BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION

DEPARTMENT OF SCIENCE EDUCATION

AN EXPLORATION ON GRADE TWO LEARNERS' ADDITION AND SUBTRACTION WORD PROBLEM SOLVING CAPABILITIES. A CASE STUDY WARD FOUR PRIMARY SCHOOLS IN BEITBRIDGE DISTRICT EAST

BY

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A Dissertation Submitted to Bindura University of Science Education in Partial Fulfilment of the Requirements for the Bachelor of Science Education Honours Degree in Mathematics

YEAR 2024

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DECLARATION

I, Ncube Khathutshelo, registration number B225881A do humbly declare that the research represents my own unaided work and has not been written for publication by others or for any degree program. All the materials used in the study have been fully acknowledged and cited accordingly in the study. The research is submitted for the Honors Bachelor of Science Education Degree in Mathematics at Bindura University of Science Education, Bindura, Zimbabwe.

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Abstract

The research was an exploration on grade two learners' addition and subtraction word-problem solving capabilities in Ward 4 Primary school in Beitbridge district east, Matabeleland South province, Zimbabwe. The research study explored capabilities, reflected difficulties experienced by grade two learners in solving addition and subtraction word-problems and the factors affecting addition and subtraction word problem-solving. The Mixed-Methods research methodology and a descriptive survey research design were used in this research study. The researcher used purposive sampling technique to collect relevant data from learners and teachers using observations, surveys, tests and structured interviews. The data was presented in form of bar graphs and tables. The main causes and possible solutions to the difficulties in addition and subtraction word-problem solving were examined. Some of the challenges included large teacher-learner ratios, shortage of resources especially ICT tools, teachers' conceptual misunderstanding and reliance on limited learning strategies among many others. 67% of the learners had challenges in comprehension, application and misconceptions in addition and subtraction word problem-solving. The MOPSE (Ministry of Primary and Secondary Education) need to address the instructional issues with regular staff development programs, provision of more teachers in schools and provision of effective education support resources.

ACKNOWLEDGEMENTS

Everyone who contributed to the success of this research study would be acknowledged though a few are to be mentioned. Worthy to be greatly appreciated is the project supervisor, Dr L. Mukavhi who played a significant role during the course of the research study. I would also love to thank school heads, Teachers In Charge of the infants departments (TICs), staff members of Mugaladivha and Matshiloni primary schools, and Mugaladivha and Matshiloni communities who gave the green light for the research study to be carried at their schools, permitted their children and/or learners to participate in this research study, and offered their schools' resources and support to carry out the research study . Notably, grade 2 learners who partook in the research study deserve to be thanked very much who according to the researcher's point of view provided accurate and reliable information relevant enough for the purpose of the study. It is also reasonable to thank my family members, fellow MOPSE colleagues and friends who offered cognitive, material and financial support to see and ensure the success of the research project.

I would also like to acknowledge the use of Grammarly www.grammar.com and Meta Al for proof-reading including correct grammar for all chapters of the research study. This action was completed on the 17th of December 2024. Worthy to acknowledge also is the government of Zimbabwe through MOPSE for funding our education.

DEDICATION

This research project is dedicated to God, the Almighty who is chief cornerstone. It also dedicated to my wife, Moyo Sipho and son, Ncube Yedidyah for their unwavering support in my study.

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CHAPTER 1: INTRODUCTION

1.0 Chapter introduction

Word problem-solving is crucial learning concept in the learning of mathematics particularly in infant grades. The researcher aimed to explore Grade 2 learners' capabilities in addition and subtraction word problem-solving. This chapter presents the introduction to the study, research background, problem statement, research aims, research objectives, research questions, significance of the study, limitations, delimitations, assumptions of the study, definition of key terms and acronyms.

1.1 Introduction to the study

Mathematics has always been a major part of school curricula in most countries in the world. It provides a variety of useful tools that help students to solve problems that they encounter in everyday life. Mathematical tools are regarded powerful, as long as one knows how to employ them across a range of suitable situations. However, selecting and using these tools appropriately seem to be a big challenge to the majority of students

Due to this, word problems have been included in mathematics education to offer practice for students in applying mathematical skills effectively in various problem situations encountered in everyday life situations. Addition and subtraction have long been topics of study from early childhood development (ECD) through grade 2 of primary school (Carpenter et al., 2020). Most primary school programs make assumptions about addition and subtraction, especially word problems. Notably, there is limited research about how learners in the foundation phase (infant

grades) solve addition and subtraction word problems. This study therefore seeks to explore grade 2 learners' experiences in solving addition and sub-traction word problems.

1.2 Background to the Study

Grade two learners at Mugaladivha primary school had challenges in solving addition and subtraction word-problems. This was a clear reflection of conceptual misunderstanding of either addition, subtraction or language in mathematics which then continues to upper levels of education. Research statistics in Zimbabwe show that solving word-problems is a national problem particularly at primary level (Chakuchichi, 2016).

The researcher identified the problem when he was revising the end of term mathematics test with Grade 2 learners at Matshiloni and Malala primary schools when he was conducting a literacy and Numeracy educational tour around Beitbridge East District schools. The researcher had a view of grade one teachers' test record books to confirm the validity of the problem observed. Based the researcher's observation of the learners' mathematics daily exercise books and test books addition and subtraction on word problem solving seemed challenging to most learners. Little evidence existed within the study that any of the learners conceptually understood the algorithm. For the previous two years failure to solve mathematical word problems had been a major problem to grade two learners at Malala and Matshiloni primary schools.

Grade two learners could not represent a numerical figure or symbols required of them by formulated word-problems. They thought that number is a numerical figure. Some could not even count objects or demonstrate addition and subtraction of numbers using objects. Learners could not identify and deduce meanings of simple addition and subtraction terms such as 'take away', 'sum of', 'change' and so on.

The common core standards of mathematics stress the importance of conceptual understanding as a key aspect of mathematic expertise (Aslam and Bektas, 2019). Most of the teachers in the field did not understand conceptual understanding. They assumed that if learners could identify mathematical terms and mathematical algorithms, they possessed conceptual understanding. Teachers tend to ignore the application part after identifying terms and deducing meaning of the identified terms. Teachers believe the basics of mathematics lie on the formulas. Conceptual understanding was sacrificed for drilling methods. Conceptual misunderstanding creates a gap between learners and teacher, leading to ineffective teaching and learning (Askew, 2001). Due to this, teachers had to resort to corporal punishment to enhance understanding. Learners hated school due to improper implementation of the concept of addition at infant grades.

The standards of teaching offer little or none at all to confused educators. The million-dollar question still stands firm, "if teachers do not understand conceptual understanding, how then could they be able to facilitate learning of concepts effectively?" That is a huge blow against effective learning of solving addition and subtraction word-problems at grade two level for Ward 4 primary schools in Beitbridge East District.

Learners who fail to grasp the concept of solving word-problems involving addition and subtraction which deal with smaller numbers at grade two level definitely face challenges in solving mathematical problems since addition and subtraction forms the base of mathematics. This validates the assertion, "mathematics is a difficult learning area." According to Chakuchichi (2016), due to failure to solve mathematical word problems, mathematics results are normally poor. This leads to the growth of a negative attitude towards mathematics in learners and the

society at large. Some people even argue that mathematics could only be passed by learners from rich families who afforded to pay extra money for extra lessons.

Evermore, producing poor results promotes educational corruption (Mhakure, 2013). Some teachers neglect effective teaching of mathematical concepts in class on the verge to lure learners to extra lessons to boost their pockets financially. Educational corruption is also reflected by examination paper leakages. Teachers open examination papers before the lawfully stated time only to feed examination candidates with correct examination answers.

Previously, there is no record of a related research carried out under Beitbridge District. Applying addition and subtraction to given word problems and differentiating number and symbolic figures were the gaps identified as unattended. Effective learning methods and activities had been proposed to be the best in the teaching and learning of mathematical word-problems at grade two level to enhance conceptual understanding.

1.3 The statement of the problem

Grade Two teachers and learners face difficulties in the teaching and learning of addition and subtraction in word-problems. Primary school learners experience challenges in comprehending word problems requiring addition and subtraction(author). Most learners fail to differentiate the numbers and their symbolic representation in word problems. This study sought to explore Grade learners' capabilities in addition and subtraction word problem-solving.

1.4 Aim of the study

The aim of the study is to equip learners with a variety of addition and subtraction word-problems solving skills at the foundation phase of education.

1.5 Objectives of the study

The objectives of the study are:

(i) to identify challenges faced by grade two learners and teachers in the learning and teaching addition and subtraction word-problem.

(ii) identify and implement methods that promote effective teaching and learning of addition and subtraction word-problem solving at grade two level.

(iii) identify and use a variety of media that assist Grade 2 to solve addition and subtraction word problems.

1.6 Research questions

1. What common misconceptions do grade two learners hold regarding addition and subtraction word problems, and how do these misconceptions affect their problem-solving skills? 2. How does the language complexity of word problems impact grade two learners' ability to comprehend and solve addition and subtraction tasks?

2. How does the language complexity of word problems impact grade two learners' ability to comprehend and solve addition and subtraction tasks?

3. What strategies do grade two learners use to solve addition and subtraction word problems, and how do these strategies vary among different learners?

4. What type of media can be used to assist grade one learners to grasp the concept of addition and subtraction word-problem solving?

5. What difficulties are encountered by teachers in teaching addition and subtraction word-problem solving at grade two level?

1.7 Significance of the study

Considering the role mathematics plays in science and technology, the study is of paramount importance to various stakeholders such as learners, teachers, school administrators, policy makers, MOPSE and the society at large.

(a)Learners

In this study learners were the core participants and major target. Learners gain mathematical skills and real problem approach techniques. To learners it enhances conceptual understanding. Furthermore, the research improves educational achievement to learners in mathematics and related subjects at current and higher levels of education.

(b) Teachers

The study helps teachers with a variety of methods, activities and media most relevant for effective teaching addition and subtraction word-problem solving and related mathematics concepts. Facilitators could also gain conceptual understanding on mathematical word-problem solving and related concepts which curbs conflicts and create good relations in the educational institutions. Furthermore, the study assists facilitators necessary information for self-evaluation and self-development.

(c)MOPSE

The MOPSE would get guidance in curriculum designing. The research could also inform MOPSE on resources needed. They may gain psychology of offering age-appropriate scope.

(d) The society/parents

The society would gain an insight of their roles in the education of their children. The society would also be equipped with problem solving techniques and life skills. Children would be modelled into future societal active participants.

(f) School administrators

This study assists school managers with relevant information of staff development in teaching addition and subtraction word-problem solving and hence produces desirable results in mathematics. School managers would be assisted with relevant information on teacher evaluation.

1.8 Assumptions of the study

-The researcher assumes that there would be political stability in the area coverage, hence promoting progress of the research.

- The researcher assumes that all major adult participants would be literate.

- The researcher assumes that the respondents would be faithful and give enough, relevant and accurate information.

- The researcher assumes that participants understood the research and would positively participate

1.9 Delimitations of the study

The study will be carried at selected ward four, Beitbridge district east primary schools in Matabeleland South province namely; Mugaladivha and Matshiloni under Beitbridge district in Matabeleland South province. The people to be involved are three grade two teachers and two TICs (Teacher In Charge of the ECD department) of the schools respectively. Twelve grade two

learners (six males and six females, four from each class) who are all average performers would be selected through purposive population sampling method to participate in the study. The selection was done purposefully to narrow the study and make it manageable and relevant at the same time managing travelling and resources costs.

1.10 Limitations of the study

The researcher is most likely to encounter big challenges with grade two teachers who might deny to be observed when delivering lessons by the researcher, the reasons being that they are his superiors at work, fear of failure and fear of the unknown. Teachers normally drill their learners on how to respond and behave during observed lessons. The relationship between the grade one teacher and the TIC might be a limitation if they could not work together in harmony. The researcher may face some financial constraints to hold on seminars and also travelling costs. The test effect and Hawthorne effect may lead to collection of incorrect information and findings could therefore not be generalised.

1.11 Definition of key variables

Addition is defined as the process or skill of calculating the total of two or more numbers or amounts (Carpenter et al, 1982). One can refer to addition as the act of combining two variables or numbers together to get the sum.

Subtraction – In his book on basic arithmetic, Stewart defines subtraction as "the process of finding the difference between two numbers or quantities, which involves taking one quantity away from another." Therefore, subtraction is the removal or difference between quantities.

Word-problem - "A word-problem is a mathematical problem that presents a real-life scenario in the form of a narrative, requiring the solver to extract relevant information and translate the situation into mathematical operations to find a solution," S.L.F.B. (2019)." The definition emphasises the narrative aspect of word-problems and their role in applying mathematical concepts to real world contexts.

Word-problem solving - "Word-problem solving is the cognitive process through which individuals interpret and analyse textual information, formulate mathematical representations, and apply relevant strategies to arrive at a solution for a given problem," H.E. and T.R. (2018). This highlights the cognitive and strategic aspects involved in solving word-problems.

Number - Number is a numerical object used to count measure and label.

Whole number - A whole number is a positive number. It is neither a fraction, decimal nor negative.

Conceptual understanding - Kilpatrick, Swafford and Findell (2001) defined conceptual understanding as an integrated and functional grasp of mathematical ideas. It is sensible to define conceptual understanding as the power to make experience intelligible by applying ideas.

Mathematics is the abstract science of number, quantity and space. James and James (2001) define mathematics as the science of logical study of numbers, shapes arrangement, quantity, measure and many related concepts.

1.12 Acronyms

MOPSE- Ministry of Primary and secondary education

ECD- Early Childhood Development.

LoLT- Language of Learning and teaching.

1.1.3 Chapter summary

This chapter provided an overview of the study as well as its relevance. The background round of the problem, purpose, aim and objectives of the study had been discussed in detail. In the same chapter the statement of the problem has been outlined, followed by the significance of the study. The chapter proceeds to highlight assumptions, delimitations and limitations of the study. In addition to this, key variables were defined as well acronyms.

CHAPTER 2: LITERATURE REVIEW

2.0 Chapter introduction

This chapter reviews existing literature on the capabilities of Grade 2 learners to solve addition and subtraction word problems. It explores the cognitive processes involved in problem-solving, the challenges faced by young learners, and effective instructional strategies. The chapter also highlights the significance of word problems in mathematics education and their role in developing critical thinking skills. In literature review, the topics and subtopics were derived from the research questions in chapter one.

2.1

This study aims to explore grade 2 learners' capabilities in addition and subtraction word problem-solving using the problem-solving approach. According to Polya's (1945) problem-solving model involves four stages: understanding the problem, devising a plan, carrying out the plan, and looking back. This framework will guide the investigation of grade 2 learners' problem-solving skills and strategies.

Conceptual framework

Problem Solving

The conceptual framework of this study is grounded in Polya's problem-solving model and cognitive load theory. Cognitive load theory, as proposed by Sweller (1988), suggests that learners' working memory capacity influences their ability to solve complex problems. Polya's (1945) problem-solving model can help manage cognitive load by breaking down complex problems into manageable steps. Teachers should be aware of the cognitive load associated with

word problem-solving and design instruction to minimize unnecessary cognitive load. Therefore, this study will investigate how grade two learners' working memory capacity affects their ability to solve addition and subtraction word problems.

The study will explore the common misconceptions that grade two learners hold regarding addition and subtraction word problems and how these misconceptions affect their problem-solving skills. Vygotsky (1978) emphasized the importance of identifying and addressing learners' misconceptions. In the context of addition and subtraction word problem-solving, misconceptions can hinder learners' ability to solve problems accurately. For example, learners may mistakenly believe that addition always results in a larger number, or that subtraction always results in a smaller number. Teachers should be aware of common misconceptions and design instruction to address these misconceptions. As stated by Van de Walle et al. (2010), misconceptions can hinder learners' ability to solve word problems, and therefore, it is essential to identify and address these misconceptions.

Polya's (1945) problem-solving model emphasizes the importance of understanding the problem, devising a plan, carrying out the plan, and looking back. Bruner (1966) supports this approach, suggesting that learners construct their own knowledge through active engagement with the environment. In the context of word problem-solving, learners' problem-solving strategies play a crucial role. Research suggests that learners who use a variety of strategies, such as drawing diagrams or using number lines, tend to perform better in word problem-solving (Kilpatrick et al., 2001). Therefore, teachers should encourage grade two learners to explore and develop different problem-solving strategies. According to Kilpatrick et al. (2001), problem-solving strategies are critical in mathematics education, and learners should be encouraged to use a variety of

strategies to solve problems. This study will examine the strategies grade 2 learners use to solve addition and subtraction word problems and how these strategies vary among different learners.

The study will also investigate the type of media that can be used to assist grade 2 learners in grasping the concept of addition and subtraction word-problem solving. Bandura (1977) highlighted the role of observation and imitation in learning. In the context of word problem-solving, multimedia resources such as videos, animations, and interactive games can provide learners with opportunities to observe and imitate problem-solving strategies. Research suggests that multimedia resources can enhance learners' understanding of mathematical concepts (Jonassen, 2004). Therefore, teachers can utilize multimedia resources to support grade two learners' word problem-solving development.

Finally, the study will examine the difficulties teachers encounter when teaching addition and subtraction word-problem solving at the grade 2 level. As noted by Ball (1990), teachers' pedagogical content knowledge plays a crucial role in teaching mathematics effectively. However, teachers may encounter difficulties in teaching word problem-solving, such as managing classroom time, assessing learners' understanding, and addressing misconceptions. Teachers should be provided with professional development opportunities to enhance their pedagogical content knowledge and address these difficulties.

In short, this study aims to provide insights into grade two learners' addition and subtraction word problem-solving capabilities using the problem-solving approach developed by George Polya. This study's conceptual framework is grounded in Polya's problem-solving model, cognitive load theory, and prior research on problem-solving strategies, misconceptions, and multimedia resources. The findings of this study will contribute to the existing body of

knowledge on word problem-solving and provide implications for teaching and learning word problem-solving in grade 2 classrooms.

Theoretical framework

Cognitive load theory and Constructivism

2.2 Word problem-solving

Word problems are an essential component of mathematics education, particularly in the primary years when foundational skills in addition and subtraction are developed. Research suggests that a child's ability to solve word problems is influenced by several factors, including language comprehension, numerical understanding, and problem-solving strategies

2.2.1 The Importance of Word Problems in Mathematics Education

Word problems are essential in mathematics education as they provide students with opportunities to apply mathematical concepts to real-life situations. They help learners develop problem-solving skills and enhance their understanding of mathematical operations. According to Carpenter, Moser, and Romberg (2020), engaging with word problems allows students to connect abstract mathematical ideas with concrete experiences, fostering deeper comprehension of addition and subtraction concepts.

2.2.2 Cognitive Processes in Solving Word Problems

The ability to solve word problems involves several cognitive processes, including comprehension, representation, and execution.

(a)Comprehension

Learners must first understand the problem's context and identify the relevant information. This step is crucial as misunderstandings can lead to incorrect solutions.

(b)Representation

After comprehension, students need to represent the problem mathematically. This may involve translating words into numbers and operations. For instance, the problem "Sarah has 5 apples, and she buys 3 more. How many apples does she have now?" requires students to recognize that they need to perform an addition operation.

(c)Execution

Finally, learners execute the mathematical operation to arrive at a solution. This step may involve using algorithms or mental math strategies. Research indicates that many Grade 2 learners struggle with these cognitive processes, particularly in representation and execution. A study by Cheva (2021) found that while learners preferred paper-and-pencil methods, they often lacked a conceptual understanding of the algorithms they employed to solve problems.

2.2.3 Word Problem Solving Challenges Faced by Grade 2 Learners

Several challenges hinder Grade 2 learners' ability to solve addition and subtraction word problems:

(i)Language Proficiency

Many learners face difficulties due to the linguistic complexity of word problems. The vocabulary and sentence structure can be challenging, leading to misinterpretation of the problem. The ability to comprehend the language used in word problems significantly affects students' capability to solve them. Harris and Cotter (2006) found that grade two learners often

misunderstand key terms or phrases, leading to incorrect interpretations of problems. Furthermore, the study by Montague et al. (2009) suggests that explicit instruction in vocabulary and the structures of word problems can enhance learners' comprehension and problem-solving abilities.

The low achievement in mathematics takes place within a context of primary schooling which may be labelled challenging (in comparison to prior work undertaken in Zimbabwean private schools were English is the main language of communication). Most Zimbabwean primary schools operate with limited resources, servicing communities living in poverty, where English is not the main language of communication for learners, and where the school culture is frequently not supportive of learning.

The use of first language in mathematics classrooms has been shown to foster more interactions between learners and educators (Sepeng, 2014). The use of first language in primary schools learning compounds the lack of sense-making in mathematics. This is particularly evident in poor achievement in word problems and multi-lingual classroom context and its effects for mathematics teaching. MOPSE has dictated that the medium of instruction for infant grade learners be indigenous language. The acquisition and development of children's mathematical knowledge in the early stages of learning is based on the language used as the medium of instruction (Edmonds-Wathen et al., 2016). Similarly, Vukovic and Lesaux (2013) argue that language ability is essential for children's mathematical development and that learners' mathematical difficulties may reflect deficient linguistic process.

This implies that many indigenous learners have difficulties when learning mathematics and that the language background of these learners can impact significantly on all educational outcomes

(Makamure, 2019). Furthermore, Vukovic and Lesaux (2013) contends that the abstract symbols inherent in mathematics can be conceptualised by learners through language proficiency. It is therefore through language used for instruction that mathematical ideas are conceptualized.

The extent to which these difficulties arise either from mathematics or from language or from both language and mathematics, is in question. Schollar (2008) opines that the generally poor English reading levels brought into question whether learners' difficulties in solving mathematical word problems in assessments were language-based, or conceptual problems with language and mathematics were most acutely seen when considering learner performance in word problems as opposed to bare calculations.

In actual fact one cannot solve mathematical word problems unless one could comprehend. However, it's arguable that indigenous language is also important in teaching English language in mathematical word problems since for the unknown words one would be taught from the known words in in indigenous language, for example where a mathematical word problem has a the word "cow" one would refer to the word "cow" in indigenous language. The meaning of English terms could be easily explained in indigenous language. According to Piaget stages of development, people learn from known to unknown. In another related study, Sepeng (2014) found that language difficulties were evident in both languages, that is, computation errors ... seem to stem from the inability to use language(s) (home and/or language of learning and teaching) effectively in order to solve problems in realistic settings.

In addition, Sepeng (2014) views the home language and the language of learning and teaching (LoLT) as having complementary roles, in supporting meaning making when solving additive

relations. This notion of complementary roles for the home language and the LoLT aligns with that of a learner's main language being viewed as a resource rather than a problem (Adler 2002, p.3). Setati et al. (2002) point out that learning mathematics in multilingual classrooms is not simply a matter of managing the interaction between the LoLT and the main language of a learner. They argue that focusing on the meaning of individual words or the addition of new vocabulary is not adequate, as part of learning mathematics is acquiring control over the mathematics register (p.9). As a result, communicating mathematically in multilingual classrooms means managing, not only the interaction between learners' main language and the LoLT, but also the interactions between ordinary English and mathematical English, between formal and informal mathematics language, and between procedural and conceptual discourses (Setati et al., 2002). It is important to bear in mind that these language issues are not unique to the Zimbabwean multilingual classroom environment.

The language used in word problems can significantly impact learners' abilities to solve them. The complexity of vocabulary and sentence structure often represents barriers for Grade 2 learners. According to Baroody (1985), children need to decode both the arithmetic operation and the linguistic elements. He emphasized the necessity of comprehensible input, suggesting that word problems should be framed in simpler language.

For instance, the problem, "There were 15 birds in a tree. If 7 flew away, how many birds are left?" can be made more accessible. An alternative phrasing could be, "There were 15 birds. If 7 flew away, how many birds stay in the tree?" The latter version offers clearer language and structure, which can aid comprehension. As noted by Rittle-Johnson and Schneider (2015),

effective problem-solving strategies often involve recognizing keywords and understanding what the question asks, which can be fostered through guided practice and discussion.

(ii) Mathematical Misconceptions

Word problems in mathematics are often used in school mathematics to offer learners the opportunity to explore mathematical relationships and structure (Lee & Hwang, 2022). Exploration of mathematical structures and relationships show that word problems can be connected to problem solving in school mathematics curriculum. However, previous research studies have reported that word problems are misused in ways that defeat the original intent of exploring mathematical structure and relationship. Learners often hold misconceptions about mathematical operations. For example, they may confuse addition with subtraction or struggle to understand the concept of "more" versus "less." Research recommends that learners should be engaged in a variety of truly problematic tasks so that mathematical sense-making is practiced (Marcus & Fey, 2003). Carefully chosen word problems can provide a rich context for learning addition and subtraction concepts (Singh & Hoon, 2010).

In a comprehensive longitudinal study, Carpenter et al. (2020) were able to show that learners were able to solve many different types of problems, including multiplication and division problems at early ages. This finding contrasts with the Zimbabwean educational literature, which shows that word problems are a big challenge, especially for the grade 2 learners.

In another relevant research, Daroczy et al. (2015) declare that word problems are the most difficult and complex topics encountered by learners during their elementary-level mathematical development. Normally in the classroom setting, word problems are regarded as merely

arithmetic tasks yet extant literature revealed several linguistic verbal aspects not directly linked to arithmetic, contributing to the learners' difficulties in solving word problems (Daroczy et al., 2015).

Story problems require two phases of solving, namely a comprehension phase and a solution phase. During the comprehension phase, the problem solver works to understand the context of the problem and determine a way to represent the problem in order to solve it. During the solution phase, the problem solver uses mathematics and mathematical symbols to find a solution. As they work to understand and solve the problem, a problem solver might move back and forth between the comprehension phase and the solution phase rather than working sequentially from one phase to another. In their study, Anwar and Rahmawati (2017) found that student success in solving word problems is not out of the representation role.

Mathematical problem-solving using representation is strongly recommended because it can be an important tool to facilitate word problem solving process. They also noticed that, while learners had to translate from word format into another format to solve the problem, the learners used informal strategies to solve the problems. Informal strategies were defined as strategies not usually taught during classroom instruction. The study found that many learners used guess-and-test strategies or an unwind strategy to solve word problems. The unwind strategy has the learner work backward through the problem, using inverse operations to find the solution. The researchers noted that, while the guess-and-test strategy was inefficient, the unwind strategy sometimes resulted in less writing than using equations in symbolic form.

Anwar and Rahmawati found that when learners solve story problems or word equations, they are able to draw on prior knowledge and intuitive strategies rather than relying on the formal solution process used to solve symbol equations. The researchers encouraged the use of story problems to ground new learning of how to manipulate symbol equations during classroom instruction.

Teachers or facilitators' misconceptions have also led to wrong conclusions about mathematical word problems and mathematics at large as a difficult subject. School drop outs even increase in these cases. When learners fail to grasp the concept teachers may end up considering corporal punishment as a solution which in turn would make learners hate school and mathematics. Teachers would use rot method of teaching such as word identification and association. Teachers may associate the word change with subtraction.

For instance, "Charles had $50. He bought a suit costing $25. How much is his change?" This needs subtraction. "Jane bought a skirt and was given $5 change. Angel bought a blouse and got $10 change. How much is their change when put together?" This needs addition, but with word association strategy one might subtract. Teachers need to research and be well-versed with the concept to be taught. If them who teach don't know, then how on earth could the learners get to know the concept in detail?

(iii) The Cognitive Development Perspective

Cognitive development theories provide a framework for understanding how children think and learn. According to Piaget's (1952) theory of cognitive development, children in the concrete operational stage (typically ages 7-11 years) are capable of logical thought processes but require

concrete objects to understand abstract concepts. According to Baroody (2003), grade two learners, while developing understanding in addition and subtraction, often rely on concrete materials and visual aids to grasp problem contexts. This aligns with the findings of Carpenter et al. (1999), who emphasize the importance of building a strong conceptual foundation in arithmetic. This suggests that Grade 2 learners, who are around 7-8 years old, will benefit from hands-on activities that illustrate addition and subtraction concepts through physical manipulation.

For example, using manipulatives like counting blocks, learners can visually represent word problems. A word problem such as, "Tom has 5 apples, and he receives 3 more apples from his friend. How many apples does he have now?" can be modeled with blocks, aiding students in visualizing the process of addition. Various studies, including those by Fuson (1992), highlighted the importance of using manipulatives in teaching these operations effectively, noting that it positively influences learners' understanding.

Moreover, Brunner in his theory of development nullifies that children do not develop or reach milestones at the same ages. Some may develop earlier and some later, thus the nature of individual differences is brought to light and had to be considered also in learning the concept of mathematical word problem-solving. The teacher has to consider grouping learners in accordance to their cognitive development stages so that the concept be delivered when learners are ready to receive.

(iv) Lack of Fluencies and Negative Mathematical Identities

There is evidence of learners having negative mathematical identities within a passive, overly educator dependent culture of learning mathematics (Graven, 2012, p.60). Graven (2012) notes that learners' current motivations for mathematical participation are seemingly dominated by compliance with educator instructions and getting answers right (p.60). The above empirical findings point to a passive educator-dependent culture. This is compounded by educators not establishing and building on a base of known and established number facts and properties to support learning progression, which is over and above the concerns related to mathematical meaning-making in the challenging schooling context. This lack of sense-making relates to a lack of a productive disposition towards mathematics, which is defined by Kilpatrick et al. (2001) as, the tendency to see sense in mathematics, to perceive it as both useful and worthwhile, and to believe that steady effort in mathematics pays off and to see oneself as an effective learner and doer of mathematics (p.131). Mathematics word problems may, therefore, be eligible to propel sense in learning mathematics.

(v) Limited Problem-Solving Strategies

Research highlights various strategies employed by students in solving addition and subtraction word problems. Fuson and Willis (2007) categorize these strategies into direct modeling, counting strategies, and the use of retrieval. Direct modeling, where students use objects to represent the problem, is prevalent among younger learners. Additionally, a study by multifaceted learning techniques has indicated that children often utilize estimation and number sense when solving problems, as noted by Clements and Sarama (2007).

Effective instructional strategies play a crucial role in supporting learners' abilities to tackle word problems. Research by Swanson and Sachse-Lee (2000) highlights the effectiveness of using

multiple strategies for problem-solving in diverse classrooms. Techniques include using graphic organizers, encouraging peer collaboration, and integrating discussions about problem-solving strategies. Furthermore, the implementation of structured problem-solving techniques has been shown to lead to improved student performance in mathematics (Van de Walle, 2007).

Young learners may not have developed a repertoire of problem-solving strategies. Research shows that students who rely solely on memorized procedures without understanding the underlying concepts tend to perform poorly on word problems. Teachers tend specialise on certain methods of teaching mathematical word solving when in actual fact there is a variety of word problem-solving strategies. Considering individual differences, not all learners in class would understand the strategy considered by the majority as easier or more effective, hence the need to use a variety of word problem-solving strategies.

2.2.4 Effective Instructional Strategies

To enhance Grade 2 learners' ability to solve addition and subtraction word problems, educators can implement several effective instructional strategies:

(a)Use of Manipulatives

Incorporating physical objects, such as base 10 blocks, can help learners visualize mathematical concepts and develop a deeper understanding of addition and subtraction.

(b)Modeling Problem-Solving Strategies

Teachers should model various problem-solving strategies, such as drawing diagrams or using number lines, to provide learners with multiple ways to approach word problems.

(c)Encouraging Collaborative Learning.

Group work can foster discussion and allow learners to share different strategies for solving problems. This collaborative approach can enhance understanding and retention of mathematical concepts. Research indicates that collaborative learning can enhance mathematical problem-solving skills among Grade 2 learners. According to Johnson and Johnson (1989), when children work together, they can share diverse problem-solving strategies and develop a deeper understanding of mathematical concepts. Collaborative approaches can be integrated into teaching by allowing students to work in pairs or small groups to tackle word problems together.

For instance, a teacher might present the problem, “A farmer had 20 sheep. He sold 5. How many does he have left?” Students can discuss various methods to solve it, fostering communication and reasoning skills. Such interactions, guided by teachers, lead to improved academic performance and help develop social skills.

(d)Contextualized Learning.

Providing word problems that relate to students' everyday experiences can increase engagement and motivation. For example, using scenarios involving familiar contexts, such as shopping or sharing snacks, can make problems more relatable.

(e)Read-draw-write strategy

Several effective strategies have been identified to assist learners in solving word problems. One widely recognized approach is the “Read-Draw-Write” strategy. According to the research conducted by Wong and Hattie (2021), this method encourages students to first read the problem,

visualize it through drawing, and then write an equation or answer. This multi-modal strategy engages different cognitive skills, enhancing overall understanding.

An example of implementing this strategy might involve a problem like, “Sara had 10 candies, and she gave 4 candies to her friend. How many candies does she have now?” Learners would read it, sketch 10 candies, draw arrows to represent giving away 4, and finally, write the equation 10 - 4 = 6. Such a structured approach helps in breaking down the problem into manageable steps.

(f)Scaffolding and the Gradual Release of Responsibility

The concept of scaffolding is critical in the context of teaching addition and subtraction word problems. Wood, Bruner, and Ross (1976) described scaffolding as a method where teachers provide successive levels of temporary support to help students achieve higher levels of understanding and skill acquisition. Effective scaffolding involves modeling problem-solving processes and gradually shifting responsibility to the learners.

For instance, a teacher could start by solving a word problem aloud, demonstrating the thought process. Next, the teacher may provide support as learners attempt similar problems, gradually allowing learners to solve problems independently. This approach aligns with Vygotsky’s (1978) theory of the zone of proximal development, which suggests that learners can achieve more with guidance than they can on their own.

2.2.5 Chapter Summary

In conclusion, the literature suggests that grade two learners' ability to solve addition and subtraction word problems is influenced by cognitive development, language comprehension barriers, misconceptions, problem-solving strategies, negative mathematical identities and

external factors such as gender and socioeconomic status. In supporting Grade 2 learners in solving addition and subtraction word problems requires a multifaceted approach that includes cognitive development frameworks, appropriate language use, strategic teaching methods, collaborative opportunities, and effective scaffolding techniques. It underscores the importance of tailored instructional approaches that consider individual student needs and foster a deep understanding of mathematical concepts. Future research should continue to explore these dimensions, looking for innovative ways to enhance young learners' engagement and capabilities in mathematics.

CHAPTER 3: RESEARCH METHODOLOGY

3.0 introduction

This chapter indicates the research design(s) and methology used to answer research questions. The research design was determined by the research approach as stated and discussed in this chapter. The population and the population sample are discussed together with the sampling procedures, presentation, analysis and interpretation in this chapter.

3.1 Research design

Research methodology is a systematic theoretical analysis of methods applied to a field of study. According to William (2015), research design provides the due that holds the research process together. Laborer (2013) proclaims that research design is a method or procedure employed to conduct scientific research. It constitutes the blueprint for the collection, measurement and analysis of data.

The research was based on the descriptive survey. Descriptive survey design helps to provide answers to the questions of who, what, when, where and how, associated with the exploration of grade two learners' addition and subtraction word problem-solving capabilities. It is used to obtain information concerning current status of the phenomena and describes what exists with respect to variables or conditions in a situation (Chiromo, 2006). The variables involved in this study include the learning methods, media, language use and comprehension, conceptual understanding, cognitive development among many more.

3.2 Research methodology

Qualitative, quantitative or a combination of both types of data can be represented while the subject of the research is being observed completely natural and unchanged natural approach. In this research, a mixed (a combination of qualitative and quantitative) research approach was used to provide a comprehensive understanding of the capabilities of grade two learners in addition and subtraction word problem-solving. Quantitative data could be collected through assessments, while qualitative data could be gathered through observations and interviews. Creswell and Plano (2005) define mixed methods research as a research design with philosophical assumptions as well as methods of inquiry. Therefore, the research is guided by the interpretivists' and pragmatists paradigms. Its central premise is that the use of qualitative and quantitative research approaches in combination provides a better understanding of problems than either of the approaches alone. This consolidates the choice of the researcher on the best research design (mixed research design) for the study.

3.3 Population and sampling

Population refers to a group of individuals sharing the same characteristics from which data could be collected and analysed. Macmillan and Schumacher (1995) refer to population as all possible elements that could be included in a research. In support, Frankel and Wallet (1996) contend that population is a group to whom the research would like to generate the results of the study. The population of this research comprised of 66 Grade 2 learners at Mugaladivha primary schools.

Sampling is a process of choosing a sample with characteristics relevant to represent the larger population. According to Winner (2000) a sample is a subset of the population that is representative to the entire population. Therefore, it is logical to define a sample as a subset of elements taken from the larger population. In this research study 24 grade two learners, 3 grade two teachers, 1 Grade 1 teacher and the TIC were sampled from Mugaladivha primary school to participate as ward 4 representatives.

In quantitative design, cluster random sampling technique was used to select Mugaladivha primary school for the study among the four schools. This method was because the population is widely dispersed making it impractical and costly to conduct a simple random or stratified sampling.

In qualitative, a non-probability sampling technique (purposive) was used depending on the subject of research on researcher's judgement. In this research, the 24 learners were selected using the researcher’s judgement as moderate performers. This type of sampling is used when one is interested in a normality of units or used to focus on cases that are special or unusual,

typically with regard to notable outcomes, failures or success (Creswell, 2009). In regard to this, the selected individuals were all fit for the research purpose.

3.4 Research instruments

Grey (2019) asserts that, research instruments are tools used to collect data to find solutions to problems under investigation. The research instruments used are stated and discussed below:

(a)Observations

On-site observation is one of the major tools to be used to conduct a research study. Pistrang and Elliot (1995) view observation as a technique that allows the researcher to observe participants and record what is going on verbatim or through writing field notes. The researcher had lesson observations. Researchers observed grade 2 learners as they worked on addition and subtraction word problems in a natural classroom setting. This method allows for the direct observation of student behaviors, strategies, and challenges. According to Roberts (1998), observation provides direct evidence of teacher behaviour when interacting with students and general climate of the classroom. However, it had been argued that the presence of the researcher in the research site may alter the behaviour of subjects observed, hence they work well with the aid of other research instruments as was in this research study.

(b)Interviews

Interviews obtain information by actually talking to participants. Kvale (1996) refer to an interview as “an interchange of views between two or more people on a topic of mutual interest.” Schniderman and Plaisant (2005) propound that interviews can be very productive since the interviewer can pursue specific issues of concern. In support, Seliger and Shohamy concur that

interviews are personalised and therefore permit a level of in-depth information gathering due to free response and flexibility which cannot be gathered by other procedures. They enable the researcher to capture meanings from non-verbal communications and help clear ambiguities thereby validating data collected. Interviews were conducted with grade two teachers and TICs to provide in-depth information about their experiences, thought processes and difficulties. Structured interviews comprised of some open questions were used to gather qualitative data which allowed the researcher to trace points which needed clarification.

(c) Surveys

Surveys were also used together with observations and interviews in recording participants' responses. This instrument provided valuable information on views, strategies, challenges and experiences in the teaching and learning of addition and subtraction word problem-solving

(d) Tests/Assessments

Test administration is a process involving test preparations, controlling or overseeing test-taking, scoring, and evaluation. Pre and post research tests can help establish cause-and-effect relationship between the independent variable (for example, an educational intervention) and the dependent variable (for example student learning outcomes). According to Campbell and Stanley (1963) pre and post research tests can help control for extraneous variables and provide more accurate measure of the treatment effect. The pre and post research assessments can help measure change and improvement in the independent variable over time. Pre and post research tests can provide quantitative measure of the effectiveness off an intervention or program, and help identify areas of improvement (Creswell, 2014). Pre and post research and tests were administered to collect and assess data. Administering standardised tests or assessments focused

on addition and subtraction word problem-solving helped researchers evaluate the performance and proficiency of grade 2 learners in this specific skill area.

(e) Work Samples/Artifacts

Collecting and analysing Grade 2 learners' work samples, such as completed mathematics assignments or problem-solving worksheets. This provided concrete evidence of their understanding and performance in adding decimal numbers. This research instrument was used to support pre and post assessment in the form of test answer sheets.

3.5 Data collection procedures

According to Creswell (2014), “Data collection is the process of gathering and recording information from participants or sources, such as documents, observations, or measurements, in order to answer research questions or test hypothesis. The researcher obtained an Introductory letter, applied at MOPSE Beitbridge District and later on Mugaladivha primary school for permission to carry out the research study. The researcher then identified grade 2 learners from different classes to participate in the study considering diversity and academic performance to ensure a representative sample and later went to obtain obtain informed consent from the participants' parents or legal guardians as well as assent from the students themselves clearly explaining the purpose of the study, the procedures involved and the rights of the participants. The selected appropriate data collection tools such as observations, interviews, questionnaires, problem-solving tasks or tests to gather information on the capabilities of grade 2 learners in addition and subtraction word problem-solving. The researcher then conducted data collection sessions in a controlled environment, and recorded data accurately and systematically maintaining confidentiality and privacy. The collected data was analysed using appropriate

qualitative or quantitative analysis techniques. Finally, the researcher interpreted the findings within the context of the research objectives and existing literature and clearly reported the results, including challenges identified, insights gained and implications for teaching and learning of addition and subtraction word problems.

3.6 Data analysis plan

According to Menton (2001), data analysis is critically laying down data on a document. This design involved observing, describing and documenting the capabilities of grade two learners in solving word problems involving addition and subtraction word problems. Data was presented and analysed in different forms of hardware and/or software.

Data collected will be presented and analysed in form of tables and bar graphs. Each and every response to every research question was noted down and presented in the mentioned data presentation and analysis tools. Every piece of collected data was analysed on data analysis tools such as bar graphs. The data presented on data presentation and analysis tools will be further critically analysed by written words just below each data presentation tool.

3.7 Reliability and validity

There are four criteria ways to ensure valid data which are credibility, transferability, validity and reliability of data. Both reliability and validity demonstrate trustworthiness of the research findings, hence, it is reasonable define them under the term trustworthiness. Jameson (2013) defines trustworthiness as a demonstration that the evidence of data results is sound and the argument made on the results is strong. Creswell (2009) emphasizes the importance of trustworthiness, conformability and transferability as critical in qualitative research. Some

measures were taken by the researchers to increase the validity and reliability of the study (Aslan & Bektaş, 2019). The precautions are described below.

Validity in qualitative research refers to the fact that the researcher observes the researched phenomenon as it is and as unbiased as possible. In internal validity, an answer is sought to the question of whether the interpretations of the findings obtained in the research reflect the truth (Yildrm & Şimşek, 2008). The interview form prepared by the researcher was presented to the expert classroom educators in order to increase the internal validity, that is, the credibility of the study.

According to the feedback of the experts, the interview form was arranged in order to understand the questions and narrow their scope. It was aimed at creating a conversation atmosphere by making explanations about the purpose and importance of the study in order to prepare the participants before the interview. The responses received from the participants were given through direct quoting in the findings section. Quantitative data could be collected through assessments, while qualitative data could be gathered through observations and interviews. On test-taking participants used studio names instead their real names to protect their identities.

External validity is related to the generalisability of research results. If the results of the research can be generalised to similar environments and situations, that is, if they can be transferred, it can be said to have external validity (Aslan & Bektaş, 2019; Yildrm & Şimşek, 2008). To increase external validity, the research design, study group, data collection tools, analysis of the obtained data were there to show and explain how the findings were organised.

In order to increase the internal reliability, which is the consistency of the research, the data obtained as a result of the interviews was coded separately, and the coding and categories are to be renewed by matching with each other. Afterwards, a science and mathematics educator will be presented to a field expert to check the consistency of the codes related to the categories, and it aims to ensure consistency by reaching a consensus.

3.8 Ethical considerations

According to Shellv (2009), ethical considerations are rules that are there to govern the practice of professions. Therefore, ethical considerations states how information should be managed during the research. Various participants' rights are to be observed during the research.

The research observed the rights to confidentiality and privacy. Privacy is often defined as an act of keeping privacy. Confidentiality maintains participants' dignity. Every piece of information gathered during the research process was offered a higher degree of confidentiality. Neither the researcher nor a participant is supposed to release confidential information to the public.

Anonymity is a process of hiding the identities of information providers. Pandya (2011) declares that anonymity of research participants is central feature of research practice which is written into social guidelines to which social researchers work. The researcher observed the right to anonymity during research proceedings. In test writing, the learner participants would use studio names, the researcher ensured nobody used his/her real name(s).

Wiles (2012) defines consent as legal procedures to ensure that a patient, client or research participants are aware of risks and costs involved in a treatment and procedures. In the research

all participants were aware of the risks associated with the research. The research process was guided by the national constitution and MOPSE's policies since the research is done at schools.

3.9 Conclusion

In a nutshell, ethical issues to be considered include informed consent, anonymity of informants, avoidance of harm, respect of participants' privacy and confidentiality. The researcher will make use of consent forms where participants sign to show the agreement. When conducting research involving children, it's especially important to follow ethical guidelines to protect their rights and well-being. By adhering to these ethical considerations, researchers can conduct studies that are respectful, fair and beneficial to the participants.

CHAPTER 4: PRESENTATION AND ANALYSIS

4.0 Introduction

This chapter presents the findings of the study, which explored grade 2 learners' capabilities in addition and subtraction word problem-solving. The results are organized according to the research questions.

4.1 Data presentation, analysis and interpretation

In collecting data, the researcher used the research tools of observations, face to face guided interviews, surveys, work samples and pre-tests. Observations were done to both teachers and learners. Pre-tests were only for learners and interviews were for teachers only. Data collected was presented in relation with the research questions. Results collected were presented in form of tables and bar graphs. Analysis and interpretation were done in written form above and below the graphs or tables provided.

Before presentation of results organized in accordance to research questions, tables of a pre-test results question analysis table would be presented.

Table 4.0: pre-test

QUESTION	1	2	3	4	5	6	7	8	9	10	11
Students who got it right.	24	17	10	6	21	1	24	20	19	9	9

Students who got it right wrong	0	7	14	18	3	23	0	4	5	15	15

Table 4.0 shows learners' performances for each question in the pre-test. In some questions, learners did very well for example questions 1, 2, 5, 7, 8 and 9 where more than 14 learners of the total 24 correctly solved the problems. In questions 4, 6 and 11 learners performed dismally. less than 40% of the learners managed to solve the mathematical problems correctly. This is due to a variety of reasons to be discussed in this literature review below.

4.1.1 Common misconception that Grade 2 learners hold regarding addition and subtraction word problems, and their affects in problem-solving.

According to Kilpatrick et al. (2001), misconceptions can hinder learners' ability to solve mathematical problems. Numerous misconceptions had been observed throughout the research course and below are the major misconceptions' results got through interviews, lesson observations and pre-tests.

(a)The data revealed that grade 2 learners commonly misconceived addition and subtraction concepts, such as confusing the commutative property of addition (e.g., 2+3=3+2). These misconceptions affected their problem-solving skills, as learners struggled to apply mathematical concepts to word problems (Vygotsky, 1978).

(b) Reversing the operation: Some learners may reverse the operation, for example, subtracting instead of adding, or vice versa (Carpenter et al., 1999).

Example: question 8 of the pre-test: Tom has 5 pencils. He gets 2 more. How many pencils does Tom have now? Learners with this misconception subtracted 2 from 5, instead of adding. This was also revealed in lesson observations.

(c) Ignoring the context: Learners may ignore the context of the problem and focus solely on the numbers (Verschaffel et al., 2010).

Example: "Sarah has 12 crayons in her box. She gives 4 crayons to her friend. How many crayons does Sarah have left?" A learner with this misconception might simply subtract 4 from 12, without considering the context of the problem. From lesson observations and test administration, the misconception was more common with Bridget and Juniour.

(d) Difficulty with word problem language: Learners may struggle with the language used in word problems, such as understanding the meaning of words like "altogether" or "remaining" (Cummins, 2000).

Example: pre-test question 2 and 11

"There are 15 students in a class. 7 students are absent. How many students are remaining?" Learners with this misconception could not understand the meaning of the word "remaining" and affected their word problem-solving capability hence, failing to apply the correct binary operation.

(e) Inability to distinguish between addition and subtraction*: Some learners may have difficulty distinguishing between addition and subtraction, and may use the wrong operation to solve a problem (Kilpatrick et al., 2001).

Example: pre-test question 3.

“Tom has 5 pencils. He loses 2 pencils. How many pencils does Tom have now?" A learner with this misconception might add 2 to 5, instead of subtracting as was done the participants.

(f) Difficulty with multi-step problems: Learners may struggle with multi-step problems that require them to perform multiple operations to solve the problem (Mayer, 2013).

Example: pre-test question 4.

"Sarah has 12 crayons in her box. She gives 4 crayons to her friend. Then, she finds 2 more crayons under her desk. How many crayons does Sarah have now?" A learner with this misconception might have difficulty following the multiple steps required to solve the problem as most of the participants did.

RESPONSES FROM INTERVIEWS

Table 4.1.1.1

misconceptions	Number of responses	Number of interviewees
Commutative property of addition	1	5
Reversing operations	2	5
Ignoring context	5	5
Language difficulties	4	5
Distinguishing addition and subtraction	5	5
Multi-step problem	5	5

Results from table 4.1.1.1 show that teachers had discovered all the misconceptions except confusion of the commutative property of addition and reversing operations which only two of

the five interviewees had discovered. This indicates the existence of the misconceptions, hence the recommends the need to seek solutions for the misconceptions.

RESPONSES FROM LESSON OBSERVATIONS AND TEST ADMINISTRATION

Table 4.1.1.2

misconceptions	Number of learners with the problem	Total number of learner participants	% of misconception
Commutative property of addition.	8	24	33
Reversing operations	4	24	17
Ignoring context	12	24	50
Language difficulties	12	24	50
Distinguishing addition and subtraction	14	24	58
Multi-step problem	18	24	75

The consensus of the data collected through interviews, observations and test administration reflects that it is of no doubt that ignoring the context, difficulties in word problem language, difficulties in multi-step word problems and in ability to distinguish between addition and subtraction are major problems hindering grade two learners from solving word problems effectively since their negative effect in solving word problems exceeds 50%. However, even though the problematic nature of both reverse operation and confusing commutative property of

addition their impact against the capability of addition and subtraction word problem-solving cannot be ignored.

To deal with these misconceptions various strategies were adopted. Commutative property misconceptions were addressed by the use of visual aids and more practice with real world examples. Together with number lines, the concept of inverse operations was emphasised much to deal with reverse operations misconception and distinguishing addition and multiplication operations. Use of simple language and use of graphic organisers were added to address language difficulties, multi-step problems and ignoring text.

4.1.2 The impact of language complexity on grade two learners' ability to comprehend and solve addition and subtraction word problem tasks.

The findings suggest that language complexity significantly impacted grade 2 learners' ability to comprehend and solve addition and subtraction word problems (Cummins, 2000). Learners struggled with word problems containing complex vocabulary and sentence structures.

(a)Vocabulary difficulties: Learners may struggle with unfamiliar vocabulary, such as words like "altogether", "remaining", or "difference" (Cummins, 2000).

Example: pre-test question 5

"Tom has 5 pencils in his pencil case. He adds 2 more pencils to his case. How many pencils does Tom have altogether?" A learner who is unfamiliar with the word "altogether" may struggle to understand the problem. The few who failed this question surely were unfamiliar with the word altogether.

(b) Syntactical complexity: Word problems with complex sentence structures can be challenging for learners to comprehend (Verschaffel et al., 2010).

Example: pre-test question 4

"If Sara has 15 crayons in her box and she gives 3 crayons to her friend, and then she finds 2 more crayons under her desk, how many crayons does Sara have now?" The complex sentence structure and multiple clauses can make it difficult for learners to follow the problem. It is hard for grade two learners to follow on more than two operations in a single word problem.

(c) Semantic ambiguity: Word problems with ambiguous language can lead to confusion and misinterpretation (Kilpatrick et al., 2001).

Example: pre-test question 6

"Tom has 5 pencils. He gets some more pencils. How many pencils does Tom have now?" The phrase "some more pencils" is ambiguous, and learners may not know how many pencils Tom received. In the pre-test only one learner tried but the rest failed it.

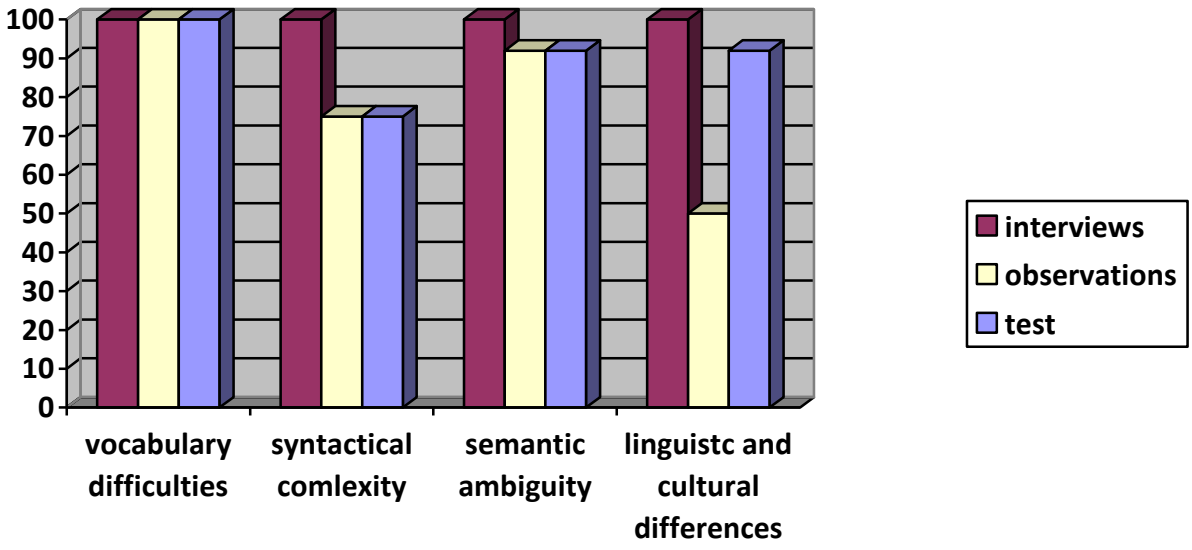
(d) Linguistic and cultural differences: Learners from diverse linguistic and cultural backgrounds may experience difficulties with word problems due to differences in language and cultural norms (Gay, 2000).

Example: pre-test question 7

"A farmer has 10 sheep. He sells 2 sheep to a neighbor. How many sheep does the farmer have left?" Learners from cultures where sheep are not commonly raised may struggle to understand the context of the problem. In this case all learners got it right because they know sheep. However, question 9 had a dollar sign which learners were not familiar with and the majority (16/24) got it wrong.

RESPONSES FROM INTERVIEWS, 0BSERVATIONS AND TEST ADMINISTRATION

Fig 4.1.2



The Y-axis presents the percentage (out of 100) of how effective each factor of language complexity is and the X-axis presents the factors of language complexity. All the three data collectors had more than 50% findings for each factor of language complexity.

Data collected through interviews, observations and test administration all agree to the fact that vocabulary difficulties, syntactical complexity, semantic ambiguity, and linguistic and cultural

differences are very effective factors of language complexity which affect the grade learners' capabilities in addition and subtraction word problem-solving.

To support learners in overcoming these challenges, teachers can use strategies such as:

1. Using simple and clear language in word problems
2. Providing visual aids and diagrams to support comprehension
3. Encouraging learners to read the problem carefully and ask questions if they are unsure
4. Using culturally responsive teaching practices to support learners from diverse backgrounds.

4.1.3 Strategies that Grade 2 learners could use to solve addition and subtraction word problems, and how they vary among different learners

The data collected in this research project show that grade 2 learners employed various strategies to solve addition and subtraction word problems, including counting on, counting back, mental math, real world experiences, and using visual aids. However, these strategies varied among learners, with some relying heavily on memorization rather than understanding mathematical concepts.

(a)Counting on: Learners use counting on to solve addition word problems by starting with the initial amount and counting on the additional amount (Carpenter et al., 1999).

Example: "Tom has 5 pencils. He gets 2 more pencils. How many pencils does Tom have now?" A learner using the counting on strategy might say, "Tom has 5 pencils. I'll count on 2 more: 6, 7. Tom has 7 pencils now." During teacher interviews, all interviewees stated the strategy, the researcher also observed it and during the method was used and clearly reflective through the use of a number line specifically by Letwin and Phumudzo.

(b) Counting back: Learners use counting back to solve subtraction word problems by starting with the initial amount and counting back the amount to be subtracted (Carpenter et al., 1999).

Example: "Sarah has 8 crayons. She gives 2 crayons to her friend. How many crayons does Sarah have left?" A learner using the counting back strategy might say, "Sarah has 8 crayons. I'll count back 2: 7, 6. Sarah has 6 crayons left." All the data collecting tools picked this method. Almost every learner participant employed the strategy.

(c) Using mental math: Learners use mental math to solve simple addition and subtraction word problems by using basic number facts and mental calculations (Kilpatrick et al., 2001).

Example: "Tom has 3 pencils. He gets 1 more pencil. How many pencils does Tom have now?" A learner using mental math might simply say, "Tom has 4 pencils now." The use of mental math as a addition and subtraction word problem strategy was gathered through interviews, from all interviewees and lesson observations from 16 of the 24 learners. It was never reflective in tests. However, during tests revision it was observed that the method was employed but learners were taught to display their working in mathematics.

(d) Using visual aids: Learners use visual aids such as blocks, counting bears, or drawings to represent the problem and solve it (Verschaffel et al., 2010).

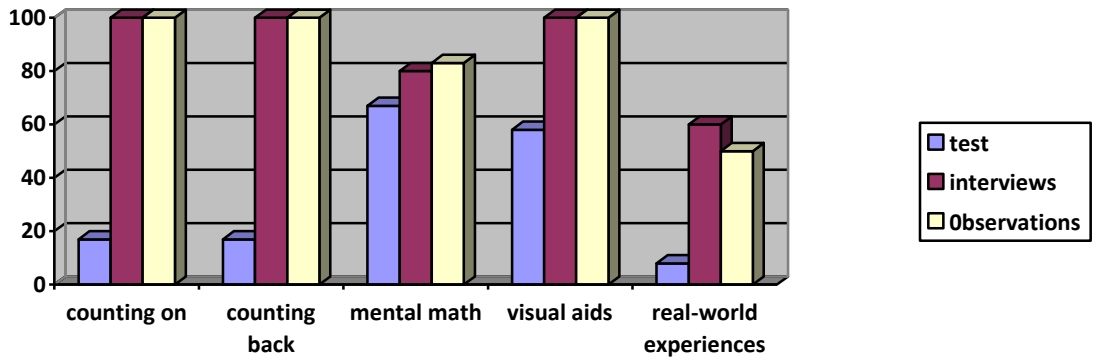
Example: "Sarah has 5 blocks. She gets 2 more blocks. How many blocks does Sarah have now?" A learner using visual aids might draw 5 blocks and then add 2 more blocks to the drawing to solve the problem. In this research visual aids were used as reflected in interviews and observations where all participants confirmed it and in pre-test 14 out of 24 used the method.

(e) Using real-world experiences: Learners use their real-world experiences and prior knowledge to solve word problems (Mayer, 2013).

Example: "Tom has 3 toy cars. He gets 1 more toy car for his birthday. How many toy cars does Tom have now?" A learner using real-world experiences might say, "I got a toy car for my birthday last year, and now I have 4 toy cars. Tom will have 4 toy cars too!" this example was number 9 in the pre-test and Lucia illustrated by drawing the toy cars. During observations and interviews real world experiences were applied.

Fig 4.1.3 below shows the results of the collected using interviews, observations and test administration.

Fig 4.1.3



These strategies vary among learners, and some learners may use a combination of strategies to solve word problems. According to Carpenter et al. (1999), learners' strategies for solving word problems are influenced by their prior knowledge, experiences, and instruction. Worthy to note is that tests are not good data collectors when searching knowledge on strategies for example count back and count on strategies seem not to be used according to test results but observations and

interviews show that the two strategies alongside visual aids are the most commonly used of them all.

The researcher eliminated the use of relying on rote memorisation approach and reliance on a single strategy by emphasing learner differences in support of Brunar's stages of development putting forward that all strategies must be used and learners would choose the strategy he/she understands better.

4.1.4 Media used to assist Grade 2 learners to grasp the concept of addition and subtraction word-problem solving

The findings suggest that multimedia resources, such as educational videos and interactive games, can assist grade 2 learners in grasping addition and subtraction word problem-solving concepts (Mayer, 2009).

(a)Images and Pictures

(i)Visual aids: Images and pictures can be used to represent word problems and make them more concrete for learners (Mayer, 2013).

(ii) Number lines: Number lines can be used to represent addition and subtraction problems and help learners visualize the relationships between numbers (Kilpatrick et al., 2001). Test administration and observation results show that 14 learners out of 24 used images and pictures as media while all interviewees confirm that images and pictures are often used as media.

(b)Digital Media

(i)Math apps: Math apps such as “Math Games” and “Addition and Subtraction” can provide interactive and engaging ways for learners to practice addition and subtraction word-problem solving (Shute, 2008).

(ii) Online games: Online games such as “Math Playground” and “Coolmath” can provide interactive and challenging ways for learners to practice addition and subtraction word-problem solving (Wouters et al., 2013).

(iii) Digital games were only mentioned on interviews. The interviewees further nullified that observations and tests administration would not pick the media usage since it is personal ICT tools used by teachers since schools do not have the ICT tools.

(c) Real-World Objects

(i) Manipulatives: Real-world objects such as blocks, counting bears, and base-ten blocks can be used to represent word problems and make them more concrete for learners (Carpenter et al., 1999).

(ii) Everyday objects: Everyday objects such as toys, pencils, and books can be used to represent word problems and make them more relevant and meaningful for learners (Verschaffel et al., 2010). During the course of test administration and lesson observations 20 of the 24 learners used real-world as media mostly in the form of stones, sticks, blocks, toys and fingers and all the interviewees mentioned real world objects as the most frequently manipulated and used in addition and subtraction word problem-solving.

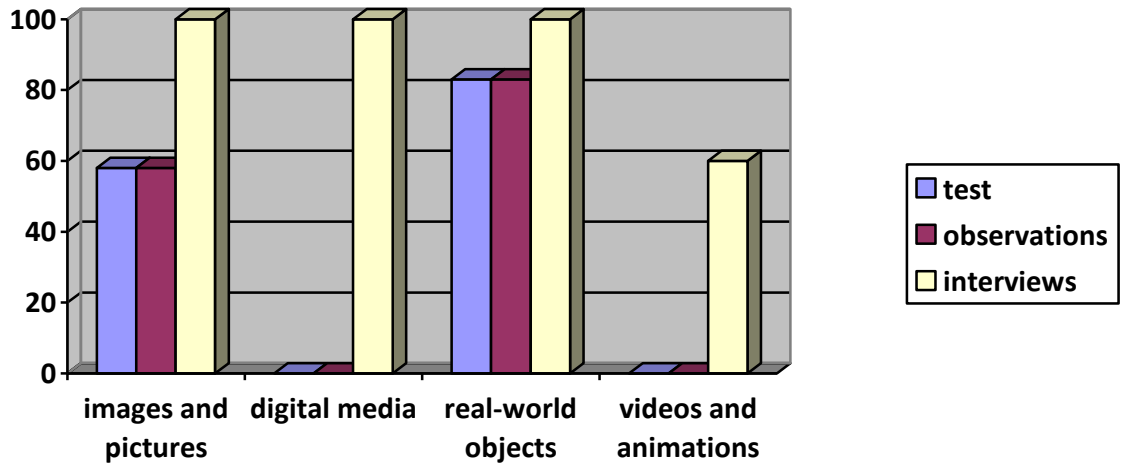
(d)Videos and Animations

(i)Video tutorials: Video tutorials such as Khan Academy and Math Antics can provide step-by-step instructions and explanations for addition and subtraction word-problem solving (Bui et al., 2016).

(ii) Animated videos: Animated videos such as "Math animations" and "Addition and Subtraction" can provide engaging and interactive ways for learners to practice addition and subtraction word-problem solving (Höffler et al., 2010). Videos and animations were only mentioned on interviews. The interviewees stated that observations and tests administration would not pick the media usage since it is personal ICT tools used by teachers because schools do not have the ICT tools to manipulate videos and animations.

Fig 4.1.4 shows results from interviews, observations and test administration.

Fig 4.1.4



Results presented in fig 4 presents the four categories of media as widely used and very relevant. However, digital media, and videos and animations were never presented by any of the grade two learners but only mentioned by their teachers in interviews who highlighted the scarcity of

ICT tools in schools. Hence, there is great need of ICT tools to foster effective learning and capability development in grade 2 learners to solve addition and subtraction word problems.

4.1.5 Difficulties encountered by teachers in teaching addition and subtraction word-problem solving at grade two level

The findings suggest that teachers encountered difficulties in teaching addition and subtraction word problem-solving at the grade 2 level, including managing learners' misconceptions and providing adequate support for struggling learners (Ball, 1990). Teachers may encounter several difficulties when teaching addition and subtraction word-problem solving at the grade two level. Here are some difficulties found and brought to light through lesson observations and interviews stated and discussed below:

(a)Limited understanding of mathematical concepts: Some teachers may not have a deep understanding of the mathematical concepts underlying addition and subtraction word-problem solving, making it challenging to teach these concepts effectively (Kilpatrick et al., 2001).

Example: A teacher may struggle to explain the concept of regrouping in subtraction, leading to confusion among learners.

(b) Difficulty in creating relevant and engaging word problems: Teachers may find it challenging to create word problems that are relevant and engaging for grade two learners, leading to a lack of motivation and interest in learning (Verschaffel et al., 2010).

Example: A teacher may create word problems that are too simplistic or unrealistic, leading to learners becoming bored or disengaged.

(c) Managing diverse learning needs: Teachers may struggle to manage the diverse learning needs of their learners, including those with learning difficulties, English language learners, and gifted learners (Tomlinson, 2001).

Example: A teacher may have learners who are struggling to understand basic addition concepts, while others are ready for more complex subtraction concepts, making it challenging to meet the needs of all learners. Under this study it has been discovered that among the 24 participating moderate performing learners there are personal differences in understanding, strategies, grasping concepts and so on. Each of the grade two teachers in the selected school has more 30 learners under his/her management. The teacher-learner ratio is abnormal for effective learning of individual learners.

(d) Assessing and providing feedback: Teachers may find it challenging to assess learners' understanding of addition and subtraction word-problem solving and provide feedback that is constructive and actionable (Black & Wiliam, 1998).

Example: A teacher may struggle to provide feedback on a learner's incorrect solution to a word problem, leading to confusion and frustration. The large teacher-learner ratio makes it impossible for teachers to make follow ups to individual learners making rectifications and corrections.

(c) Limited resources and support: Teachers may have limited access to resources and support, including technology, manipulatives, and professional development opportunities, making it challenging to teach addition and subtraction word-problem solving effectively (Darling-Hammond, 2010).

Example: A teacher may not have access to ICT tools or manipulatives that can support learners' understanding of addition and subtraction concepts. Schools need to have the resources.

Data collected from interviews

Table 4.1.5

challenges	Number of responses	Number of respondents	percentage
Conceptual understanding	0	5	0
Engaging word problems	0	5	0
Diversity of learning needs	5	5	100
Feedback providing	4	5	80
Limited resources	5	5	100

Worthy to note is while observations picked all the 5 difficulties, teacher interviews managed to pick only the last three. Diversity of learning needs, provision of feedback and limited resources were mentioned because they are more linked and are government's responsibilities. Conceptual misunderstanding and difficulties in engaging word problems are directly linked to interviewees' incompetence hence, the hide it. This limits the reliability of using interviews for data collection since teachers being the interviewees involved in the teaching and learning process who tend be protective of their own weakness in fear of being blamed for their learners' poor performances.

Below are interventions used and suggested to eradicate teacher difficulties discussed above:

-teacher capacitating programs and workshop.

- use of resource persons and/or area experts.

- reducing the teacher-learner ratio in education.

- the government to hire more teachers.

- provide adequate teaching and learning resources at schools.

4.2 Conclusion

This chapter presented the findings of the study, which explored grade 2 learners' capabilities in addition and subtraction word problem-solving. The results highlight the importance of addressing misconceptions, language complexity, and prior knowledge in teaching mathematical concepts. Teachers play a vital role in developing learners' problem-solving skills, and effective instructional strategies can significantly impact learners' success

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter summarizes the all the previous chapter, main findings of the study, discusses the implications of the findings, researcher's general perspectives, and provides recommendations for teaching and learning addition and subtraction word-problem solving at the grade two level and for all stakeholders of the study. All sources cited in the research are to be acknowledged and all the relevant materials used should be presented in this chapter.

5.1 Summary of Findings

The study found that grade two learners hold various misconceptions regarding addition and subtraction word problems. According to Carpenter et al (1999), various misconceptions

regarding addition and subtraction word problems, which affect their problem-solving skills. The language complexity of word problems also impacts learners' ability to comprehend and solve addition and subtraction tasks. Learners use a few among various strategies of solve word problems, including counting on, counting back, mental math, real-world experiences, and using visual aids. In agreement Kilpatrick et al (2001) contends that learners use various strategies to solve word problems, including counting on, counting back, and using visual aids.

Worthy to note is that learners have to manipulate various types of media which include digital media, pictures and images, videos and animations, and real-world objects and Zimbabwean education must engage new technologies practically rather than theoretically. There is shortage of technological resources yet ICT is a subject assessed. Prior knowledge of mathematical concepts had been found significant in developing skills and capabilities of grade two learners in solving addition and subtraction word problems and related mathematical concepts. Mayer (2013) consolidates that prior knowledge of mathematical concepts influences learners' success in solving word problems.

Teachers encounter difficulties in teaching word-problem solving, including limited understanding of mathematical concepts, difficulty in creating relevant and engaging word problems, diversity of learning needs, feedback providing and scarcity of resources. Teachers play a crucial role in developing learners' skills for solving word problems, and instructional strategies such as modeling and demonstrating, providing scaffolding and support, encouraging problem-solving strategies, and providing feedback are most effective.

5.2 Implications of the Findings

The findings of this study have implications for teaching and learning addition and subtraction word problem-solving at the grade two level. Basing on the findings of the study, a combination of factors affected learning of addition and subtraction word problem-solving for grade two learners. The effects of great impact include big teacher-learner ratio, scarcity of ICT resources, misconceptions, limited strategies used

Teachers should be aware of the common misconceptions that learners hold and design instruction to address these misconceptions. Teachers should also consider the language complexity of word problems and provide scaffolding and support to help learners comprehend and solve the problems. However, teachers also need to research deeper on the concept of addition and subtraction of word problem-solving to boost their own conceptual understanding. Research findings show that teachers specialize on certain strategies which does not for individual differences. Teachers should introduce learners to a variety of strategies and encourage learners to use a variety of strategies to solve word problems. The view of the research show that there is need for teacher capacity development programs to furnish teachers with topical methods to bolster the teaching and learning of addition and subtraction word problem-solving at grade two level.

Furthermore, research findings reflect that teachers do not provide feedback and assessment to help learners understand their strengths and weaknesses. While teachers are required to provide feedback and assessments, the government is also required to employ more teachers. It has been discovered that the failure to provide feedback and assessments by teacher arise from big

teacher-learner ratio. Teachers are managing a big number of learners which hinder them from effective teaching.

In response to these problems, suggested solutions are noted down under recommendations. Therefore, it holds water to contend that it needs combined efforts of all educational stakeholders to see success in fostering grade two learners' capabilities in addition and subtraction word problem-solving.

5.3 Recommendations

Based on the findings of this study, the following are recommendations for some stakeholders:

5.3.1 Educators/Teachers

(a). Teachers should provide explicit instruction on the concepts of addition and subtraction and the language used in word problems.

(b). Teachers should use a variety of instructional strategies, including mental math, real-world experiences, modeling, scaffolding, and providing feedback, to support learners' development of word-problem solving skills.

(c). Teachers should provide opportunities for learners to practice solving word problems in a supportive and encouraging environment. Teachers have to create a conducive learning environment which encourage learners to learn, explore and discover on their own or guided. An environment which challenge their thinking capacity.

(d). Teachers should use formative and summative assessments to monitor learners' progress and adjust instruction accordingly.

(e). Teachers should consider the language complexity of word problems and provide scaffolding and support to help learners comprehend and solve the problems. Factors to consider in vocabulary are language simplicity and culture.

5.3.2 Government/MOPSE

(a). The government should consider teacher capacitation through empowerment workshops to develop conceptual teaching and learning and improve teaching techniques.

(b). The government through the ministry of education should employ more teachers in schools to eliminate mismanagement and ineffective learning caused by huge teacher-learner ratios in educational institutions.

(c). Educational institutions should provide adequate resources particularly ICT resources to foster conceptual understanding, match with new technologies and effective learning. Furthermore, teacher should be introduced to ICT resources and new technologies.

5.3.3 School administrators

(a) School administrators should seek donations for educational resources in form of text books, learning aids, infrastructure, and more importantly ICT resources.

(b) School administrators should regularly conduct stuff development programmes for training teachers.

(c) They should also create conducive working areas for teachers through motivational schemes.

5.3.4 Parents

(a) Parents should assist learners with their school work.

(b) Parents must support the education of the learners by providing learning aids and ICT resources.

(c) Parents should support the educational institutions with funds through payment of levies so as to improve the learning environments and cater for scarce educational resources.

5.4 Limitations of the Study

This study had several limitations. The sample size was small, and the study was conducted in just two schools. The study also relied on teacher interviews and tests, which may not provide a complete picture of learners' understanding and skills. The researcher had scarce resources to carry on the research as anticipated. Some senior teachers denied the researcher to observe them delivering lessons.

5.5 Future Research Directions

Future research should investigate the effectiveness of different instructional strategies for teaching addition and subtraction word-problem solving at the grade two level. Future should explore the role of the teacher in the learning of addition and subtraction word problem-solving. Research should also explore the role of technology in supporting learners' development of word-problem solving skills. Additionally, research should investigate the impact of language complexity on learners' ability to comprehend and solve word problems.

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7.0 APENDICES

Appendix A

Teachers' interview guide

I am Ncube Khathutshelo, a student (Reg number: B225881AA) of Bindura University of Science Education (BUSE) studying HBSceEd in Mathematics carrying a research study entitled "An exploration on grade 2 learners' capabilities in addition and subtraction word problem-solving" in Beitbridge district ward 4 primary school. I do hereby ask for your honest responses. I promise that that the information collected would be used only in this research study and and it shall also be kept private and confidential.

Section 1: Background Information

1. What is your teaching experience, particularly in grade 2 mathematics?

2. What mathematics curriculum do you follow, and how do you incorporate word problems into your teaching?

Section 2: Misconceptions and Problem-Solving Skills

1. What common misconceptions have you observed grade 2 learners holding regarding addition and subtraction word problems?

2. How do these misconceptions affect their problem-solving skills?

3. What strategies do you use to address these misconceptions?

Section 3: Language Complexity and Word Problem-Solving

1. How does the language complexity of word problems impact grade 2 learners' ability to comprehend and solve addition and subtraction tasks?

2. What strategies do you use to support learners with language difficulties?

3. How do you modify word problems to make them more accessible to learners with language difficulties?

Section 4: Strategies for Solving Word Problems

1. What strategies do you observe grade 2 learners using to solve addition and subtraction word problems?

2. How do these strategies vary among different learners?

3. What strategies do you teach learners to use when solving word problems?

Section 5: Media and Instructional Strategies

1. What type of media do you use to assist grade 2 learners in grasping the concept of addition and subtraction word-problem solving?

2. What instructional strategies do you find most effective in teaching addition and subtraction word-problem solving?

3. How do you differentiate instruction for learners with varying abilities and learning styles?

Section 6: Prior Knowledge and Success

1. How does prior knowledge of mathematical concepts influence grade 2 learners' success in solving addition and subtraction word problems?

2. What strategies do you use to build on learners' prior knowledge?

3. How do you assess learners' prior knowledge and adjust instruction accordingly?

Section 7: Difficulties and Role of Teachers

1. What difficulties do you encounter when teaching addition and subtraction word-problem solving at the grade 2 level?

2. What role do you think teachers play in developing grade 2 learners' skills for solving addition and subtraction word problems?

3. What instructional strategies do you think are most effective in this regard?

Thank you!

Appendix B

Research project Grade 2 Pre-Test: **Word problem-solving**

1. "Tom has 5 pencils. He gets 2 more. How many pencils does Tom have now?"

2. There are 15 students in a class. 7 students are absent. How many students are remaining?"

3. Tom has 5 pencils. He loses 2 pencils. How many pencils does Tom have now?"

4. Sarah has 12 crayons in her box. She gives 4 crayons to her friend. Then, she finds 2 more crayons under her desk. How many crayons does Sarah have now?

5. Tom has 5 pencils in his pencil case. He adds 2 more pencils. How many pencils does Tom have altogether?

6. Tom has 5 pencils. He gets some more pencils. How many pencils does Tom have now?

7. A farmer has 10 sheep. He sells 2 sheep to a neighbor. How many sheep does the farmer have left?"

8. Tom has 5 pencils. He gets 2 more pencils. How many pencils does Tom have now?

9. Tom has 3 toy cars. He gets 1 more toy car for his birthday. How many toy cars does Tom have now?

10. Sarah has 14 crayons. She gives 7 crayons to her friend. How many crayons does Sarah have left?

11. Sarah has $5. She spends $2 on a toy. How much money does Sarah have left?

Appendix C

RESEARCH OBSERVATION GUIDE

Exploring Grade 2 Learners' Capabilities in Addition and Subtraction Word Problem-Solving

PART 1: LEARNER OBSERVATION

1. **Learner's Approach to Problem-Solving**:

- Does the learner read the problem carefully before attempting to solve it?

- Does the learner identify the key elements of the problem (e.g., numbers, operations)?

- Does the learner use visual aids or diagrams to help solve the problem?

2. **Common Misconceptions**:

- Does the learner demonstrate any common misconceptions regarding addition and subtraction word problems (e.g., confusing addition and subtraction, ignoring key words)?

- How do these misconceptions affect the learner's problem-solving skills?

3. **Language Complexity**:

- How does the learner respond to word problems with varying levels of language complexity?

- Does the learner struggle to comprehend word problems with complex vocabulary or sentence structures?

4. **Problem-Solving Strategies**:

- What strategies does the learner use to solve addition and subtraction word problems (e.g., counting on, counting back, using number lines)?

- How does the learner adapt these strategies to different types of word problems?

5. **Use of Media**:

- How does the learner respond to the use of media (e.g., videos, apps, games) to support addition and subtraction word-problem solving?

- Does the learner demonstrate an improved understanding of word problems when using media?

PART 2: TEACHER OBSERVATION

1. Teaching Strategies:

- What instructional strategies does the teacher use to teach addition and subtraction word-problem solving (e.g., explicit instruction, guided practice, independent practice)?

- How effective are these strategies in promoting learner understanding and problem-solving skills?

2. **Teacher Support:**

- How does the teacher provide support and scaffolding for learners as they work on word problems?

- Does the teacher use formative assessments to inform instruction and adjust support as needed?

3**. Classroom Environment**:

- What is the classroom environment like during word-problem solving activities (e.g., collaborative, independent, technology-rich)?

- How does the classroom environment impact learner engagement and motivation?

PART 3: ADDITIONAL OBSERVATIONS

1. **Prior Knowledge**:

- How does the learner's prior knowledge of mathematical concepts influence their success in solving addition and subtraction word problems?

- Are there any gaps in prior knowledge that impact the learner's ability to solve word problems?

2. **Difficulties Encountered by Teachers**:

- What difficulties do teachers encounter when teaching addition and subtraction word-problem solving at the grade 2 level?

- How do teachers address these difficulties and what support systems are in place to help them?

Data Collection Methods

1. Observation Notes: Record detailed notes during observations, focusing on learner and teacher behaviors, strategies, and interactions.

2. **Audio or Video Recordings**: Record lessons or learner interviews to capture more detailed information and facilitate later analysis.

3. **Learner Artifacts**: Collect learner work samples, such as worksheets or tests, to analyze problem-solving strategies and identify common misconceptions.

4. **Teacher Interviews**: Conduct interviews with teachers to gather more information about their instructional strategies, challenges, and support systems.

Data Analysis

1. Coding and Theme Identification: Analyze observation notes, audio or video recordings, and learner artifacts to identify patterns, themes, and common misconceptions.

2. **Quantitative Analysis**: Analyze quantitative data, such as test scores or survey responses, to identify trends and correlations.

3. T**riangulation**: Use multiple data sources and methods to triangulate findings and increase the validity and reliability of the results.

APPENDIX D

Pre-Test marked answer sheets.

Nguluvhe Gibusisiwe 9/11
Grade 2B 2024
Mugaladirha primary school

Test
word problem solving.

1. Tom has 5 pencils. He gets two more. Tom has 3 pencils now.
   5 - 2 = 3
   ||||++
2. 15 - 7 = 8. There a 8 students remaining.
3. 5+2 = 7. Tom has 7 pencils now.
4. 12-4+2 = 10. She has 10 crayons now.
   +++++||||||||+||
5. 5+2 = 7. Tom has 7 pencils altogether.
6. 5+0 = 5. Tom has 5 pencils now.
7. 10-2 = 8. The farmer does have 8 sheep left.
8. 5+2 = 7. Tom has 7 pencils now.
9. 3+1 = 4. Tom has 4 toy cars now.
10. 14 - 7 = 7. Sarah has 7 crayons left
11. Sarah has $3 left.
    $5 - $2 = $3.

5/11

Chuma Junior T Cirade 2 2024
Matshiloni primary.
Word problem-solving test.

1. 5+2 = 7 ooooo + oo.
2. 15-7 = 8✓ ϕϕϕϕϕϕϕoooooooo
3. 5+2 =7 ooooo + oo.
4. 12-4-2 = 6 ϕϕϕϕoooooooϕϕ
5. 5+2 =7✓ ooooo + oo.
6. Tom has 5 pencils.
7. 10-2 = 8✓ oooooooooϕϕ
8. 5+2 = 7✓ ooooo + oo
9. 3+2 2 ϕoo
10. 14 + 7 = 21 oooooooooooooo + ooooooo
11. $5-$2 =$3✓ ϕϕooo

Ignoring the context of the question and dealing with numbers only.

10/11

Ndou Ashley A
Grade 2A 2024
Mugaladirha primary school
Word problem-solving test.

1. 5-2=3
Tom has 3 pencils now.

2. 15-7=8
There are 8 students remaining.

3. 5-2=3. Tom has 3 pencils now.

4. 12-4+2=10. Sarah has 10 pencils now

5. 5+2=7. Tom has 7 pencils altogether

6. 5+0=5. Tom has 5 pencils now.

7 10-2=8. The farmer has 8 sheep left

8 5+2=7. Tom has 7 pencils now.

9 3+1=4. Tom has 4 toy cars now.

10 14-7=7. Sarah has 7 crayons left.

11. $5-$2=$3. Sarah has $3 left.

7/11

Muleya Mphulusi
Grade 2A 2024.
Mugaladivha primary schod.
Word problem-solving.

1. Tom has 3 pencils now.
5-2 =3

2. There are 8 students remaing:
15-7=8

3. Tom has 3 pencils now.
5-2=3.

4 12-4=8.
Sarah has 8 pencils now

5. 5+2=7. Tom has 7 pencils altogether

6. Tom has 5 pencils now.

7. The farmer has 8 sheep left.
10-2=8.

8. Tom has 7 pencils now.
5+2=7

9. Tom has 4 toy cars now.
3+1=4

10. Sarah has 21 crayons left.
$$\begin{array}{r} 14 \\ +\ 7 \\ \hline 21 \end{array}$$

11. Sarah has 03 left.
$$\begin{array}{r} \$5 \\ -\$2 \\ \hline 03 \end{array}$$

6/11

Chauke Irvine.
Grade 2B 2024
Mugaladirha primary school.
Word problem solving test.

1. Tom has 3 pencils now. ✓
   5 − 2 = 3 ϕϕϕoo

2. There are 8 students. ✓
   15 − 7 = 8. ϕϕϕϕϕϕϕooooooo

3. Tom has has 7 pencils now.
   5 + 2 = 7 (ooooo) (oo)

4. She has 14 crayons now.
   12 + 2 = 14 (oooooooooooo) (oo)

5. 5+2=7. (ooooo) (oo)
   Tom has 7 pencils altogether. ✓

6. Tom has 5 pencils now.

7. The farmer has 8 sheep left. ✓
   10 − 2 = 8 ϕϕooooooo

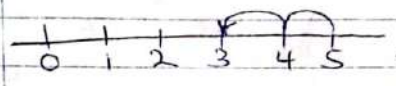
8. Tom has 7 pencils now. ✓
   5+2=7 (ooooo) (oo)

9. Tom has 4 toy cars. ✓
   3 + 1 = 4 (ooo) (o)

10. Sarah has 8 crayons. 14 − 7 = 8
    ϕϕ ϕϕϕϕoooooooo

11. $5 - $2 = 513.
Sarah has 513 left.

Muleya Letwin 3/11
Grade 2A 2024 Mugaladicha.
Kbrd problem solving test.

1. 

. Tom has 3 pencils.

2. 15-7=8 

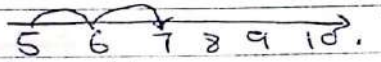
There are 8 students remaining.

3. 

. Tom has 7 pencils now.

4 

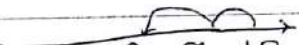
. She has 10 crayons now.
wrong working

5. 

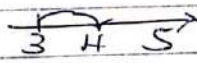
. Tom has 7 pencils altogether.

6. 

. Tom has 5 pencils.

7. 

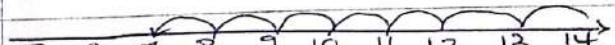
. The farmer has 8 sheep.

98. 

. Tom has 4 toy cars now.

89. 

. Tom has 7 pencils.

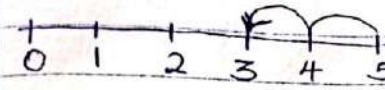
10. 

. Sarah has 7 crayons left.

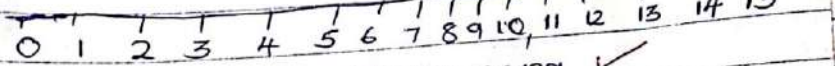
11. $5 $2. Sarah has $5$2.

8/11

Mbedzi Phumudzo
Grade 2B Mugaladirha
Word problem Sdring test

1. 

Tom has 3 penals ✓

2 15 - 7 = 8 

There are 8 students remaining ✓

3 The farmer has 8 sheeps left ✓
10 − 2 = 8

4 Sarah has 21 crayons left
$\begin{array}{r} 14 \\ +\ 7 \\ \hline 21 \end{array}$

5 

Tom has 7 penals altogether

6 

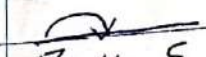
Tom has 5 penals

7 

The farmer has 8 sheep

8 

Tom has 7 penals ✓

9 

Tom has 4 toy cars now

10 

Sarah has 7 crayons

11 $5 $2 Sarah has $5 $2.

Chauke Yanessa 7/11
Grade 2B Mugaladitha
Word problem solving test

1 Tom has 3 pencils now ✓
5 - 2 = 3

2 There are 8 students remaining ✓
15 - 7 = 8

3 Tom has 3 pencils now ✓
5 - 2 = 3

4 12 - 4 = 8
Sarah has 8 pencils now

5 5 + 2 = 7 Tom has 7 pencils altogether ✓

6 Tom has 5 pencils now

7 The farmer has 8 sheep left ✓
10 - 2 = 8

8 Tom has 7 pencils now ✓
5 + 2 = 7

9 Tom has 4 toy cars now ✓
3 + 1 = 4

10 Sarah has 21 crayons left
14
+ 7
21

11 Sarah has 03 left
$5
$2
03

NCube Amadeus. Grade 2 2024
Matshiloni primary
Word problem solving test.

1. 5-2 = 3 pencils. ✓

2. 15 +7 = 22 students remaing.
oooooooooooooooo + ooooooo

3. 5+2 =7. pencils now. ✓
ooooo + oo

4. 12-4-2 = 6 crayons now.
ΦΦΦΦooooooΦΦ

5. 5+2 = 7 pencils altogether ✓
ooooo+oo

6. 5+0 =5 pencils

7. 10-2 = 8 sheep. ✓
XX||||||||

8. 5+2 = 7 pencils ✓
ooooo + oo

9. 3+1=4 toy cars. ✓
ooo + o

10 14 -7 = 7 crayons ✓
|||||||+++++++

11. $5
$2
03

4/11

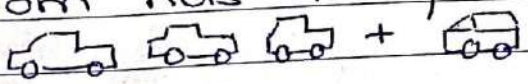
Sibanda Bridget Gracie 2 2024
Matshilan primary
Word problem solving.

1. 5 + 2 = 7
2. 15 - 7 = 8 ✓
3. 5 + 2 = 7
4. 12 + 4 + 2 = 18
5. 5 - 2 = 3
6. 5 pencils.
7. 10 - 2 = 8 sheep. ✓
8. 5 - 2 = 3
9. 3 + 1 = 4 toy cars ✓
10. 14 - 7 = 7 ✓
11. $5 + $2 = $7

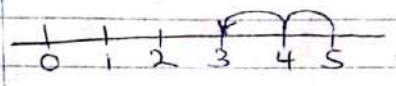
Ignoring the context of the word problem and concentrating on number only.

6/11

Sithole Lucia Grade 2 2024
Matshiloni primary
Word problem-solving test.

1. Tom has 3 pencils now. ✓ ◻◻◻◻◻
2. There are 8 students remaining. ✓
◻◻◻◻◻◻◻◻ ◻◻◻◻◻◻◻◻
3. Tom has 7 pencils now. ◻◻◻◻◻◻ + ◻◻
4. 4 + 2 = 6 crayons.
5. Tom has 7 pencils altogether. ✓
◻◻◻◻◻◻ + ◻◻
6. many ✓ ✓
7. The farmer has 8 sheep. ✓
8. Tom has 3 pencils. ◻◻◻◻◻
9. Tom has 4 toy cars now. ✓

10. Sarah has 0 crayons.
11. Sarah has it cant left.
$2 - $5 = it cant.

Muleya Letwin 3/11
Grade 2A 2024 Mugaladicha.
Kbrd problem solving test.

1. 

. Tom has 3 pencils.

2. 15-7=8 

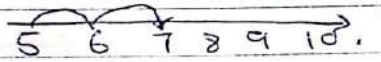
There are 8 students remaining.

3. 

. Tom has 7 pencils now.

4 

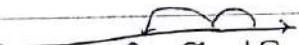
. She has 10 crayons now.
wrong working

5. 

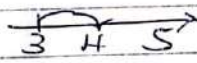
. Tom has 7 pencils altogether.

6. 

. Tom has 5 pencils.

7. 

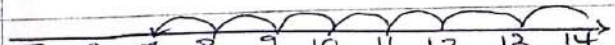
. The farmer has 8 sheep.

98. 

. Tom has 4 toy cars now.

89. 

. Tom has 7 pencils.

10. 

. Sarah has 7 crayons left.

11. $5 $2. Sarah has $5$2.

Ndlovu Blessing
Grade 2A Mugaladirha
Word problem solving test

6/11

1. Tom has 3 pencils ✓
   5 - 2 = 3 ϕϕϕoo

2 There are 8 students ✓
   15 - 7 = 8 ϕϕϕϕϕϕϕooooooo

3 Tom has 7 pencils
   5 + 2 = 7 (ooooo) (oo)

4 She has 14 crayons
   12 + 2 = 14 (oooooooooooo) (oo)

5 5 + 2 = 7
   Tom has 7 pencils ✓

6 Tom has 5 pencils

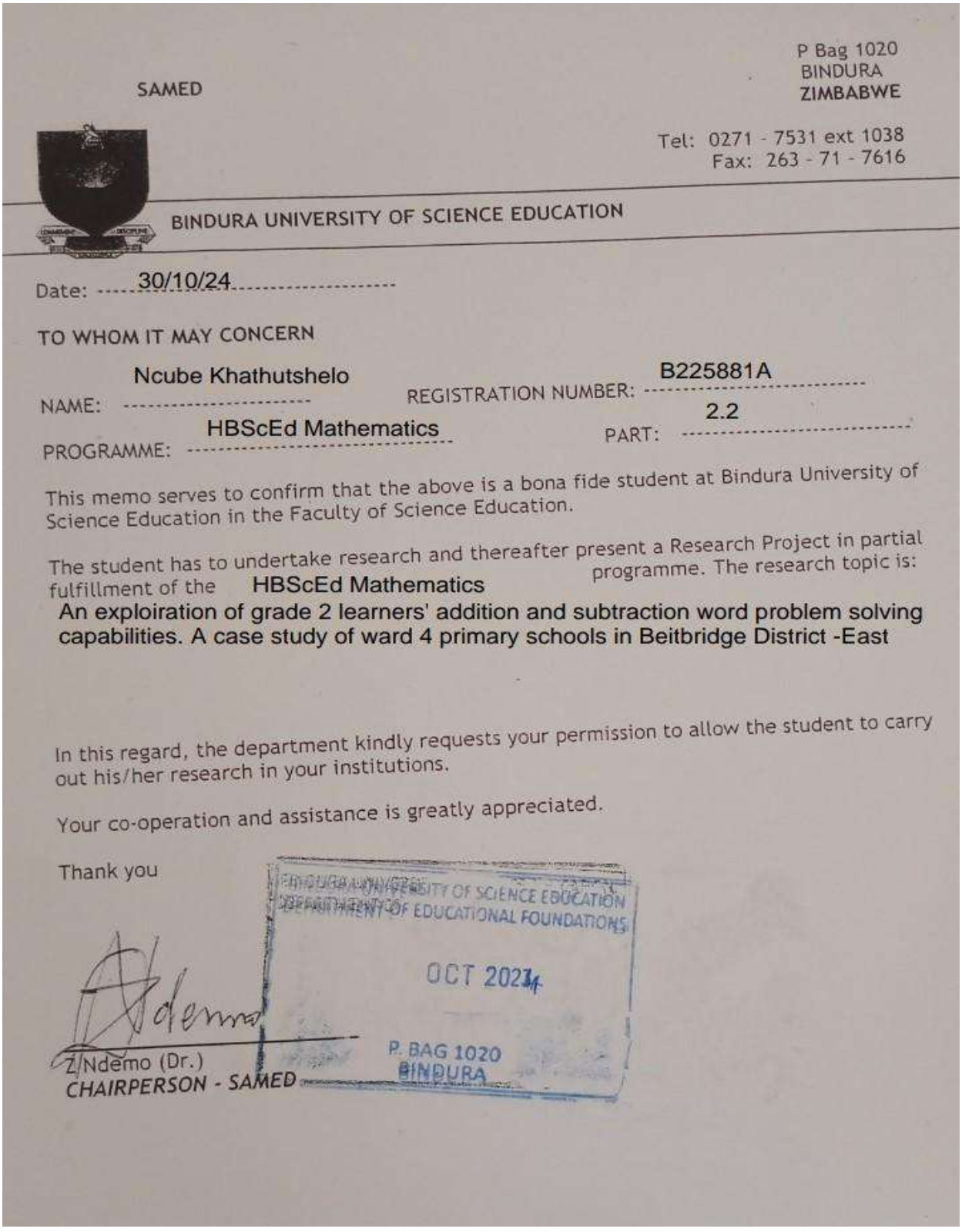
7 The farmer has 8 sheep ✓
   10 - 2 = 8 ϕϕooooooo

8 Tom has 7 penals ✓
   5 + 2 = 7 (ooooo) (oo)

9 Tom has 4 toy cars ✓
   3 + 1 = 4 (ooo) (o)

10 Sarah has 8 crayons.
   14 - 7 - 8 ϕϕϕϕϕooooooo

APPENDIX E



SAMED

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ZIMBABWE

Tel: 0271 - 7531 ext 1038
Fax: 263 - 71 - 7616

BINDURA UNIVERSITY OF SCIENCE EDUCATION

Date: 30/10/24

TO WHOM IT MAY CONCERN

NAME: Ncube Khathutshelo REGISTRATION NUMBER: B225881A

PROGRAMME: HBScEd Mathematics PART: 2.2

This memo serves to confirm that the above is a bona fide student at Bindura University of Science Education in the Faculty of Science Education.

The student has to undertake research and thereafter present a Research Project in partial fulfillment of the HBScEd Mathematics programme. The research topic is:

An exploiration of grade 2 learners' addition and subtraction word problem solving capabilities. A case study of ward 4 primary schools in Beitbridge District -East

In this regard, the department kindly requests your permission to allow the student to carry out his/her research in your institutions.

Your co-operation and assistance is greatly appreciated.

Thank you

BINDURA UNIVERSITY OF SCIENCE EDUCATION
DEPARTMENT OF EDUCATIONAL FOUNDATIONS
OCT 2024
P. BAG 1020
BINDURA

Z Ndemo (Dr.)
CHAIRPERSON - SAMED

APPENDIX F

PLAGERISM REPORT

Limitations beyond our capabilities.