaidullah et al.(2015) indicated that a large majority of the educators agreed that planning a problem-solving lesson positively motivated them and it guided them well in leading the task well. Using the learners' HL and guiding the learners to using a variety of techniques to solve the MWPs can be classified as doing mediation, which was one of the elements from the Vygotsky's sociocultural theory, during the lesson. Chauke and Tabane (2021) define mediation as a process, whereby the learner "takes possession of the cognitive tools" that makes construction of knowledge possible. By using the learners' HL the educator plays the role of the mediator by translating some of the terminology that learners' do not understand into their HL. In addition, guiding them to use the technique of continuous subtraction enhances the learners' prior knowledge of subtraction to new develop knowledge they can implement.

5.3. The Educators' Experiences of Teaching Mathematical Word Problems

In this study, it was found that the common experience that the educators have is the use of English bringing challenges while teaching MWPs. Educator A stated that during the first lesson, the challenges that she observed was that the use of English made it more challenging for the learners. She said that word problems are a new topic for Grade 4 learners and the use of English makes it more challenging as it is a language they are still getting used to being taught with. This meant that the researcher had to use their HL during the lesson so they could participate. The terminology used was a challenge, while Educator B state that "The one problem that educators encounter is the language used for teaching and learning, which is English. Majority of the learners in my classroom are Sotho speaking and in the Foundation Phase, they were taught mathematics in SeSotho, therefore, I find it somewhat difficult to teach the whole lesson in English". The use of English during a MWP lesson makes it difficult for the Grade 4 educators when teaching MWPs, as the learners relied mostly on their HL to learn and

communicate their understanding in the mathematics while they were in the Foundation Phase and they have carried this way of learning on to the Intermediate Phase.

The researcher observed from the survey questionnaire that a large number of the educator participants agree that the language used makes MWPs hard. This applies to the experiences of both the educators and learners. During the lessons, it was clear that when the educators attempted to guide the learners in English, the learners were not respondent. However, when the educators *translanguaged*, using English and Sesotho as the learners' HL, they were eager to communicate their understanding and participate during the lesson. The researcher also observed that the dependency on the learners HL promoted understanding, however, it also becomes difficult for the learners to understand MWP questions in formal tests as the questions are only written in English. This results in the educators' experiencing a lot of the learners failing the MWP questions in the tests.

While doing corrections of the homework task they were given, the researcher observed that the Grade 4 learners struggled with their calculations. Therefore, this led to the educators having to divert back to teaching the learners basic addition and subtraction techniques. Grade 4 learners are used to doing calculations with three or less digits, and now in the intermediate phase, the number of digits has increased to four.

5.3.1. Recommendations for educators' experiences of teaching mathematical word problems

The findings of the experiences of educators are mostly based on the use of language. The study recommends that educators should implement language strategies such as translanguaging, code switching and translating. Translanguaging brings together learners' HL and English to create understanding for the learners. In addition, it encourages the learners to be able to explicitly discuss topics with greater understanding (Ittner et al. 2019). Code switching affords learners similar benefits to translanguaging, however, it leads to more of a "translating" form of communication, which is

advantageous when having to translate key mathematical word problems terminology to the learners' HL, so they are able to grasp what the MWP task requires from them. Mpalami (2022) highlights that translating learners' tasks into their African HL is a positive move for South African learners to gain a better understanding of mathematics. A study done by Moleko and Mosimege (2020) recommends teaching learners the mathematical vocabulary to address the lack of English proficiency that makes teaching and learning MWPs difficult, especially for Grade 4 learners.

RSA DBE (2011) recommends that different techniques be taught to the learners when doing addition and subtraction calculations. Therefore, this means that as an educator you, have to present a variety of technique that simplifies calculations for the learners. Using techniques like the breaking down method or the column method, gives learners the opportunity to find what works best for them.

5.4. The Types of Mathematical Tasks that Grade 4 Educators Use when Teaching Mathematical Word Problems

MWPs tasks are cognitively demanding. 49 educator participants agree that MWPs are hard, because of the high cognitive demands of the tasks. However, 66 educators do not recommend taking them out of the syllabus. In the observed lessons, the educators used verbal discussions at the beginning of the lesson. The verbal discussions are used to discuss each question with the learners. Kurshumilia and Vula (2015) highlight that to provide learners with more opportunities to know which steps to take, it is required for educators to take time to discourse over the words related to MWPs and their meanings in context of the problem. The educators asked the learners questions such as *what do you understand?* when the question asks *what is the difference between…?* When they could not answer, they educator asked them what the word difference means in their HL. The learners answered it is *phapang bakeng sa* (the difference between). When the learners confirmed it was correct, the learners were able to express their full understanding of the question. Post verbal discussions, the educators gave the learners classwork tasks. Classwork tasks are informal tasks that test whether the learners

understand what the educator was teaching during the verbal discussions. Furthermore, the classwork tasks enabled the educators to identify what the learners struggle with and understand. Both Educators A and B were able to identify that the Grade 4 learners struggled with the MWP questions being in English and also with calculations with long numbers.

5.4.1. Recommendations on the types of mathematical tasks that Grade 4 educators use when teaching mathematical word problems

The study suggests that educators should make use of tasks that will guide the learners' cognitive development when they have to solve MWPs. Starting the lesson with a low order informal task such as "verbal discussions", stimulates the learners' understanding. This is where the educator asks the learners questions that can guide them in solving the MWPs.

Once the verbal discussions have been concluded, the learners should engage in a classwork task, whereby they will test and apply the knowledge and understanding they have developed during the verbal discussions. The researcher further recommends that the educator should get the learners to write informal tests, so they are well prepared for the unknown complexity of the MWPs that are found in formal assessments. mathematics tasks are standardised according to the cognitive levels which are *knowledge (25%), routine procedure (45%), complex procedure (20%) and problem solving (10%)*, therefore, each task, whether formal and informal, must be set according to the levels. When drafting MWPs tasks educators should consider, implementing scaffolding as an approach. The Indeed Editorial Team (2023) states that the material of the content is scaffolded into smaller chunks so the learner can expand their understanding of the material of the content. A question that requires multiple steps should be broken down into questions that will guide the learner into giving the final solution. For example: *Mark has 76 balloons and gives Terry 20. He gets 30 more from Julie. How many balloons does mark have left?*

(a) How many balloons does Mark have left after giving Terry 20?

(b) How many balloons does he have after Julie gave him 30 more?

*S*caffolding the question into smaller chunks,guides the learner into kenning that they must firstly subtract the 20 given from the 76. Once they have gotten the answer they then add the 30 that he received from Julie.

5.5. How Educators Use Learner-Teacher Support Materials

Learner-teacher support materials are inclusive of a variety of resources that educators can use in the classroom. It is required that educators use prescribed textbooks to get different tasks that can be used in the classroom or administered to the learners. Educator A used the DBE workbook, while Educator B used the VIVA mathematics textbook to get the tasks they used in the lessons presented. Both these books are part of the prescribed Curriculum assessment Policy Statement (CAPS) approved textbooks. The majority of mathematics educators are reliant on textbooks to get the MWPs for their lessons. This is apparent in how 78 educators out of the 129 survey questionnaire participants agreed that they take word problems from textbooks. In addition, Educator B stated that most of the time, she gets MWPs from the textbook.

During the lessons, both educators did not make use of teaching aids as they found that it was unnecessary. However, 66 educator participants agreed that they use teaching aids to teach word problems. The use of teaching aids in mathematics assists in strengthening the content being taught. The schools that the study was conducted at, are Section 21 schools, this means that it is difficult for the educators to be bought different aids they might use as they are not prioritised in the schools' budgets. Therefore, it is required for the educators to be creative and make their own.

5.5.1. Recommendations on the use of learner-teacher support materials

This study suggests that educators should use other sources such as Google to get a variety of MWPs. Using Google gives educators access to a variety of websites that offer MWP worksheets that cater for different cognitive levels. In addition, the study suggests that mathematics educators should adopt the Word Problem Enrichment (WPE) program that was developed by Hannula-Sormunes et al. (2016). The WPE program encourages educators to create MWPs that focus on the environment of their learners. By adopting this program, educators will not be so overstretched when it comes to source out LTSM as the learners will be able to relate to MWPs that have been presented. In addition, the learners will show a better understanding and educators will be able to easily guide learners and mediate the lesson.

The use of manipulatives during MWP tasks assists in creating a more visualistic representation of the MWPs. Adendorff et al. (2018) highlight that manipulatives have both visual and tactile appeal. For instance, on the question of Bongiwe and Petrus, the educator can draw a sketch that illustrates the scenarios of the question. The illustration should be used to visualise a story of how far the learners walk to school and how much further Bongiwe walks than Petrus. In addition, the educator can use a distance conversion diagram to assist the learners in converting the distances to metres as the question states.

To successfully use manipulatives and teaching aids in a lesson requires for the educator to be knowledgeable about the aids they will be using as they will be playing the role of the mediator and guider during the using of these components in a lesson.

5.6. Limitations of the Study

This research project was planned out to follow a certain route, however, some things did not go accordingly. Therefore, there was a limitation to the study. The limitation was how the researcher was not able to employ S.P.S.S.

to analyse the survey questionnaire due to not having access to the software. After numerous attempts to request the software from the University's ICT offices, the attempt was unsuccessful, which resulted in time being wasted and having to find an alternative method of analysis. However, using Excel only limited the researcher to only recording the data using percentages and a proper analysis that S.P.S.S. could have provided.

5.7. Contributions of the Present Study

This study will not only contribute to the Grade 4 mathematics educators, but will also contribute to the mathematics educators of other grades. Furthermore, contributions from this research project will continue to spread to all the schools locally and globally. The educator participants in this study provided a variety of strategies and solutions, which will further add to what others are already implementing in their mathematics classrooms.

5.8. Recommendations for Further Research

The aim of the study was to explore the teaching of Grade 4 MWPs in the Thabo Mofutsanyana District. In the quest of the exploration, the perceptions, experiences of educators and strategies to combat the challenges identified were discussed. Multiple strategies and ideas were shared during the lesson observations and post-lesson interviews. However, some of the solutions shared such as the translation being one of the ways to foster understanding for the learners will not always be possible as it cannot be assumed that all the learners in the classroom will not always have the same HL. In contrast, the strategy that both the educators and the learners can benefit from is the use of translanguaging in and during a MWPs lesson. Omidire and Sameera (2022), identifies the use of translanguaging as a way to compensate for the challenges that multilingual learners experience as it builds understanding.

Separating the MWPs questions that were presented to the learners in their tasks, assisted them in building an understanding of what is required from them to solve the problem presented to them. However, as they could not

really identify with the MWP questions asked, therefore, it is recommended that educators should consider adopting the WPE program developed by Hannula-Sormunes et al. (2016). This program encourages educators to be original and create MWPs that learners can identify with, thus encouraging the learners to have a clearer kenning of the MWPs presented. It is highly encouraged that mathematics educators make use of teaching aids such as pictures, diagrams and any other visual representations during a MWP lesson as they assist in giving abstract ideas a visualistic representation (Adendorff et al. 2018). Moleko (2018) and Bhengu (2020) further highlight that the use of concrete manipulatives adds to the solutions for the challenges faced in MWPs.

Cekiso and Smith (2023) and Chaturika and Rajapaksha (2015) deduced from their studies that the main challenges that the educators faced in using teaching aids was them having limited knowledge of teaching aids and not being trained to use them. Having lack of knowledge and training debunks the whole notion of how successful they are when implemented into a lesson. Furthermore, having no knowledge or training results in the educator not using them or finding the importance of having them in a lesson. Therefore, it is important for the department and schools to offer trainings for educators to be more knowledgeable of teaching aids. Dinsmoor (2022) states that a challenges of using manipulatives is that when learners use them too much it prevents them learning imperative problem-solving and having difficulty in transferring new knowledge to new contexts. Majority of schools in the country are not financially well. Teaching aids and manipulatives are expensive, therefore the reality is that most schools do not have them unless the educator makes their own or buys their own.

5.9. Conclusion

This study was aimed at exploring the teaching of MWPs in the Thabo Mofutsanyana District. In an attempt to do so, the researcher investigated the educators' perceptions and experiences of teaching MWPs, identified the type of tasks used by mathematics educators and furthermore, how

educators use learning and teaching support materials. This study has shown that Grade 4 learners struggle with MWPs due to not being proficient in the language that the tasks are written in. From the analysis of the quantitative and qualitative findings, the main finding was that the use of the learners' HL had a major contribution on the learners developing an understanding of MWPs. Therefore, the researcher recommends that the educators use strategies such as translanguaging during an MWPs lesson. In addition, the use of translanguaging also encourages learners to be able to participate in the lesson as they are not linguistically limited to only using English. Another finding was that the use of LTSM such as teaching aids and manipulatives is important for assisting learners when having to work with abstract ideas. Therefore, the researcher recommends that educators include teaching aids and manipulatives into their lessons in order to strengthen the content and learning.

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APPENDICES

APPENDIX A:

ETHICS APPROVAL

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS UV

GENERAL/HUMAN RESEARCH ETHICS COMMITTEE (GHREC)

11-Sep-2023

Dear Ms Mpho Mokhathi

Application Approved

Research Project Title:
Exploring the teaching of Grade 4 mathematical word problems in the Thabo Mofutsanyana District.

Ethical Clearance number:
UFS-HSD2023/0887

We are pleased to inform you that your application for ethical clearance has been approved. Your ethical clearance is valid for twelve (12) months from the date of issue. We request that any changes that may take place during the course of your study/research project be submitted to the ethics office to ensure ethical transparency. furthermore, you are requested to submit the final report of your study/research project to the ethics office. Should you require more time to complete this research, please apply for an extension. Thank you for submitting your proposal for ethical clearance; we wish you the best of luck and success with your research.

Yours sincerely

Dr Adri Du Plessis
Chairperson: General/Human Research Ethics Committee

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APPENDIX B: TITLE REGISTRATION

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS EDUCATION

16 May 2023

APPLICATION FOR TITLE REGISTRATION

Applicant: Mokhathi, M
Student Number: 2014103168
Discipline: Curriculum Studies
Study Code: Masters (EDCI8900)

Dear Ms Mokhathi

Your registered title is as follows: "Exploring the teaching of Grade 4 mathematical word problems in the Thabo Mofutsanyana District"

All of the best with your studies.

Yours sincerely,

Prof Patrick Mafora
Chair: CTR committee

Ms CS Duvenhage
Secretary: CTR committee

205 Nelson Mandela Drive | Park West, Bloemfontein 9301 | South Africa
P.O. Box 339 | Bloemfontein 9300 | South Africa | www.ufs.ac.za

APPENDIX C: ETHICAL CLEARANCE FROM THE DEPARTMENT OF BASIC EDUCATION

Enquiries: M.Z. Thango
Ref: Research Permission: M. Mokhathi
Tel. 051 404 8808
Email: MZ.Thango@fseducation.gov.za

education
Department of Education
FREE STATE PROVINCE

5691 Lefothane Street
Phuthaditjhaba- A
9866

Dear Ms. M. Mokhathi

PERMISSION TO CONDUCT RESEARCH IN THE FREE STATE DEPARTMENT OF EDUCATION: THABO MOFUTSANYANA DISTRICT

This letter serves to inform you that you have been granted permission to conduct research in the Free State Department of Education within the Thabo Mofutsanyana Education District. The details in relation to your research project with the University of the Free State are as follows:

Topic: Exploring the teaching of Grade 4 mathematical word problems in the Thabo Mofutsanyana District.

1. **List of schools involved:** Clubview Primary School and Tharollo Combined School.
2. **Target Population:** Two educators teaching Mathematics in grade 4 at the selected schools.
3. **Period of research**: From the signature of this letter until 30 September 2023. Please note that the department does not allow any research to be conducted during the fourth term (quarter) of the academic year. Should you fall behind your schedule by three months to complete your research project in the approved period, you will need to apply for an extension. The researcher is expected to request permission from the school principals to conduct research at schools.
4. The approval is subject to the following conditions:
   - 4.1 The collection of data should not interfere with the normal tuition time or teaching process.
   - 4.2 A bound copy of the research document should be submitted to the Free State Department of Education, Room 101, 1st Floor, Thuto House, St. Andrew Street, Bloemfontein or can be emailed to the above-mentioned email address.
   - 4.3 You will be expected, on completion of your research study to make a presentation to the relevant stakeholders in the Department.
   - 4.4 The ethics documents must be adhered to in the discourse of your study in our department.
5. Please note that costs relating to all the conditions mentioned above are your own responsibility.

Yours Sincerely,

Mr. MZAMO W. JACOBS
DIRECTOR: QUALITY ASSURANCE, M&E AND STRATEGIC PLANNING

DATE: 06/06/2023

Enquiries: M.Z. Thango
Ref: Notification of research: M. Mokhathi
Tel. 051 404 8808
Email: MZ.Thango@fseducation.gov.za

education
Department of Education
FREE STATE PROVINCE

District Director
Thabo Mofutsanyana District

Dear Ms. Mabaso

NOTIFICATION OF RESEARCH: PERMISSION TO CONDUCT RESEARCH PROJECT IN THABO MOFUTSANYANA DISTRICT

This letter serves to inform you that Ms. M. Mokhathi has been granted permission to conduct research in the Thabo Mofutsanyana District under the auspices of the University of the Free State. The details in relation to the research project are as follows:

Topic: Exploring the teaching of Grade 4 mathematical word problems in the Thabo Mofutsanyana District.

1. **List of schools involved**: Clubview Primary School and Tharollo Combined School.
2. **Target Population:** Two educators teaching Mathematics in grade 4 at the selected schools.
3. **Period of research**: From the signature of this letter until 30 September 2023. Please note the department does not allow any research to be conducted during the fourth term (quarter) of the academic year nor during normal school hours. The researcher is expected to request permission from the school principals to conduct research at schools.
4. **Research benefits:** Educators and the Free State Department of Education will benefit from this study by reading through the findings and implementing them to improve the teaching of mathematics at the intermediate phase.
5. The Sub-directorate of Research and policy will make the necessary arrangements for the researchers to present the findings and recommendations to the relevant officials in the Department.

Yours Sincerely,

Mr. MZAMO W. JACOBS
DIRECTOR: QUALITY ASSURANCE, M&E AND STRATEGIC PLANNING

DATE: 06/06/2023

APPENDIX D: REQUEST FOR PERMISSION TO CONDUCT RESEARCH

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS UV

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

Dear *Sir/Madam*

I am a master's student at the University of the Free State, Qwa Qwa Campus doing research and would like to request permission to conduct my research at *your school.*

DATE

26 January 2024

TITLE OF THE RESEARCH PROJECT

Exploring the teaching of Grade 4 mathematical word problems in the Thabo Mofutsanyana District.

PRINCIPLE INVESTIGATOR / RESEARCHER(S) NAME(S) AND CONTACT NUMBER(S):

Principal investigator: Mpho Mokhathi 2014103168 083 402 1733 / 069 373 0914

FACULTY AND DEPARTMENT:

Name of Faculty: Faculty of Education
Name of Department: Department of Mathematics, Natural Sciences and Technology Department

STUDYLEADER(S) NAME AND CONTACT NUMBER:

Study leader: Dr Nkosinathi Mpalami
Contact number: 078 678 1125

WHAT IS THE AIM / PURPOSE OF THE STUDY?

The purpose of this study is to explore the teaching of Grade 4 mathematical word problems. I am conducting this study to explore the different strategies that educators implement to teach this challenging concept in mathematics.

WHO IS DOING THE RESEARCH?
I am Mpho Mokhathi and I am a Masters' student at the University of the Free State. I am conducting this study as I have noticed that as Grade 4 educators there is a need to have more access to different approaches and strategies that can be used in the mathematics classroom as it is one of the subjects where learners are struggling. The concept that is most challenging is mathematical word problems, hence the focus of this study is on how mathematical word problems are taught.

205 Nelson Mandela Drive/Rylaan, Park West/Parkwes, Bloemfontein 9301, South Africa/Suid- Afrika
P.O. Box/Posbus 339, Bloemfontein 9300, South Africa/Suid- Afrika, T: +27(0)51 401 9111, www.ufs.ac.za

HAS THE STUDY RECEIVED ETHICAL APPROVAL?

This study has received approval from the Research Ethics Committee of UFS. A copy of the approval letter can be obtained from the researcher.

Approval number: UFS-HSD2023/0887

WHY ARE YOUR INSTITUTION INVITED TO TAKE PART IN THIS RESEARCH PROJECT?

Your institution have been chosen as one of the two institutions to participate in this study as your participation in this research study will add great value to the study. The selection was done using purposive sampling as this study is aimed at Grade 4 mathematical educators in the Thabo Mofutsanyana District.

WHAT IS THE NATURE OF PARTICIPATION IN THIS STUDY?

The researcher will be observing you during a lesson on mathematical word problems. Once the lesson observation has been completed, a clinical interview will be conducted, whereby you will be answering questions based on the lesson that you have presented. The researcher will only be observing you for two periods and an additional 30minutes for the interview.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?

Your participation in this study will be kept confidential, however the information and data from your participation will benefit other educators as they will use your strategies and approaches to better teach in the classroom

WHAT IS THE POTENTIAL RISKS TAKING PART IN THIS STUDY?

Your identity as a participant will be kept confidential. If another participant mentions your name or your school's name, it will not be mentioned in the study, instead you will be referred to as "Participant A or Participant B".

WILL THE INFORMATION BE KEPT CONFIDENTIAL?

To maintain confidentiality, your name will not be recorded anywhere in the study. A pseudonym such as "Participant A or Participant B" will be used to refer to you. The researcher and you as the participant will have access to the data. Your answers may be reviewed by people responsible for making sure that research is done properly, including the transcriber, external coder, and members of the Research Ethics Committee. Otherwise, records that identify you will be available only to people working on the study, unless you give permission for other people to see the records.

The data that you have given might be used for other purposes such as presentation, journal articles, etc. A report of this study may be submitted for

publication, however you as a participant will not be identified.

HOW WILL THE INFORMATION BE STORED AND ULTIMATELY DESTROYED?

Hard copies of your answers will be stored by the researcher for a period of five years in a locked cupboard cabinet at the researchers' residence for future research or academic purposes; electronic information will be stored on a password protected computer. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable. When the period of five years has passed, the hardcopies will be destroyed, and the soft copies will be deleted on the electronic device it has been stored on.

WILL THERE BE PAYMENT OR ANY INCENTIVES FOR PARTICPATING IN THIS STUDY?

The will be no incentives or payments that you will receive as a participant. However, your participation in this study will be of great value.

HOW WILL THE INSTITUTION / ORGANISATION / COMPANY BE INFORMED OF THE FINDINGS / RESULTS OF THE STUDY?

If you would like to be informed of the final research findings, please contact the researcher, Mpho Mokhathi on 083 402 1733/ 069 373 0914 or send an email to 2014103168@ufs4life.ac.za. Please do not use home telephone numbers. Departmental and/or mobile phone numbers are acceptable. Should you require any further information or want to contact the researcher about any aspect of this study, please contact the principal researcher on the abovementioned contact details. Should you have concerns about the way in which the research has been conducted, you may contact the principal researcher.

Yours sincerely

Mpho Mokhathi

APPENDIX E: CONSENT FORM

Research study information leaflet and consent form

26 January 2024

Title of the research project:

Exploring the teaching of Grade 4 mathematical word problems in the Thabo Mofutsanyana District.

Principle investigator / researcher(s) name(s) and contact number(s):

Mpho Mokhathi Student number:2014103168 Contact number: 083 402 1733/ 069 373 0914

Faculty and Department:

Name of Faculty: Faculty of Education
Name of Department: Department of Mathematics, Natural Sciences and Technology Education.

Study leader(s) name and contact number:

Name of Study Leader: Dr Nkosinathi Mpalami
Contact number: 078 678 1125

What is the aim / purpose of the study?

The aim of this study is to explore the teaching of Grade 4 mathematical word problems in the Thabo Mofutsanyana District. This study is being conducted to explore and investigate the approaches and strategies that Grade 4 mathematical educators use to teach word problems.

Who is doing the research?

I am Mpho Mokhathi and I am a Masters' student at the University of the Free State. I am conducting this study as I have noticed that as Grade 4 educators there is a need to have more access to different approaches and strategies that can be used in the mathematics classroom as it is one of the subjects where learners are struggling. The concept that is most challenging is mathematical word problems, hence the focus of this study is on how mathematical word problems are taught.

Has the study received ethical approval?

This study has received approval from the Research Ethics Committee of UFS. A copy of the approval letter can be obtained from the researcher.

Approval number: UFS-HSD2023 /0887

Why are you invited to take part in this research project?

You have been chosen as one of the two participants of this study as your participation in this

research study will add great value to the study. The selection was done using purposive sampling as this study is aimed at Grade 4 mathematical educators in the Thabo Mofutsanyana District.

What is the nature of participation in this study?

The researcher will be observing you during a lesson on mathematical word problems. Once the lesson observation has been completed, an interview will be conducted, whereby you will be answering questions based on the lesson that you have presented. The researcher will only be observing you for two periods and an additional 30minutes for the interview.

Can the participant withdraw from the study?

Being in this study is voluntary, and you are under no obligation to consent to participation. However, if you have submitted the questionnaire and have signed the consent form it will not be possible to withdraw. However, should an emergency arise whereby you are unavailable, the observation and the interview will be postponed.

What are the potential benefits of taking part in this study?

Your participation in this study will be kept confidential, however the information and data from your participation will benefit other educators as they will use your strategies and approaches to better teach in the classroom.

What is the anticipated inconvenience of taking part in this study?

Your identity as a participant will be kept confidential. If another participant mentions your name, it will not be mentioned in the study, instead you will be referred to as "Participant A or Participant B".

Will what I say be kept confidential?

To maintain confidentiality, your name will not be recorded anywhere in the study. A pseudonym such as "Participant A or Participant B" will be used to refer to you. The researcher and you as the participant will have access to the data. Your answers may be reviewed by people responsible for making sure that research is done properly, including the transcriber, external coder, and members of the Research Ethics Committee. Otherwise, records that identify you will be available only to people working on the study, unless you give permission for other people to see the records.
The data that you have given might be used for other purposes such as presentation, journal articles, etc. A report of this study may be submitted for publication, however you as a participant will not be identified.

How will the information be stored and ultimately destroyed?

Hard copies of your answers will be stored by the researcher for a period of five years in a locked cupboard cabinet at the researchers' residence for future research or academic purposes; electronic information will be stored on a password protected computer. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable. When the period of five years has passed, the hardcopies will be destroyed and the soft copies will be deleted on the electronic device it has been stored on.

Will I receive payment or any incentives for participating in this study?

The will be no incentives or payments that you will receive as a participant. However, your participation in this study will be of great value.

How will the participant be informed of the findings / results of the study?

If you would like to be informed of the final research findings, please contact the researcher, Mpho Mokhathi on 083 402 1733/ 069 373 0914 or send an email to 2014103168@ufs4life.ac.za. Please do not use home telephone numbers. Departmental and/or mobile phone numbers are acceptable. Should you require any further information or want to contact the researcher about any aspect of this study, please contact the principal researcher on the abovementioned contact details. Should you have concerns about the way in which the research has been conducted, you may contact the principal researcher.

Thank you for taking the time to read this information sheet and for participating in this study.

Consent to participate in this study

I, the undersigned,

_____
(participant's full names to be included), (the "Participant")
confirm that I voluntarily agree to participate in the research study referred to as the

_____ (the "Study") in relation to

_____

and which Study is being conducted by

_____
(insert the name of the researcher), (the "**Researcher**").

I, the undersigned Participant, further confirm that–

1. the Researcher has explained the nature, procedure, potential benefits and anticipated inconvenience of my participation in the Study;
2. I have read (or had explained to me) and understood the Study as explained in the attached information sheet;
3. I have had sufficient opportunity to ask questions and am prepared to participate in the Study;
4. I understand that my participation in the Study is entirely voluntary and that I am free to withdraw at any time without penalty (if applicable);
5. I voluntarily provide the UFS and the Researcher with my personal information and consent to the UFS and the Researcher collecting, disclosing and processing my personal information in order to conduct the Study and any related activities in relation thereto;
6. I hereby acknowledge and confirm that I understand the purpose for which the UFS and the Researcher may collect, store, use, delete, destroy, outsource, transfer or otherwise process, as the context and circumstances may require and as contemplated in terms of POPIA, my personal information as set out herein;
7. I am aware that the findings of the Study will be anonymously processed into a research report, journal publications and/or conference proceedings and that my personal information will be aggregated and deidentified at such stage;
8. I also give the UFS permission to share, without notification, the collected data with other researchers at the UFS or other Higher Education Institutions. This permission is dependent on the same principles of ethical research practices, anonymity/confidentiality, safekeeping of information, and other issues listed above applying.

I, the Participant, agree to the recording of the <insert specific data collection method>.

Full Name of Participant: _____

Signature of Participant: _____ Date: _____

Full Name(s) of Researcher(s): _____

Signature of Researcher: _____Date: _____

APPENDIX F: SURVEY QUESTIONNAIRE

Questionnaire (Intermediate Phase)

Research topic: Exploring the teaching of Grade 4 mathematical word problems in the Thabo Mofutsanyana District.

Purpose of the survey: The purpose of the survey questionnaire is to gather information about Grade 4 teachers' experiences on the teaching of **mathematical word problems**.

Key: 1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree

I teach at Intermediate Phase, **Yes** ☐ **No** ☐

My teaching experience is **0 – 5years** ☐ **6 – 10years** ☐ **11 – 16years** ☐ **17 years and above.** ☐

I teach grade **4** ☐ **5** ☐ **6** ☐

	1	2	3	4	5	Comments
a) I am a qualified teacher						
b) I enjoy teaching mathematics						
c) I am confident to teach mathematics						
d) I am not competent to teach mathematics						
e) Mathematical word problems are hard to teach						
f) I like to teach Mathematical word problems						

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Supervised by: Dr Nkosinathi Mpalami. University of the Free State Qwa Qwa Campus. Office: 1019, Kgorong Education Building

g) I use Teaching Aids to teach word problems						
h) I take word problems from textbook(s)						
i) I create my own word problems						
j) Learning Mathematics in English in Grade 4 makes it hard for learners						
k) Grade 4 learners fail word problems						
l) Mathematical word problems are hard because of the language used						
m) Mathematical word problems are hard because of the high cognitive demands of the tasks						
n) Mathematical word problems must be taught in home languages						
o) Mathematical word problems must be taken out of the syllabus						

I would like to sincerely thank you for your participation in this study.

Mpho Mokhathi (2014103168)
Contact details: 069 373 0914

Supervisor: Dr. Nkosinathi Mpalami

Principal Researcher: Mpho Mokhathi 2014103168 Cell: 083 402 1733
Supervised by: Dr Nkosinathi Mpalami. University of the Free State Qwa Qwa Campus. Office: 1019, Kgorong Education Building

APPENDIX G: LESSON OBSERVATION TOOL

UNIVERSITY OF THE FREE STATE
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YUNIVESITHI YA FREISTATA
UFS UV

Lesson Observation Instrument For Educator

Name of Observer:	**Date:**
Lesson Title:	**Subject:**
Duration of lesson:	**Grade:**

Focus of the Observation:	**Types of Strategies used in the lesson:**
The types of tasks used during the lesson:	**Effectiveness of the use of learner teacher support material:**

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Additional notes and comments:

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APPENDIX H: INTERVIEW SCHEDULE

Interview Schedule:

1. How many years have you been teaching Grade 4 mathematics?

_____

2. What would you consider as the successes in lesson 1?

_____

_____

_____

_____

3. What would you consider as the successes in lesson 2?

_____

_____

_____

_____

4. What would you consider as the challenges in lesson 1?

_____

_____

_____

_____

5. What would you consider as the challenges in lesson 2?

_____

_____

_____

_____

6. What influenced your choice of learner teacher support material?

_____

_____

_____

OR.

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7. Why did you not use any learner- teacher support material?

_____

_____

_____

8. Do you deem it necessary to use teaching aids?

_____

_____

9. In your opinion, what challenges do educators encounter when teaching mathematical word problems?

_____

_____

_____

_____

_____

10. Besides getting mathematical word problems from textbooks, are there any other platforms (such as workshops) where they are discussed? If not, would you suggest that it be discussed?

_____

_____

_____

_____

_____

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11. Which strategies would you recommend to other mathematics educators to use during a mathematical word problem lesson?

_____

_____

_____

_____

_____

Please sign below to verify that the above answers are a true reflection of your truth as an educator.

Participant's signature: _____

Date: _____

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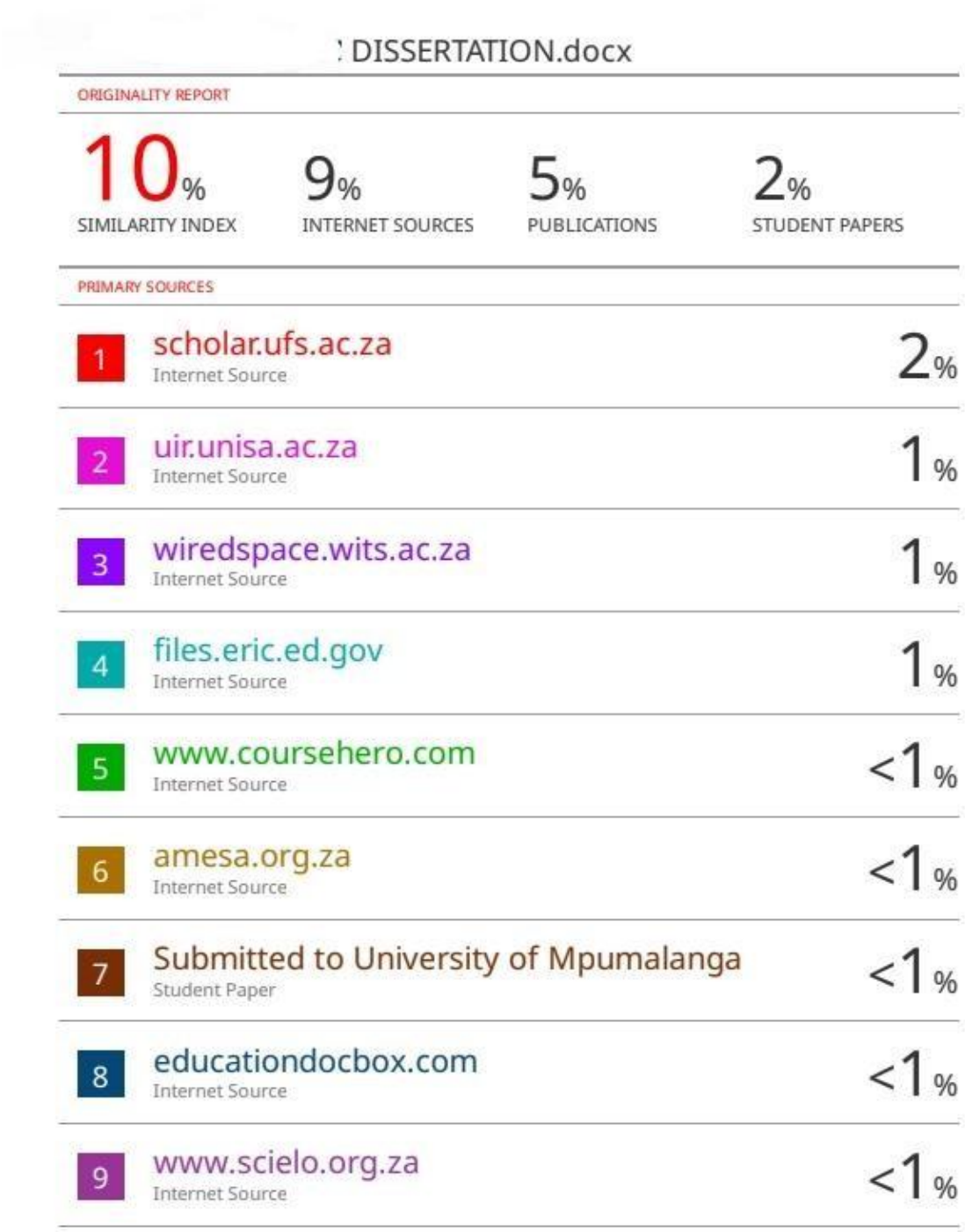
APPENDIX I: SIMILARITY INDEX DOCUMENT



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APPENDIX J: LANGAUGE EDITING CERTIFICATE

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SCHOOL OF BIOLOGICAL SCIENCES

Tel: +27 18 389 2289 **Fax:** 018 389 2134

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Date: 30th June 2024

To Whom It May Concern,

REF: Language Editing and Proof-reading of Dissertations/Theses

Dear Sir or Madam,

This serves to confirm that I have proof-read and edited the **M.Ed. Dissertation** of **M Mokhathi** (Student number: **2014103168**; **UFS**) entitled: **Exploring the teaching of Grade 4 mathematical word problems in the Thabo Mofutsnayna District**. The candidate then later corrected all the identified language and technical errors to my utmost satisfaction. Thus, the document presented here is of sufficient and acceptable academic standards.

Editor

Prof. O Ruzvidzo