

EXPLORING GRADE 4 TEACHERS' CHALLENGES IN USING  
MANIPULATIVES TO TEACH PLACE VALUE: THE CASE OF RUNDU CIRCUIT,  
KAVANGO EAST REGION

A THESIS SUBMITTED IN PARTIAL FULFILMENT  
OF THE REQUIREMENTS FOR THE DEGREE

OF

MASTER OF EDUCATION (MATHEMATICS EDUCATION)

OF THE

UNIVERSITY OF NAMIBIA

BY

HAILULU RAKKEL KULAUMONE

201704534

APRIL 2025

SUPERVISOR: DR. L.N. KANANDJEBO (UNIVERSITY OF NAMIBIA)

## **ABSTRACT**

This qualitative exploratory case study design explored the challenges faced by Grade 4 Mathematics teachers in utilising manipulatives to teach place value in Rundu Circuit, Kavango East educational region. Although, manipulatives play a crucial role in enhancing mathematical understanding, particularly for foundational concepts such as place value; many Namibian teachers do not utilise them. Studies carried out on manipulatives in Mathematics did not explore challenges that Grade 4 Mathematics teachers face when incorporating manipulatives to teach the topic place value. The study is situated in Shulman's theory of Pedagogical Content Knowledge (PCK) and Piaget's Constructivism theory. Data was collected using semi-structured interviews with ten (10) out of a population of fifty-one (51) Grade 4 Mathematics teachers from 32 government schools in the Rundu circuit. The teachers were purposively selected based on their experience of teaching Grade 4 for more than two years. The researcher further analysed documents, which were composed of lesson plans and three learners' assessment tasks done on the topic place value of each sampled teacher for data triangulation purposes. Thematic analysis was used to identify patterns, themes and categories within the data. The findings reveal that the main challenges that teachers experience in using manipulatives include teaching in overcrowded classrooms, lack of training, availability of manipulatives, lack of professional development opportunities for novice teachers, and time constraints. The factors influencing the selection and implementation of manipulatives were teachers' pedagogical knowledge and preparedness, knowledge of learners, language barriers and learners' behaviours.

Based on the findings, the study recommends provision professional development opportunities focused on manipulatives, adjustments in the mathematics curriculum content as well as in the duration of teaching. The study further recommends availing resources to Mathematics teachers.

**Keywords:** Place value, Grade 4, Mathematics teachers, Manipulatives, Challenges

## TABLE OF CONTENTS

ABSTRACT .....	i
LIST OF FIGURES.....	vi
LIST OF TABLES.....	vii
LIST OF ACRONYMS.....	viii
ACKNOWLEDGEMENTS .....	ix
DEDICATION .....	x
DECLARATION.....	xi
CHAPTER ONE: INTRODUCTION.....	1
1.1 Background of the study .....	1
1.1.1 Grade 4 Namibian place value curriculum and challenging topics.....	4
1.1.2 General overview of teaching and learning place value .....	7
1.2 Statement of the problem .....	9
1.3 Objectives of the study.....	9
1.4 Significance of the study.....	10
1.5 Limitations of the study .....	10
1.6 Delimitations of the study.....	11
1.7 Definition of terms .....	11
1.8 Chapter summary .....	11
CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK..	12
2.1 Manipulatives for Teaching Mathematics .....	13
2.2 General Understanding Place Value.....	15
2.3 Factors influencing the selection and implementation of manipulatives .....	16
2.4 Challenges of teaching using manipulatives .....	16
2.4.1 Teaching in overcrowded classrooms .....	17
2.4.2 Lack of training.....	18
2.4.3 Availability of manipulatives .....	19
2.4.4 Time constraint.....	20
2.5 Strategies and recommendations on the usage of manipulatives to teach place value .....	21
2.6 Theoretical framework.....	22

2.6.1 Shulman’s theory of Pedagogical Content Knowledge .....	22
2.6.2 Piaget’s Constructivism theory .....	26
2.7 Implications of theories in the study .....	27
2.8 Chapter summary .....	28
CHAPTER THREE: METHODOLOGY .....	30
3.1 Research design.....	30
3.2 Population .....	31
3.3 Sample and sampling procedures.....	31
3.4 Research instruments .....	32
3.4.1 The Interview Schedule.....	32
3.4.2 Document Analysis Guide.....	33
3.5 Pilot study .....	34
3.6 Data collection procedures .....	35
3.7 Data analysis .....	36
3.8 Trustworthiness of the data .....	37
3.9 Ethical considerations .....	38
CHAPTER FOUR: PRESENTATION OF RESULTS AND DISCUSSION.....	39
4.1 Presentation of results .....	40
4.1.1 Demographic information of the participants .....	40
4.1.2 Manipulatives Used when teaching place value .....	42
4.1.3 Factors influencing the selection and implementation of manipulatives .....	44
4.1.4 Challenges experienced by Grade 4 teachers.....	47
4.1.5 Effectiveness of teaching place value with manipulatives.....	53
4.1.6 Suggestions and recommendations on manipulatives usage.....	54
4.2 Discussion of the data .....	59
4.2.1 Manipulatives used when teaching place value .....	59
4.2.2 Factors influencing the selection and implementation of manipulatives .....	60
4.2.3 Challenges experienced by grade 4 teachers.....	61
4.2.4 Assessing the effectiveness of manipulatives on teaching place value .....	62
4.2.5 Suggestions and recommendations on manipulatives usage.....	62
4.2.6 Conclusion .....	63

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS .....	64
5.1 Summary of the research process.....	64
5.2 Summary of findings.....	65
5.2.1. Manipulatives used when teaching place value .....	65
5.2.2. Factors influencing selection and implementation.....	65
5.2.3 Challenges experienced by Grade 4 teachers.....	66
5.2.4 Assessing the effectiveness of manipulatives on teaching place value.....	67
5.2.5 Suggestions for improvement in the usage of manipulatives.....	67
5.3 Conclusions .....	67
5. 4 Recommendations on addressing challenges .....	67
5.5 Recommendations for future research .....	69
REFERENCES.....	70
APPENDIX 1: ETHICAL CLEARANCE CERTIFICATE .....	84
APPENDIX 2: RESEACH PERMISSION LETTER .....	85
APPENDIX 3: LETTER TO EDUCATION DIRECTOR.....	86
APPENDIX 4: PERMISSION LETTER FROM THE EDUCATION DIRECTOR.....	88
APPENDIX 5: LETTER TO PRINCIPALS .....	89
APPENDIX 6: INFORMATION SHEET -.....	91
APPENDIX 7: CONSENT FORM .....	92
APPENDIX 8: SEMI- STRUCTURED INTERVIEW QUESTIONS.....	93
APPENDIX 9: DOCUMENT ANALYSIS GUIDE.....	96
APPENDIX 10: RAW DATA Teachers’ lesson plans, manipulatives used, and learners’ works.....	98
APPENDIX: LANGUAGE EDITING DECLARATION LETTER .....	108

**LIST OF FIGURES**

Figure 1 Components of teacher’s knowledge that can render effective learners' understanding .....24

**LIST OF TABLES**

Table 1 The learning objective and competencies on place value concepts .....5  
Table 2 Mathematics topics learners found challenging .....5  
Table 3 Participants demographic information .....41  
Table 4 The workshops attended by the participants in the study.....49

## **LIST OF ACRONYMS AND ABBREVIATION**

ASCD	Association for Supervision and Curriculum Development
NIED	National Institute for Educational Development
MoEAC	Ministry of Education, Arts and Culture
PCK	Pedagogical Content Knowledge

## ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to God for His unwavering presence and guidance throughout my studies. Your strength has carried me through challenges and triumphs alike.

I extend my heartfelt appreciation to my supervisor, Dr. Leena N. Kanandjebo, whose exceptional guidance and support have been invaluable. Your mentorship has not only shaped my academic journey but has also nurtured me as a scholar and an individual.

I am profoundly grateful to my grandmother Ester N. David for being my cheerleader, always encouraging me with her love and wisdom. To my mother Lena O. Hamutenya, your emotional support and steadfast belief in my abilities have been a constant source of motivation.

Special thanks to my siblings, especially Iyaloo and Hidipo, whose companionship has made this journey more enjoyable. I would also like to recognise my aunt, Paulina Ndeumona Amakali, for being my backbone and providing essential support along the way.

To my sister-in-law Klementine Hamutenya, your emotional support has been a great comfort to me during this process. My uncles, especially Josua and Abed, have provided an incredible foundation of care and encouragement, for which I am truly appreciative.

Lastly, I am thankful to my two friends, Perfect *friend*, for your unwavering support throughout this course and Diana Mangundu, my prayer warrior, whose faith in me and consistent prayers have uplifted my spirit throughout this journey.

Each of you has played a significant role in my success, and I am eternally grateful for your love and support.

## **DEDICATION**

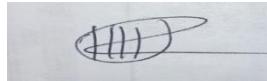
To my beloved grandmother Ester David,

Your unwavering strength, boundless love, and unwavering support have been the cornerstone of my journey. You are truly a superwoman in every sense of the word. This thesis is dedicated to you, as a small tribute to the countless sacrifices you made and the invaluable lessons you imparted. Thank you for believing in me and for being my greatest inspiration. I hope to make you proud.

**DECLARATION**

I, Rakkell Kulaumone Hailulu, hereby declare that this study is my own work and is a true reflection of my research, and that this work, or any part thereof, has not been submitted for a degree at any other institution. No part of this thesis may be reproduced, stored in any retrieval system, or transmitted in any form, or by means (e.g. electronic, mechanical, photocopying, recording or otherwise) without the prior permission of the author, or The University of Namibia on that behalf. I, 201704534, grant The University of Namibia the right to reproduce this thesis in whole or in part, in any manner or format, which The University of Namibia may deem fit.

Rakkell K. Hailulu



April 2025

.....

.....

.....

Name of Student

Signature

Date

## **CHAPTER ONE: INTRODUCTION**

This study sought to explore Grade 4 teachers' challenges in using manipulatives to teach place value in the Rundu circuit, Kavango East Region. This chapter introduces the study by presenting the background of the study, statement of the problem, objectives of the study, significance of the study, limitation and delimitation of the study, definition of key terms used in this study as well as the chapter summary.

### **1.1 Background of the study**

Mathematics serves as a cornerstone in various domains of life, playing a pivotal role in driving technological advancements and is crucial in facilitating progress in the modern era. It is a fundamental subject that serves as a key determinant for entry to the next grade level, and career progression to most higher education programs (Larbi & Mavis, 2016). Notably, acquiring proficiency in Mathematics is a dynamic process that evolves through learners' interactions with their learning environment, peers (Larbi & Mavis, 2016) and learning resources. This underscores the importance of learning approaches that cater to individual strengths and weaknesses. Marasign et al. (2019) emphasised the necessity for teachers to provide tailored resources that reinforce learners' understanding of Mathematics, highlighting the significance of making the subject relevant and meaningful in the classroom.

A solid understanding of Mathematics during the senior primary phase is crucial for future academic pursuits and empowers learners to apply mathematical concepts in their everyday lives (Ministry of Education Arts and Culture, 2024). Luwango et al. (2023) noted that the manner in which teachers convey mathematical knowledge during the formative grades significantly influences learners' comprehension and performance.

Consequently, establishing a strong foundation for mathematical comprehension at the onset is essential, and teachers must effectively engage learners to enhance their performance (Pham, 2015).

The Southern and East African Consortium for Monitoring Educational Quality (SACMEQ) IV has reported that the Kavango region although having a high population, demonstrates low performance in Mathematics. Despite significant investments in primary education in Namibia, challenges persist in achieving high-quality educational outcomes (Shigwedha et al., 2017). As a teacher over the past three years, the researcher has consistently observed that learners' performances in Mathematics at grades 4 in Rundu circuit, Kavango East Region, frequently rank either last or second to last among six promotional subjects. Moreover, the analysis of the 2023 results revealed that the Rundu Circuit dropped from the second position to the fourth position out of six circuits in the region despite having a large number of learners; this decline in academic performance raised significant concerns (Kangungu, 2024). This trend is concerning, considering Mathematics' fundamental role in shaping critical thinking and problem-solving skills essential for overall academic success.

Numerous learners' progress to higher grades without a solid understanding of basic concepts because of insufficient teaching or practice in earlier years which worsens their academic progress. Additionally, an overemphasis on rote learning rather than conceptual understanding makes it harder for learners to recognise Mathematics' relevance in real-life situations (Kapenda et al., 2018). Consequently, a great number of learners express anxiety toward Mathematics, fearing failure, which reinforces negative self-images and diminishes their motivation and engagement with the subject (Klinger, 2010).

Reflecting on the researcher's observations, the researcher has recognised the pivotal role teachers play in shaping learners' mathematical comprehension. This is further supported by the study conducted in Kavango West and Kavango East regions by Mateya et al., (2016) on factors that cause poor performance in Mathematics at the National School Secondary Certificate level compared to Junior Secondary Certificate level in four selected schools. The study revealed that learners' performance in Mathematics in Kavango East is not satisfactory. Similarly, Mutuku (2015) noted that senior primary school learners have consistently scored below the expected standard in Mathematics.

Additionally, Haimbodi (2019) concurred with Ilukena (2009) that upper primary Mathematics teachers often omit teaching topics in which they lack competency and confidence due to inadequate qualifications and limited understanding of the subject matter. In some cases, teachers tend to rush learners through challenging topics, resulting in gaps in understanding. Therefore, teachers' incompetence in teaching Mathematics and their insufficient mastery of the curriculum content negatively impacts learners' mathematical comprehension and overall performance (Nambira, 2016). Peters (2016) posits that a significant impact on learners' confidence in Mathematics may stem from their teachers' understandings and potentially a restricted grasp of the topics. Despite these challenges, teachers are expected to take the lead in the teaching and learning process through active involvement and participation of learners (Potgieter, 2015).

Effective Mathematics teaching involves assisting learners in making important connections between conceptual understanding, procedural fluency and productive disposition while finding a balance between the three (Stephanus, 2018). Essentially, the combination of practice, targeted resources, and personalised teaching methods is vital

for fostering a comprehensive grasp of Mathematics. This, in turn, paves the way for continuous learning and application in various spheres of life (Larbi & Mavis, 2016; Marasign et al., 2019). Lusin (2013) suggested that young children often lack the mental maturity to grasp abstract mathematical concepts if presented solely in words or symbols; they need many experiences with concrete materials and visual representations for learning to occur effectively. Therefore, teachers need to use manipulatives when teaching to support learners learning. Drawing from the researcher's experiences, it is believed that employing manipulatives can bridge the gap between abstract concepts and concrete understanding. To enhance learners' performance in Mathematics concepts such as place value, the use of manipulatives should be emphasised to promote deeper comprehension (Larbi & Mavis, 2016). Therefore, this study aims to explore Grade 4 teachers' challenges in using manipulatives to teach place value: the case of the Rundu circuit, Kavango East Region.

### **1.1.1 Grade 4 Namibian place value curriculum and challenging topics**

The overview in Table 1 below, highlights the Namibian curriculum for Grade 4 learners with a specific focus on the place value competencies.

**Table 1** *The learning objective and competencies on place value concepts*

<b>Learning Objectives</b> <b>Learners will:</b>	<b>Competencies</b> <b>Grade 4 learners should be able to:</b>
<b>(c) Place value</b>	
<ul style="list-style-type: none"> <li>• Understand the positional notation of the base ten number system</li> </ul>	<ol style="list-style-type: none"> <li>1. recognize and write down the missing numbers on the number chart and number line</li> <li>2. recognize and identify the place value and the value of the digit in a four-digit number (0-999)</li> <li>3. express four-digit numbers up to 10 000 in expanded notation and vice versa (in thousands, hundreds, tens and ones e.g., 1253=1000+200+50+3)</li> </ol>

*\*Table 1 is an extract from the Mathematics syllabus for grades 4-7 (MoEAC, 2024, p. 10).*

From Table 1, the syllabus for Mathematics senior primary grades (4-7) outlines only three broad competencies that teachers teach Grade 4 learners under only one main learning objective, which is understanding the positional notation of the base ten number system. It also illustrates what learners are expected to learn and the skills they should be able to demonstrate after learning the concepts of place value, which are, filling in the missing numbers on the chart or line, identifying place value and digit value in four-digit numbers and express four-digit numbers up to 10 000 in expanded notation and vice versa. However, a study by Luwango et al. (2023) on analysing Grade 4 learners' Mathematics books in pursuit of quality basic education in Namibia has indicated that the competencies outlined in Table 1 are challenging for Grade 4 learners to comprehend. Table 2 presents Luwango et al. (2023) findings on the challenging topics.

**Table 2** *Mathematics topics learners found challenging*

Topic number	Description of the challenge(s)
1.	Value and place
2.	Filling in missing numbers on a number line
3.	Rounding off to the nearest 10, 100,1000
4.	Write the value of the underlined digit e.g. 3724=100, <u>9</u> 65 =100, 2 716 = 100,
5.	Expanded notation

*\*Table 2 is adapted from Luwango et al. (2023, p. 9).*

Table 2 shows that the sub-topic on Value and Place, which relates to competency number 1 stated that learners should be able to recognise and write down the missing numbers on the number chart and number line. Filling in missing numbers on a number line is also based on competency one. Furthermore, the sub-topic Rounding off to the nearest 10, 100,1000 stemmed from competency number 2, which suggested that learners should be able to recognise and identify the place value and the value of the digit in a four-digit number (0-999). Thus, the sub-topic: Write the value of the underlined digit, for instance, 3724=100, 965 =100, 2 716 = 100 also derives from competency 2. Lastly, the sub-topic: Expanded notation is on competency number 3, which says learners should be able to express four-digit numbers up to 10 000 in expanded notation and vice versa (in thousands, hundreds, tens and ones, e.g., 1253=1000+200+50+3). This implies that all these competencies under the place value topic are challenging for Grade 4 learners. This could further mean there is a need to enhance teaching and learning through the use of teaching and learning resources.

In addition, a study by Westaway et al. (2024) on the comparison of place value across four African Primary School Curricula conducted in South Africa, Namibia, Malawi and Kenya that focused on place value, revealed that greater emphasis is given to the

development of place value understanding in the Namibian Curricula. Their findings revealed that place value topic is critical for the development of learners' mathematical understanding. However, the curriculum does not pay sufficient attention to the development of learners' conceptual understanding of place value. As a result, during the intermediate phase, the challenge persists for teachers tasked with teaching place value to Grade 4 learners, who are transitioning into the senior primary phase (Westaway et al., 2024). The observed challenges (Table 2) revealed serious gaps in understanding and application of mathematical concepts under place value topic, suggesting a need for targeted teaching strategies to better support learners in achieving the curriculum objectives and enhancing their overall academic performance.

### **1.1.2 General overview of teaching and learning place value**

The teachers' Mathematics comprehension and teaching skills affect learners' ability to understand place value concepts. Admittedly, some teachers lack a strong understanding of the aspects of place value, making it challenging to effectively teach this important mathematical concept (Kortenkamp & Ladel, 2013; Westaway et al., 2024). Previously, Kortenkamp and Ladel (2013) identified place value as a difficult topic to teach efficiently. Poor understanding of place value can be traced back to ineffective teaching methods, which ultimately results in overall poor performance. As a result, Graven and Venkat (2021) indicated that poor Mathematics performance was in part due to learners' lack of understanding of place value and the base 10 number system.

Furthermore, Golafshani (2013) discovered that teacher training plays a crucial role in the effectiveness of teachers' utilization of manipulatives. Maboya (2020) has extensively added that teachers' training in manipulation techniques significantly impacts their

effectiveness. The Association for Supervision and Curriculum Development (2015) suggested that Mathematics teachers should have a strong understanding of the subject and must stay updated on educational matters to improve their teaching quality. Thus, teachers should be given continuous professional development workshops on pedagogy for them to acquire the skills and understanding necessary to teach effectively (Hamukonda & Luneta, 2023). Moreover, Potgieter (2015) stated that if teachers are not adequately trained on how to use teaching aids in Mathematics lessons, it will negatively impact the productive use of these aids in the classroom. As suggested by Andrews and Sayers (2014), teachers' lack of effectiveness in teaching hinders pupils' overall learning and, specifically, their ability to grasp Mathematics. Ronden (2012) also pointed out that limited in-service training opportunities for teachers can retard learners' success in Mathematics. Lack of teachers' proficiency in Mathematics results in learners' poor performance, as inferred by Hamukonda (2021). Therefore, this serves as a complete impetus for conducting a study on exploring Grade 4 teachers' challenges in using manipulatives to effectively teach place value. In Southern African schools, Grade 4 serves as a transitional phase between the lower primary and senior primary levels. This phase is particularly challenging in Mathematics as it sets the groundwork for understanding number concepts (Maboya, 2014). The revised curriculum encourages the integration of learning materials into teaching practices (Joshua et al., 2022); thus, future studies should investigate how to integrate teacher effectiveness, the selection of manipulatives, and learner engagement when utilizing these manipulatives these in mathematical instruction (Carbonneau et al., 2020; Laski et al., 2015).

## **1.2 Statement of the problem**

Studies conducted by Miranda and Adler (2010) as well as Hamukonda (2021) pointed out that many Namibian teachers do not utilise manipulatives to enhance mathematical comprehension of topics in their lessons. Explicitly, in the Kavango East Region, it has been observed that the application of manipulatives to enhance mathematical understanding poses an ongoing challenge for Mathematics teachers (Ilukena et al., 2020). Subsequently, this influences learners' academic performance, which has become a recurring issue in the region and in foundational topics such as place value (Luwango et al., 2023; Kangungu, 2024). It is specifically argued that learners struggle to align digits according to their respective place values (Ilukena, et al, 2020; Luwango et al., 2023). Notably, the researchers (Miranda & Adler, 2010 and Hamukonda, 2021) did not identify any specific studies on the challenges Grade 4 teachers face when incorporating manipulatives to teach place value. Furthermore, Ilukena et al.'s (2020) research focused on Grade 6 learners, while Luwango et al. (2023) provided limited insights into Grade 4 education, revealing a gap in the existing literature. Consequently, this study aims to investigate the challenges encountered by teachers in using manipulatives for effective place value instruction in Namibian senior primary education. As such, the study will be exploratory in nature, addressing research questions that have previously not been thoroughly investigated.

## **1.3 Objectives of the study**

The main objective of the study is to explore the challenges that Grade 4 teachers in the Rundu circuit experience when using manipulatives to teach place values. The study was guided by the following sub-objectives:

- To identify the factors influencing the selection and incorporation of manipulatives in teaching place value among Grade 4 teachers in Rundu Circuit.
- Identify challenges that Grade 4 teachers in Rundu Circuit experience when using manipulatives to teach place values.
- To suggest strategies and recommendations to support Grade 4 teachers in overcoming these challenges and improving their use of manipulatives to teach place value in Rundu Circuit.

#### **1.4 Significance of the study**

It is therefore believed by the researcher that the study's findings will add value to the scant body of knowledge on how teachers can overcome challenges faced in utilising manipulatives effectively in teaching place value concepts. Moreover, it is hoped that the results of this study will inform and educate teachers about how to overcome the challenges of using manipulatives in teaching place values to Grade 4 learners. This study will also provide data to the Ministry of Education, Arts and Culture, curriculum designers, planners, and policymakers to guide them build policies on how to support teachers in the use and provision of manipulatives.

#### **1.5 Limitations of the study**

The first limitation identified in the study was that the research was conducted exclusively in 10 schools within Rundu Circuit. This restricted the generalisation of the findings to other schools in the region. However, it was acknowledged that other schools in the region could still derive valuable insights from this research. Lastly, a significant limitation was the time required to meet participants, which was less than an hour for each session per participant. The researcher set this time by arranging with the participants to meet them

either after school hours or during their off periods. To address this issue, the researcher took a day off with permission from work in order to dedicate sufficient time to meet up with participants.

### **1.6 Delimitations of the study**

The aim of this study was to explore Grade 4 teachers' challenges using manipulatives to teach place value. The scope of this study was limited to senior primary Mathematics teachers that taught Grade 4 in the Rundu circuit, Kavango East Region. For this reason, this study was specifically restricted to those teachers from 10 government schools in the Rundu circuit.

### **1.7 Definition of terms**

**Place value:** in this study, place value is referred to as a key mathematical concept used to describe the value assigned to a digit according to its position in a number (Benton et al., 2018; MoEAC, 2024) and is fundamental to later mathematical attainment.

**Manipulatives:** are virtual or physical objects that are precisely made to represent mathematics ideas (Maboya, 2014), however in this study, manipulatives are referred to as physical objects, which are teaching and learning resources used as teaching tools as well as learning tools to engage learners in hands-on learning of mathematics, and help learners to increase their understanding of abstract concepts ( Kennedy, 1986; Boggan, 2011; Ligget, 2017).

### **1.8 Chapter summary**

This chapter presented the background of the study, the statement of the problem, the research objectives and the significance of the study. Additionally, the limitations, delimitations, definition of concepts and the summary of the chapters have been

discussed. All the outlined concepts above have been discussed according to the Grade 4 teachers' challenges experienced in using manipulatives to teach place value in the Rundu circuit, Kavango East region. The next chapter presents the literature review according to research objectives and the theoretical framework. The researcher has outlined the discussion of the theoretical framework by using the Shulman's theory and Piaget's theory as lenses.

## **CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK**

The literature review serves as a survey of scholarly sources on specific topics, providing insight into existing knowledge and identifying gaps in the existing research that can later be applied to their thesis topics (McCombes, 2023). This chapter explores literature regarding the use of manipulatives to teach place value, structured around the following objectives of the study:

1. Identify factors influencing the selection and implementation of manipulatives in teaching place value among Grade 4 teachers in the Rundu circuit.
2. Identify challenges Grade 4 teachers in the Rundu circuit experience when using manipulatives to teach place value.
3. Suggest strategies and recommendations to support Grade 4 teachers in overcoming these challenges and improving their use of manipulatives for teaching place value.

Firstly, the discussion is on the key areas such as: manipulatives for teaching the topic of place value (subsection 2.1); the general understanding of place value (subsection 2.2); factors influencing the selection and implementation (subsection 2.3); challenges of using manipulatives (subsection 2.4); suggestion and recommendations (subsection 2.5). Lastly, the theoretical framework (Subsection 2.6) is discussed. Therefore, ideas in literature are discussed as follows:

### **2.1 Manipulatives for Teaching Mathematics**

Manipulatives are necessary tools in Mathematics education, enabling learners to explore and understand mathematical concepts through tangible experiences. They transform

abstract ideas into concrete understanding, facilitating problem-solving based on perceptual evidence (Carbonneau et al., 2020; Carbonneau & Marley, 2015). They can be objects from learners' surroundings like stones, blocks and beans, making Mathematics more meaningful for those who struggle with the subject (Larbi & Mavis, 2016).

A study by Marasigan et al. (2019) examined the impact of using manipulatives in Mathematics teaching on the performance of Filipino primary learners. The aim of their study was to address the gap in understanding the specific effects of manipulatives compared to traditional teaching methods. Their study found that learners perform better when using manipulatives, which might mean that learners can perform better when using manipulatives. Furthermore, their study has suggested the effectiveness of manipulatives in improving performance among primary school learners compared to traditional teaching methods. Another study by Maboya's (2014) explored how manipulatives are utilised in teaching Mathematics in primary schools' classrooms, focusing on the relationship between teachers' Mathematics knowledge and their pedagogical practices. It was conducted with four grade six Mathematics teachers from four primary schools in South Africa. This study has examined how manipulatives enhance teaching practices and identified gaps in teachers' abilities to abstract mathematical concepts, emphasising their role in promoting understanding.

In addition, manipulatives foster connections between concrete experiences and abstract principles, deepening comprehension of concepts like place value (Lange, 2021). Engaging with these tools not only improves learner performance (Guarino et al., 2013; Liggett, 2017) but also accommodates diverse learning styles, enriching classroom experiences (Larbi & Mavis, 2016). Despite their benefits, effective implementation of

manipulatives depends on teachers' understanding of Mathematics and pedagogical strategies (Maboya, 2014). A study by Adendorff (2018) that explored how foundation phase teachers use concrete manipulatives to teach number concepts and their effectiveness in enhancing learners' understanding of mathematics that involved five selected teachers from two primary schools in the Western Cape, South Africa, has found gaps in the optimal use of manipulatives, even when teachers recognised their importance. This highlights the need for further research into the challenges Grade 4 teachers face in teaching concepts like place value using these tools.

Manipulatives are necessary for improving Mathematics education in primary schools, addressing learning difficulties, and enhancing motivation. The ancient saying, "I hear, and I forget; I see, and I remember; I do, and I understand" (Confucius, 551-479 BC, as cited in Monte, 2021), underscores their significance in fostering comprehension and engagement in Mathematics. Although this section discussed manipulatives for teaching Mathematics, the focus is on place value.

## **2.2 General Understanding Place Value**

Place value is critical for comprehension in mathematics and is defined by its position in a multi-digit number (MoEAC, 2024; Kortenkamp & Ladel, 2013). Its teaching establishes foundational principles for arithmetic and mathematical operations (Räsänen, 2015; Witzel et al., 2013). Thus, understanding place value is essential for learners as it enables them to perform calculations accurately (Van de Walle et al., 2014; Sarı & Aydoğdu, 2020). However, many learners find this concept difficult due to historical undervaluation in teaching (Olkun & Toluk-Uçar, 2018; Themane & Luneta, 2021). This topic, place value, is one of the core topics in Mathematics and once learners go wrong

with it the entire Mathematics is affected. This is the reason it needs to be taught properly with understanding.

The next subsection presents literature on the factors that influence teachers' selection of manipulatives and the implementation of manipulatives in their classrooms.

### **2.3 Factors influencing the selection and implementation of manipulatives**

Teachers' understanding of manipulatives significantly influences their selection and implementation in teaching place value. Effective materials include base ten blocks, counters, and digit cards (Lawton & Hansen, 2011; Westaway et al., 2024). The appropriate integration of manipulatives enhances learners' engagement and understanding (Larbi & Mavis, 2016; Demetriou, 2015), supports all learners, particularly those with diverse learning styles (Lange, 2021). A study by Odum (2022) on examining the use of manipulative materials in teaching Mathematics among junior high school teachers conducted in Seikwa, Ghana has identified factors such as non-availability, inadequate supply of materials and high cost of some manipulative materials influences' usage of manipulatives during teaching.

### **2.4 Challenges of teaching using manipulatives**

Teachers often face various challenges when using manipulatives in their teaching practices. Various studies have discussed the shortcomings in the use of manipulatives in teaching and learning (Back, 2016; Cooper, 2016). In this section, the challenges are discussed based on the following themes: overcrowded classrooms, lack of training, availability of manipulatives, time constraints (Golafshani, 2013; Yusof & Lusin 2013; Pham, 2015; Maboya et al., 2020; Tjandra, 2023). These themes are used to analyse data

on research objective two which focuses on identifying challenges that Grade 4 teachers in the Rundu circuit experience when using manipulatives to teach place values.

#### **2.4.1 Teaching in overcrowded classrooms**

In a study by Maseko et al. (2022) on exploring how science teachers use manipulatives in the classroom in Manzini Region, Eswatini, it was evident that one significant hindrance to the effective use of manipulatives in the classrooms is the prevalence of overcrowded classes. Although Maseko et al.'s (2022) study conducted in science is similar to the current study because it has explored how science teachers use manipulatives in the classroom at the primary level. Furthermore, its objectives were to determine challenges faced by teachers in using manipulatives and suggestions on how these challenges can be mitigated. Maseko et al.'s (2022) study was used to back up challenges of using manipulatives in Mathematics because challenges related to the use of manipulatives might be the same and, in some cases, science and Mathematics can be taught by the same teacher. Therefore, the author believes that Mathematics teachers might face the same challenges. When classroom sizes exceed optimal levels, teachers are restricted in their ability to move around space, which limits their capacity to demonstrate the use of manipulatives effectively to learners, a common trend in Rundu Circuit, Kavango East Region. This might be a challenge because the teacher-learner ratio is 1:35 and many classrooms have exceeded that number (Maseko et al., 2022; MoEAC, 2021; Uugwanga, 2023). Consequently, many teachers resort to lecture methods, avoiding the use of manipulatives, which can inhibit the overall teaching and learning process (Yusof & Lusin, 2013). This might mean that overcrowded classrooms not only hinder teaching methods but also contribute to increased teacher workload. For instance, if

teachers might opt to use manipulatives, they will have to split learners into many small groups that they might not even finish attending to on time with one or two manipulatives available as all learners need to be attended to. As the demands of managing large classes mount, some teachers may find it easier to forgo the use of manipulatives entirely. This avoidance can diminish the engagement and hands-on learning experiences that manipulatives can provide, eventually impacting learners' understanding of complex concepts (Grahm, 2023). Therefore, addressing the issue of overcrowded classrooms is essential for fostering an environment where manipulatives can be effectively utilised, thereby enhancing both teaching and learning outcomes (Cockett & Kilgour, 2015).

#### **2.4.2 Lack of training**

Teachers often do not receive the necessary training to effectively utilise manipulatives in the classrooms at tertiary institutions and through in-service training (Pham, 2015; Tjandra, 2023). If teachers are equipped with the skills and confidence to use manipulatives effectively, they can create a more engaging and supportive learning experience for their learners, ultimately enhancing their understanding of mathematical concepts (Maboya, 2014). As a result, if teachers are inadequately prepared in using these teaching tools, they inevitably encounter challenges implementing them. Moreover, teachers who lack proper training in the subject matter tend to avoid topics in which they feel less competent in (Mateya et al., 2016). This avoidance might imply that teachers might not have a clear understanding of which manipulatives to use in each specific objective and how to integrate them into their classroom. Furthermore, the effectiveness of teaching place value and other mathematical concepts is significantly influenced by the expertise of the teachers and the strategies they employ during teaching (Ozdemir & Soylu,

2017; Maseko et al., 2022). Indeed, teachers' reluctance to incorporate manipulatives in their Mathematics classrooms stems from their uncertainty about how to use them effectively.

### **2.4.3 Availability of manipulatives**

The availability and shortage of manipulatives in terms of quantity is a challenge. Thus, the absence or shortage of manipulatives presents a significant challenge to schools when they plan to teach various concepts. It emphasised that the limited accessibility of resources is one of the obstacles teachers face when trying to utilise manipulatives (Yuson & Lusin, 2013). Consequently, learners often miss out on crucial opportunities to engage with concrete materials, primarily due to a scarcity of supplies.

Moreover, in certain instances, manipulatives may be difficult to procure and may require to be ordered in advance; for instance, some schools might need to order them months in advance (Pham, 2015; Odum, 2015; Tjandra, 2023). To address these challenges, it is imperative for teachers to creatively incorporate local materials such as stones, sticks and bottle tops into their lessons. By doing so, they can make learning more relatable and engaging for learners, utilising the manipulatives readily available in their immediate environment (MoEAC, 2015). Additionally, the complete absence of manipulatives can pose another significant challenge, especially considering the curriculum's directive for teachers to incorporate learning materials in their instruction. Many learners remain deprived of the opportunity to physically manipulate concrete materials, primarily due to limited supply (Yuson & Lusin 2013; Maboya, 2014). Therefore, it is crucial for teachers to explore resourceful strategies to enhance their teaching practices, ensuring that all learners have access to the manipulatives necessary for practical learning experiences.

#### **2.4.4 Time constraint**

While manipulatives are valuable tools in the teaching process, they can be time consuming during lesson planning and teaching in the classroom. Thus, this involves extra time not only for lesson planning but also for searching for materials and additional time for creating some in case of teacher-made and selecting as well as sourcing appropriate materials and designing relevant activities (Pham, 2015; Tjandara, 2023). During teaching, teachers reported that learners often require more time to effectively engage with manipulatives to deepen their understanding of mathematical concepts (Mntunjani et al., 2018). However, it is essential to consider that using manipulatives can also lead to potential drawbacks. For example, they may cause confusion among learners and generate unnecessary disruptions in the classroom. As result, the teacher will have to stop and maintain order in the class and afterwards start over for the learners to be at the same pace, which is time consuming (Maboya et al., 2020). Thus, many teachers become hesitant to incorporate manipulatives into their lessons due to concerns regarding time constraints. Balancing the benefits of manipulatives with the practical challenges of their implementation remains a crucial consideration for teachers aiming to enhance learners learning in mathematics (Golafshani, 2013; Mntunjani et al., 2018).

In addition, the following challenges such as lack of technological knowledge, resistance from learners, culture difference and inadequate implementation also emerge from the data (Tjandara, 2023). It is worth noting that some of the challenges, such as the availability and cost, can be categorised as factors influencing teachers' selection and implementation of manipulative in Mathematics teaching (Odum, 2022); however, in this study, they were not used interchangeably.

## **2.5 Strategies and recommendations on the usage of manipulatives to teach place value**

Training and workshops should be done to address the identified challenges, targeted training programs should be established to enhance teachers' confidence and skills in using manipulatives effectively in their Mathematics instruction (Maboya, 2014). Adding on, Maseko et al. (2022) also suggested that teachers should be appropriately equipped in the use of manipulatives through training and workshops. This is because it is essential for teachers to possess both content and pedagogical knowledge to instill confidence and foster a positive attitude towards teaching Mathematics, ultimately nurturing a culture of mathematically inclined learners. In this regard, Kapenda et al. (2018) have argued that a lack of appropriate pedagogical and subject content knowledge impairs learners' learning abilities.

In terms of resource allocation issues, schools and educational authorities should ensure the availability of suitable manipulatives and encourage teachers to integrate local materials creatively (MoEAC, 2015). Ilukena et al. (2018) further added that current education in Namibia encourages parental participation in their children's learning, which might help on the provision of resources to learners. Maseko et al. (2022) and Odum (2022) also recommended that the government through Ministry of Education should avail enough resources to school.

In order to manage overcrowded classrooms effectively, teachers should be provided with strategies to promote better use of manipulatives and enable teachers to provide more individualised attention to learners (Tahir, 2019). Lastly, workshops focusing on time-efficient teaching practices with manipulatives can enhance their integration into

Mathematics lessons, allowing for engaging, hands-on learning experiences (Golafshani, 2013). The views presented in this section by (Maboya, 2014; MoEAC, 2015; Pham, 2015; Ilukena et al., 2018; Tahir, 2019; Maseko et al., 2022; Odum, 2022; Tjandara, 2023) are used to research objective three, which is on suggestions of strategies and recommendations to support Grade 4 teachers in overcoming these challenges and improving their use of manipulatives for teaching place value.

The following subsection presents theoretical frameworks:

## **2.6 Theoretical framework**

This study is situated in Shulman's (1986) theory of Pedagogical Content Knowledge (PCK) and Piaget's (1896) Constructivism theory. Shulman argued that effective teaching requires more than subject knowledge and general pedagogical skills; it necessitates an understanding of how to present topics in ways that learners can easily comprehend. Furthermore, the Constructivism theory of learning by Piaget (1896), emphasises that learners actively construct their knowledge through interaction with the physical world (Craig, 2019).

### **2.6.1 Shulman's theory of Pedagogical Content Knowledge**

Shulman (1986) described PCK as a crucial aspect of teaching, which includes the use of powerful analogies, illustrations, examples, explanations, and demonstrations to make complex ideas accessible to learners. Furthermore, it entails understanding the preconceptions and conceptions that learners of various ages and backgrounds bring to frequently taught topics, which can significantly affect the learning process, either facilitating or hindering it. In this regard, PCK integrates educators' expertise with subject-

specific knowledge, learners-centred knowledge, and contextual understanding. This distinctive type of knowledge transcends mere mastery of the subject; it encompasses a tailored approach to teaching that meets the needs of learners.

In addition, Shulman (1986) characterises content knowledge as the cumulative quantity and organisation of information within a teacher's cognition. This includes facts, concepts, justifications for their validity, and processes involved in knowledge acquisition and organisation within a specific field. In Mathematics, the importance of this expertise cannot be overstated. Effective instruction requires a comprehensive understanding that covers subject knowledge and delves into the underlying structures that constitute the subject matter itself.

Moreover, Shulman (1986) proposed additional categories of teacher knowledge that are essential for effective teaching. These include general pedagogical knowledge, knowledge of learners, knowledge of educational contexts, knowledge of the purpose of education, content knowledge, and curriculum knowledge. Each of these categories addresses critical aspects of teaching, such as classroom management, the characteristics of learners, the dynamics of classrooms, educational philosophy and history, and an understanding of curriculum. Shulman's theory on PCK generally outlined the principles that are relevant to the teaching of Mathematics more broadly, particularly concerning the number concept (Maboya 2014). This implies the teaching of place value as well since place value is also a component of number concepts.

1. *General Pedagogical Knowledge*: This area emphasises the importance of classroom management and organisation, ensuring effective teaching and learning experiences for learners.

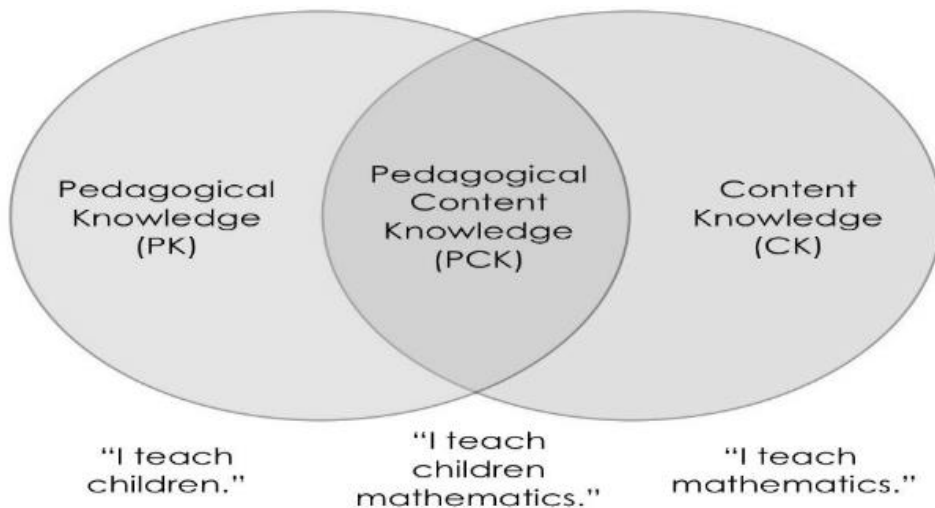
2. *Knowledge of Learners*: Understanding the general characteristics of learners at a specific grade level, including the dynamics within classrooms and school communities, is crucial for effective teaching.

3. *Knowledge of Educational Contexts*: This dimension involves a grasp of the unique dynamics and cultural contexts that impact both classrooms and school environments.

4. *Curriculum Knowledge*: This refers to 'tools of the trade,' including knowledge of subjects and topics taught at a particular grade level, the ability to identify suitable teaching materials, and an awareness of the content covered in previous and forthcoming grades.

Shulman posited that information related to education is separated into seven categories. Within this framework, the PCK category significantly shifted researchers' focus and displayed the interconnectedness between content knowledge and pedagogical knowledge, as illustrated in Figure 1.

**Figure 1** *Components of teacher's knowledge that can render effective learners' understanding*



*\*Adopted from Habiyaremye et al. (2023, p. 3).*

Based on Shulman's theory, both content knowledge and pedagogical knowledge are essential for teachers to effectively convey knowledge to their learners. Content knowledge involves the organisation of various elements within a subject domain, such as rules and propositions. In contrast, pedagogical knowledge primarily emphasises aspects such as lesson planning, teaching strategies, lesson delivery, and the selection of teaching materials (Nambira, 2016).

A study by Alberto (2023) examined pre-service teachers' mathematical knowledge for teaching, focusing on how they explain arithmetic properties using manipulatives. The study found that when teachers engage with manipulatives, they struggle to effectively select and contextualise them, thus, the findings highlight the need for improved pedagogical content knowledge. This might mean that teachers need to have strong PCK to effectively select and teach with manipulatives. Prior to that, a study by Marshman (2015) explored course design strategies for enhancing Pedagogical Content Knowledge (PCK) in primary pre-service Mathematics teachers, focusing on the effective use of manipulatives. The participants included graduate diploma pre-service teachers who examined and discussed children's mathematical work to deepen their understanding of PCK. The study revealed that explicitly sharing teaching through the teaching process significantly aids pre-service teachers in diagnosing learners and employing appropriate manipulatives for effective Mathematics teaching. This might imply that teachers' training plays a major role in teachers' PCK, and if teachers are not well trained, their PCK is likely to be influenced.

### **2.6.2 Piaget's Constructivism theory**

In Piaget's theory (1896), it is noted that learners can develop their understanding of Mathematics concepts by actively interacting with their surroundings and utilising physical objects to comprehend the working of the concepts. This means that teachers cannot simply transmit knowledge to learners, but learners must actively engage in learning by manipulating materials (Maseko et al., 2022). Hence, using manipulatives or teaching aids in the classroom can help learners gain a better understanding of Mathematics concepts such as place value (Lange, 2021). These manipulatives bridge the gap between abstract and concrete ideas (Ligget, 2017) and promote constructivism by fostering interaction between competent and less competent learners.

Bada (2015) conducted a study on constructivism learning theory as a paradigm for teaching and learning. The study highlighted that constructivism underscores the importance of active engagement and meaningful learning environments that provide learners' specific needs, making education enjoyable and impactful. The study further encouraged teachers to reflect on their teaching and continually adapt their teaching strategies to enhance learners' understanding and take ownership of learning. Teachers who utilise manipulatives in their lessons create constructivist-based classrooms (Golafshani, 2013). Thus, this involves learner-centred processing of information because learners construct their knowledge through the world around them. Similarly, this approach is rooted in the idea that learners actively engage in discovery as they learn. Ideas cannot be poured into passive learners, but learners must be mentally active for learning to take place by interacting with manipulatives (D'angelo & Iliev, 2012).

Moreover, based on Piaget's theory, children build their understanding through hands on experiences, suggesting that manipulatives aid in the learning of abstract Mathematical concepts such as place value. As a result, learners benefit more from physical objects and get a chance to construct their understanding of place value through exploration and discovery.

### **2.7 Implications of theories in the study**

Combining Shulman's Pedagogical Content Knowledge (PCK) with Piaget's constructivism offers a valuable understanding of the challenges faced by Grade 4 teachers in the Rundu Circuit when using manipulatives to teach place value. First, teachers should possess a strong PCK to effectively teach mathematical concepts. Without adequate knowledge of manipulatives and their teaching benefits, teachers may struggle to use them in lessons. Therefore, professional development programs should focus on enhancing teachers' understanding of manipulatives and their application to adopt better learning outcomes.

Moreover, constructivism emphasises the importance of active learners' engagement. Teachers should create an environment where learners can interact with manipulatives, allowing them to explore and construct their understanding of place value. This method helps learners grasp mathematical concepts and promotes a sense of ownership over their learning. In this context, teachers must transition from traditional teachers to facilitators, developing a deeper understanding of their learners' behaviours, learning styles, and needs. By leveraging their PCK, teachers can tailor their teaching strategies to ensure that manipulatives are used effectively to promote understanding.

Additionally, teachers should be willing to modify their teaching approaches to align with their learners' levels of understanding and interests. Incorporating interactive activities, such as physical manipulatives, can significantly enhance learners' engagement and comprehension. Teachers can create a more inclusive and responsive learning environment by focusing on active teaching methods. Finally, encouraging collaboration and reflective practices among teachers can help them share experiences and strategies regarding the use of manipulatives., allowing for continuous improvement in their teaching effectiveness.

Integrating Shulman's PCK and Piaget's constructivism underscores the necessity for Grade 4 teachers in the Rundu Circuit to enhance their knowledge and use of manipulatives. Teachers can overcome challenges by promoting active learning environments and adapting teaching strategies and significantly improve learner understanding of place value. This is in line with the study by Ijeh and Nkopodi (2013) that focuses on developing a theoretical framework to improve Mathematics and science teachers' pedagogical content knowledge (PCK) in South Africa and Zimbabwe, which involved twelve secondary schools Mathematics teachers.

## **2.8 Chapter summary**

The literature review concerning the challenges experienced by Grade 4 teachers in using manipulatives to teach place value highlights several significant gaps. While existing research extensively discusses the importance of manipulatives in enhancing learners' understanding of abstract mathematical concepts, such as place value, it reveals a notable deficiency in empirical studies that directly address the specific challenges faced by educators in diverse classroom settings, particularly in overcrowded environments.

Current findings indicate that teachers often revert to traditional teaching methods due to barriers like insufficient training, inadequate resources, and time constraints. The lack of comprehensive training on pedagogical content knowledge further exacerbates the issue, as many educators feel ill-equipped to incorporate manipulatives effectively, which aligns with the theoretical framework put forward by Shulman (1986) that emphasises the necessity of integrating subject knowledge with pedagogical skills.

Moreover, there appears to be a dearth of investigation into the practical application of manipulatives specifically for teaching place value among Grade 4 teachers. While the literature establishes the relevance of manipulatives and their positive correlation with improved learner performance, it lacks clarity on the nuanced challenges and teacher perceptions regarding their use. Therefore, this study on exploring the challenges experienced by Grade 4 teachers in implementing manipulatives becomes crucial. It aims to fill the existing gaps by providing contextual insights into educators' experiences and developing actionable strategies to enhance the effectiveness of teaching methodologies in mathematics, particularly concerning the foundational concept of place value.

## **CHAPTER THREE: METHODOLOGY**

This chapter outlines the various methodological aspects employed in this study to collect, organise, and analyse data. The subsections of this chapter include the research design, the population of the study, the sample and sampling procedures, research instruments, the pilot study, data collection procedures, data analysis and the trustworthiness of the data. Additionally, ethical considerations relevant to the research have been discussed.

### **3.1 Research design**

This study utilises the qualitative research method as an approach that explores human experiences and perspectives in depth, focusing on understanding phenomena rather than simply quantifying them (Tandon, 2021; Awasthy, 2019). It employs various methods such as interviews, observations, and focus groups to capture the complexity of social contexts (Awasthy, 2019). Qualitative research is inherently designed to explore and understand complex phenomena and the meanings that individuals or groups attach to them (Creswell & Poth, 2016). By utilising this methodology, the researcher aimed to gather rich, detailed data that reflects the subjective experiences of teachers, which is crucial for identifying the barriers they encounter in effectively incorporating manipulatives in their teaching practices. In addition, an exploratory case study was used to gain a deeper understanding of complex phenomena within their real-life contexts (Crowe et al., 2011; Debout, 2016). This approach is particularly suitable for investigating research questions that have not been thoroughly examined in previous studies (Pathirana et al, 2020). By employing this design, the researcher sought to gather background information, define the key aspects of the research problem, identify

potential areas for future inquiry, prioritize research objectives, and clearly articulate the challenges being addressed (George, 2023).

The exploratory nature of this study allows for an in-depth examination of teachers' perspectives, experiences, and interactions within their teaching environments, thus providing rich contextual insights into these challenges (Monday, 2020). Therefore, this choice is justified by the need to uncover the nuanced experiences, beliefs, and attitudes of teachers, which quantitative methods might overlook.

An exploratory case study approach not only allows for a deeper understanding of the challenges faced by teachers but also provides insights that can inform strategies for enhancing their teaching methods (Monday, 2020).

### **3.2 Population**

The population of the study included fifty-one (51) Mathematics teachers for the senior primary phase from thirty-two (32) government schools in Rundu Circuit, Kavango East Region.

### **3.3 Sample and sampling procedures**

A sample is defined as a group of items selected to represent a larger population (Levy & Lemeshow, 2013). This research used homogeneous sampling, which is a purposive sampling technique in qualitative research, to select participants with similar characteristics or experiences (Nyimbili & Nyimbili, 2024). Purposive sampling is particularly effective because it focuses on cases that exhibit specific traits relevant to the study (Creswell, 2014).

In this context, purposive sampling was appropriate as it allowed the researcher to identify participants who were information-rich and had relevant experience in teaching Grade 4. For this study, ten (10) Mathematics teachers from 10 different schools, each teaching Grade 4, were selected from a pool of 51 senior primary Mathematics teachers in the Rundu circuit. The selection criteria required that teachers had at least two years of experience in teaching Grade 4, ensuring that the participants could provide valuable insights based on their teaching experiences.

### **3.4 Research instruments**

An interview schedule and document analysis guide are the instruments that were used to collect data and are presented as follows:

#### **3.4.1 The Interview Schedule**

An interview is an instrument for gathering data that enables researchers to explore people's perspectives in more detail and it provides direct insights through in-depth conversational exchanges (Monday, 2020). In this study, a semi-structured interview schedule (Appendix 8) was designed to engage Grade 4 Mathematics teachers, facilitating qualitative data collection about their experiences with manipulatives in teaching place value. This approach encourages face-to-face interactions, fostering a personal connection that promotes detailed discussions. The interview questions aligned with the study's objectives: identifying factors influencing the selection and implementation of manipulatives, exploring teachers' decision-making processes, and investigating challenges faced in their integration. By gathering firsthand accounts, the researcher aimed to reveal the complexities of teaching with manipulatives and sought solutions to enhance teaching practices. The semi-structured format allowed flexibility, enabling

deeper exploration of specific challenges while maintaining focus on the main research questions. All interviews were recorded with participants' consent, ensuring accuracy and validity in data representation. Eventually, this structured yet adaptable approach provided a comprehensive understanding of the messages involved in using manipulatives for teaching place value in the Rundu circuit.

### **3.4.2 Document Analysis Guide**

Although interviews can be a powerful way of getting insights into interviewee's perceptions, they could go hand in hand with other methods providing in-depth information about participants, that is why a document analysis guide was used to supplement data from interviews (Monday, 2020). Additionally, document analysis (Appendix 9) is a qualitative research method that systematically reviews and interprets documents to gather facts and understand program purposes (Danilović, 2021). In this study, document analysis is particularly relevant as it complements interview findings, offering a deeper understanding of the use of manipulatives in teaching place value. The researcher systematically analysed key documents with reference to the topic place value, including teachers' lesson plans, answer scripts, and learners' books, to investigate how teachers plan to teach place, manipulatives used and learners' performance in the topic. Three books were collected from each teacher, representing the highest, average and lowest-performing learners

The aim was to uncover insights into learners' performance as evidenced by answer scripts and to understand learners' learning processes through their books, while lesson plans provided insights into teaching and learning resources especially used to teach place values. This was done to address objectives 1 and 2 and confirm what teachers said.

### **3.5 Pilot study**

A pilot study is a preliminary investigation aimed at assessing different facets of the methodologies intended for a larger, more extensive, or confirmatory research project. Its main objective is not to address specific research inquiries but to ensure that researchers do not embark on a major study without a sufficient understanding of the proposed methods. Essentially, a pilot study is carried out to avoid significant errors in a study that could lead to substantial time and financial loss (Lowe, 2019). The pilot study provided valuable insights into the research instruments, leading to significant adjustments and ensuring their credibility and trustworthiness in capturing relevant data (Brooks et al., 2016).

The pilot study was conducted in two primary schools within the Rundu Circuit of Kavango East Region, involving two Mathematics teachers who had experience teaching Grade 4. These primary schools did not participate in data collection. The purpose of the pilot study was to evaluate the credibility and trustworthiness of the research instruments to ensure they effectively addressed the research objectives. During the pilot study, several errors such as some questions appeared to be the same, objectives were not included in the introduction and questions on professional development were not detailed were discovered and necessary changes were made by removing and condensing questions that appeared to be the same, adding objectives in the introduction as well as expanding questions on professional development in more detail.

The interview questions and document analysis guide were thoroughly reviewed by the research supervisor before implementation to enhance the trustworthiness of the instruments. This review process ensured that the instruments were refined and relevant

to the research objectives. Additionally, to prevent the researcher's bias, the teachers involved in the pilot study were excluded from the actual research, further reinforcing the integrity of the findings.

### **3.6 Data collection procedures**

After the study had received ethical clearance and permission to access the research site, the researcher collected data from the participants. Data were collected from Grade 4 Mathematics teachers by using a semi-structured interview schedule and document analysis guide. The researcher carried out interviews first. These interviews lasted about 40 minutes and were scheduled at times convenient for the participants, either after school hours or during their free periods. The interviews were conducted in venues provided by the participants, ensuring a comfortable setting for discussions. Audio recordings of the interviews were made and later transcribed for analysis.

Document analysis occurred immediately after each interview session. The researcher and the participant would review relevant documents together, starting with lesson plans, which took about 20 minutes. This timing allowed the researcher to examine the alignment between the participants' verbal responses during the interviews and the written documentation. The nature of the interviews and document analysis allowed for a richer understanding of the data. Insights gained from the interviews guided the document analysis, as the researcher could probe deeper into specific aspects mentioned by the participants. On the other hand, the document analysis provided context and verification for the claims made during the interviews, creating a more comprehensive picture of the teaching practices and perspectives of the participants.

The integration of interviews and document analysis facilitated a dynamic interaction between the two data sources, enhancing the depth and reliability of the findings (Natow, 2020). However, challenges were encountered, such as participants' reluctance to engage fully and difficulties in finding suitable venues for discussions, which the researcher had to navigate to ensure successful data collection.

### **3.7 Data analysis**

Qualitative data on challenges experienced by Grade 4 teachers in using manipulatives to teach place value were analysed thematically. The data collected from interviews and document analysis underwent thematic analysis to identify patterns, themes, and categories within the data (Braun & Clarke, 2014; Salleh et al., 2017). This approach allowed for a holistic understanding of the challenges teachers face. The analysis began with familiarising oneself with the data through transcription and coding of interview responses to identify recurring themes related to the use of manipulatives, associated challenges, and suggestions for improvement. Initial codes were generated by systematically organising data segments aligned with research objectives, focusing on specific challenges and their categorisation.

Shulman's Pedagogical Content Knowledge (PCK) and Piaget's Constructivism theory were used as frameworks to enhance the analysis. PCK contextualised the relationship between teachers' content knowledge and pedagogical practices, while Piaget's constructivism theory provided insights into the cognitive challenges learners face with manipulatives. The thematic analysis followed a structured approach that included initial coding and iterative refinement to identify overarching themes and sub-themes (Salleh et al., 2017). Themes were generated by clustering related codes to ensure they accurately

represented the data as identified in various studies (Golafshani, 2013; Yusof & Lusin, 2013; Pham, 2015; Maboya et al., 2020; Tjandra, 2023).. These themes were further analysed with supporting quotations from participants and document analysis. Finally, the researcher drew conclusions and made recommendations based on the themes identified, ensuring a comprehensive understanding of the challenges Grade 4 teachers face when using manipulatives for teaching place value.

### **3.8 Trustworthiness of the data**

In this thesis, trustworthiness is a foundational element that is established through a combination of interviews and document analysis. Trustworthiness encompasses the degree of confidence that can be placed in the data, the interpretations drawn from it, and the methodologies employed, all of which are vital for ensuring quality research (Connelly, 2016). To enhance the relevance and reliability of the research outcomes, the researcher applied the established criteria that underpin trustworthiness: credibility, transferability, dependability, and confirmability (Pickard, 2013). Each of these elements plays a crucial role in validating the research process and its findings.

*Credibility* is rooted in ensuring that the research findings reflect an accurate representation of the participants' experiences, and the context studied (Ahmed, 2024). By employing in-depth interviews, the researcher was able to gather rich, nuanced data directly from participants, allowing for a deeper understanding of their perspectives.

*Transferability* refers to the applicability of the research findings to other contexts or settings (Stalmeijer et al., 2024). By providing a detailed description of the research context, participant demographics, and the methodologies used, the researcher aimed to

equip readers with the necessary information to determine how the findings might resonate with their contexts. This comprehensive documentation allows for critical assessment of the relevance of the findings beyond the initial study setting.

*Dependability* involves the consistency of the research process over time (Kale, 2019). To ensure that the study could be repeated or understood within a changing context, the research maintained a detailed audit trail of the research decisions and processes.

*Confirmability* addresses the objectivity of the research (Amin et al., 2020). The researcher took steps to ensure that findings and interpretations are grounded in the data and not influenced by researcher bias. This was achieved through triangulation of data, where the research compared findings from interviews with evidence gathered through document analysis. By cross-verifying with the research supervisor data from multiple sources, the researchers reinforced the accuracy of the conclusions and enhanced the overall integrity of the research.

The trustworthiness of this study is firmly established through a deliberate application of the criteria of credibility, transferability, dependability, and confirmability. By employing rigour in the methodology, including thorough interviews and careful document analysis, heightens the research findings by providing valuable insights and contribute meaningfully to the academic discourse in the field.

### **3.9 Ethical considerations**

The researcher adhered to research ethics by applying for and obtaining ethical clearance from the University of Namibia's Research Ethics Committee (Appendix 1) and further applied for and obtained a research permission letter from the University of Namibia's

Postgraduate Research Centre (Appendix 2). The researcher further sought and obtained permission from the Ministry of Education, Arts and Culture via the Regional Director (Appendix 4) to conduct a study of this nature in Rundu Circuit as well as from the school principals (Appendix 5). Moreover, the participants have received full information (Appendix 6) about the purpose and objectives of the study. Furthermore, this study has adhered to ethical guidelines by ensuring that participants first signed the consent forms (Appendix 7) which provided them with the information they needed to make the voluntary decision to participate in the study as well as their right to refuse or withdraw from participating any time they felt like doing so without any penalty against them. In addition, the researcher has assured the participants that confidentiality and anonymity were strictly maintained throughout the study as they were given numbers only. Ultimately, all data will be stored securely and used solely for the purposes of this research and will be kept for 5 years before it is destroyed.

## **CHAPTER FOUR: PRESENTATION OF RESULTS AND DISCUSSION**

In this chapter, the researcher presents the results and discussion of the findings of the study that explored challenges faced by Grade 4 teachers when using manipulatives to teach place value in Rundu Circuit, Kavango East, Namibia. This data is collected from interviews and document analysis in an attempt to address research objectives. It is divided into two parts: the first part is 4.1 which presents the presentation of results, and the second part 4.2, presents a discussion of data.

### **4.1 Presentation of results**

This subsection presents the findings of the study as they were collected during data collection to address the objectives of the study. It first provides demographic information for the participants and secondly, it addresses the research objectives. In addressing the research objectives of the study as outlined in Chapter 1, the findings are structured according to the themes identified from the study informed by the literature and theoretical frameworks, which are Shulman's PCK theory and Piaget's Constructivism theory.

#### **4.1.1 Demographic information of the participants**

This subsection presents demographic information of the participants, as shown in Table 3. Participants were given names such as Participant 1 to maintain anonymity and to protect their identities.

**Table 3** *Participants demographic information*

<b>Participant number</b>	<b>Gender</b>	<b>Teaching experience</b>
1	Male	13
2	Female	4
3	Female	13
4	Male	3
5	Female	3
6	Female	8
7	Female	7
8	Female	28
9	Female	6
10	Male	3

Table 3 shows that the participants were three males and seven females, all of whom are Grade 4 Mathematics teachers. All of them have taught for more than 2 years. As per the criteria, those with the lowest years of experience are the ones with 3 years, and the highest is the one with 28 years of experience. This also shows that the majority of the Grade 4 teachers are females. The participants were selected using homogeneous sampling to ensure that all individuals shared common experiences of teaching Mathematics at the same educational level. From an overall population of fifty-one teachers across thirty-two government schools, the sample was narrowed to ten participants based on their professional experience and workshop engagement. The importance of qualitative

methodologies allows for a deeper understanding into the challenges faced by these teachers, contributing valuable perspectives to the educational discourse in the area.

#### **4.1.2 Manipulatives Used when teaching place value**

Participants were asked to indicate the types of manipulatives they use in their teaching of place value as a driving question to know if they use manipulatives in their lessons or not before they can be asked other further questions. Most of the participants (5 out of 10) indicated that they use an abacus because it is common among all other manipulatives used, and this is the only manipulative they have learned from university. It was also evident in their lesson plans as abacus appeared to be the only teaching tool used.

For example, Participant 10 indicated that:

*“At our school, we only have an abacus, and that is the only teaching aid I use.”*

To add on, Participant 2 said:

*“I don’t really use manipulatives to teach place value with the fear that learners will be confused or not familiar with them, and I’m also not open or familiar with them. However, I use an abacus sometimes.”*

Moreover, 4 out of 10 participants, all females, have indicated that they use a variety of manipulatives when they are teaching place value to make sure that their learners have understood the topic well and it is clearly shown in their lesson plans (see Appendix 10).

Participant 3 says:

*“I use manipulatives more often because Grade 4 learners learn best when they manipulate or touch concrete objects, and Mathematics itself is a practical subject*

*and it has its own language. Therefore, when I'm teaching place value mostly, I like using the abacus, beads, place value charts, flash cards and straws to make sure I enhance my learners understanding."*

Participant 8 explicitly says:

*"I use a place value mat, beads and place value chart throughout the teaching of place value, just to make sure all of my learners have understood."*

It is also evident from the data that some participants only use manipulatives when introducing the topic of place value as Participant 7 says:

*"I only use place value chart when I'm introducing the topic of place value...."*

In addition, it is evident in some lesson plans that teachers introduce the topic with competency 2 instead of competency 1 (Table 1). Competency 1 focuses on recognising and writing down the missing numbers on a number chart and number line, while competency 2 involves recognising and identifying the place value and the value of the digits in a four-digit number (0-999). This shift in focus suggests that some teachers may lack pedagogical content knowledge, as the manipulative place value chart is specifically designed for competency 2 and cannot be effectively used to introduce the topic of competency 1 (see Appendix 10). Manipulatives are not interchangeable between these competencies due to their distinct purposes and level of cognitive development they aim to advance in the learners. For example, a number chart is intended to help learners visualise and identify the sequence of numbers, an essential skill outlined in competency 1. Conversely, a place value chart is for understanding the importance of digit placement and numerical value as specified in competency 2.

### **4.1.3 Factors influencing the selection and implementation of manipulatives**

Selection and implementation factors are factors that are in the selection of materials when lesson planning and their usage during teaching presentations. Participants were asked about factors that influence the selection and implementation of manipulatives in the teaching of place value, which is research objective number 1. The findings have revealed the factors related to teachers' pedagogical content knowledge, learners' prior knowledge, language barrier and learners' behaviours.

#### **4.1.3.1 Teachers' pedagogical content knowledge and preparedness**

Teachers were asked to state the extent to which they use manipulatives and their pedagogical content knowledge. The findings revealed that teachers hardly use manipulatives throughout the topic, and their understanding of manipulatives influence the usage of manipulatives in the classrooms.

Participant 4 stated:

*“Some teachers lack knowledge on how to use manipulatives...”*

Participant 1 mentioned:

*“When I'm not prepared, I hardly use manipulatives and sometimes if I'm not sure of how to use a certain manipulative, I don't use it.”*

Participant 2 confessed:

*“I don't really use manipulatives because I'm not familiar with them and with a fear that learners will get confused.”*

It is also apparent that although it is about knowledge of the usage, it can also be knowledge of the learners in the fear of confusing them, as Participant 2 confessed.

In addition, Participant 3 argues in terms of learners' learning abilities and perceptions, expressed:

*“Sometimes learners might not take the use of manipulatives seriously because they fail to see the link between the content and sometimes me as a teacher, I fail to make learners realise the link between the content and the tool I'm using, ....”*

#### **4.1.3.2 Knowledge of learners**

Some participants stressed that the prior knowledge of learners creates additional difficulties in the learning environment.

Participant 4 stated,

*“...the learners' prior knowledge also affects manipulatives usage.”*

Participant 6 added:

*“The learners' learning ability is also a factor; some are fast while others are slow...”*

The different types of learners in the classroom also influence the teaching with

#### **manipulatives. 4.1.3.3 Language barriers**

Language is also a challenging factor in teaching with manipulatives. The findings have revealed that the medium of instruction is critical when it comes to Grade 4 learners on the use of manipulatives. This is how the teachers communicate to the learners as Participant 10 emphasised the medium of instruction's impact, saying:

*“Learners in Grade 3 are taught in vernacular languages, and for them to understand, you have to code-switch.”*

Participant 4 explained:

*“Language barrier is a main issue; when I’m explaining, most of my learners are lost, and only a few understand through demonstration.”*

In the end, if the teacher did not code switch, only a few learners would get what the teacher was saying through observation, as Participant 4 said:

#### **4.1.3.4 Learners’ behavior**

Learners’ behaviours also fall under the knowledge of learners, which is about understanding the general characteristics of learners, including dynamics within classrooms. The findings have revealed that some participants (4 out of 10) have also raised concerns about learners' behaviours and engagement levels as it also influences how manipulatives are integrated into teaching.

This is because manipulatives can sometimes lead to playful behaviour as learners fail to see the link between the topic and the tools used in class. As Participant 6 said:

*“Only a few learners would understand; the majority are just into playing, and they influence each other to play because of the abacus.”*

Additionally, Participant 8 warned that teachers need to be very careful because:

*“When learners see the manipulatives brought to class, they get excited and turn the lesson into playtime, which can prevent manipulatives from serving their purpose.”*

Learners' misbehaving also affects the use of manipulatives in teaching place value limiting the grasping of place value concepts as also alluded by Participant 10 as:

*“Learners lose focus and influence others to misbehave, and as a teacher, you have to maintain order in the class, which takes up time and reduces the effectiveness of the lesson.”*

Although active classrooms are necessary for teaching, only a few learners understand, and the rest have turned a class into a playground, and no teaching and learning is taking place.

#### **4.1.4 Challenges experienced by Grade 4 teachers**

Participants were asked about the challenges they experienced when they were using manipulatives to teach place value, they have indicated similar challenges. The challenges they face are as follows, teaching overcrowded classrooms, lack of training, availability of manipulatives and time constraints.

##### **4.1.4.1 Teaching in overcrowded classrooms**

Most of the participants (9 out of 10) indicated that overcrowded classrooms are an issue which hinders providing individualised attention and support. In addition, overcrowded classrooms are also a barrier to the monitoring and supervision of the use of manipulatives as well as ensuring that all learners are taking part in meaningful learning experiences.

Overcrowded classrooms pose a challenge in terms of presentation as Participant 1 expressed:

*“Nowadays we have a lot of learners in classes, and that poses a big challenge to the teacher because the teacher has to attend to all learners, do the teaching, give an activity and mark during the lesson to give feedback immediately.”*

Similarly, Participant 2 shared the same views:

*“Overcrowded classrooms is one of the main challenges I face here.”*

Participant 6 explicitly said:

*“Overcrowded classrooms hinder our ability to identify learners who need additional help.”*

In addition, overcrowded classrooms can also be a challenge in terms of maintaining discipline and interest while using manipulatives and as Participant 3 stated:

*“The number of learners in the class really disrupts because handling an overcrowded classroom is not for everyone due to too much noise, disruption, and a lack of interest, as not all are interested in math. To maintain order, I have to stop and enforce discipline, which forces me to start over.”*

Participant 6 says:

*“The number of learners we have in the classroom is a bigger challenge because when you are in front, those at the back cannot see. We have about 70 learners in a class.”*

Participants reflected on the difficulty of managing learners’ engagement in such overcrowded environments as they failed to allow all learners to have a chance to participate in the use of the available manipulatives.

#### 4.1.4.2 Lack of training

Participants were also asked if they had attended any professional development workshops on Mathematics manipulatives. The data is summarised in Table 4. The question was necessary for the researcher to confirm if they received training on how to use manipulatives which could influence their usage of manipulatives.

**Table 4** *Professional development workshops attended on using manipulatives in Mathematics*

Participant number	Workshop attended
1	One
2	None
3	One
4	None
5	None
6	None
7	None
8	Many
9	One
10	None

Table 4 shows the number of workshops attended by the participants in the study. Many (6 out of 10) participants have indicated that they had not attended any workshop whether on manipulatives or any related to Mathematics ever since they started their teaching career, and a few (4 out of 10) attended workshops on how to use manipulatives, as shown

in Table 4. Further, those who received training indicated that it was during their teacher training on using an abacus, as that was the only manipulative introduced to them at the university for teaching place value. It seems there is a lack of training on how to use manipulatives in Mathematics. This indicates they had not been sufficiently trained during pre-service, and even during in-service, they were not receiving proper support. This made the participants do self-learning as Participant 2 explicitly communicated,

*“...like in my case, this is my fourth year in teaching, but I never attended a workshop. If there is something I don’t know that I encounter while lesson planning, I only use to go to YouTube and watch some videos.”*

Participant 1 said:

*“I have been working for 13 years now, but the workshop I attended is only one which was on curriculum reform; throughout my teaching career, I was not trained on how to use manipulatives...”*

#### **4.1.4.3 Availability of manipulatives**

Many (9 out of 10) participants in the study indicated a lack of materials at their schools. The lack of adequate materials poses major obstacles for teachers aiming to use manipulatives in their lessons. Participant 1 explicitly says:

*“The availability of resources is also one of the challenges hindering us from teaching effectively because even if you want to incorporate teaching tools, you have nowhere to find them.”*

Participant 2 elaborated that:

*“Lack of resources really affects my teaching and always demotivates us, taking us a step backwards. I only use an abacus because it is the only one available at school.”*

In addition, due to a lack of resources, some teachers have resorted to improvising which sometimes does not serve any purpose as Participant 3 stated:

*“Due to lack of resources as a teacher, I improvise by making my own abacus, but sometimes it is not strong, and it can be destroyed while carrying it before it even reaches the class.”*

Noting the influence of manipulatives on learners’ interest, lack of resources hinders all the learners from being interested and demotivates them as Participant 4 expressed:

*“The main challenge I face is the lack of resources. At our school, we only have one abacus, and that abacus is always with me in front. All children want to manipulate it at the same time, and it is impossible. As a result, they will lose interest because it is like I have deprived them of what belongs to them, and the lesson will turn out to be boring to them.”*

The 9 out of 10 participants reveal a critical shortage of manipulatives, as many schools lack essential resources like abacuses, place value charts, and flashcards.

Participant 10 stated:

*“Lack of resources is really a big issue here, as we only have two abacuses; learners are always fighting to come to the front and be near the teacher.”*

#### 4.1.4.4 Time constraint

Eight out of ten participants have indicated that limited teaching time is another major challenge. The content to be covered is a lot; teachers often feel pressured to adhere to strict timelines, which can hinder the use of manipulatives for teaching place value as well as view manipulative usage as time consuming. As Participant 1 communicated:

*“Time to appropriately select material is also an issue; to get appropriate manipulatives, you need to think, compare, and look for them, which is time-consuming.”*

While manipulatives are highly beneficial, the necessity of completing the syllabus causes time constraints for Grade 4 learners, who may progress slowly, as Participant 2 stated.

*“The time allocated to the lessons is not enough since our lessons only last for 30 minutes due to the platooning system we have, which forces us to mostly use traditional methods of teaching.”*

This means the time is not enough for the use of manipulatives. Teachers find it challenging, and this is also influenced by the school culture or arrangements and the school’s internal policy.

Participant 5 expressed that time has an influence on teaching methods as many teachers resorted to the lecture method, which is against Piaget's Constructivism theory as learners are not actively involved in the lesson and are perceived to be passive:

*“When I’m teaching with manipulatives, I will spend about two weeks on this topic since learners are too slow, and to avoid that, I will be forced to do away with manipulatives.”*

Participant 8 shared further explanation by commenting,

*“Since the time is limited, all learners do not get time to interact with the manipulatives in the class, and some learners will not understand.”*

Collectively, these challenges influence the whole teaching and learning process as Participant 10 expressed:

*“Due to the number of learners in the class, 40 minutes is nothing, as most of the time is spent on maintaining order, and even if you have manipulatives, they will not be used effectively.”*

#### **4.1.5 Effectiveness of teaching place value with manipulatives**

Although, the study aimed to explore challenges experienced by Grade 4 teachers’ in using manipulatives to teach place value, the researcher deemed it necessary to assess the effectiveness of teaching with manipulatives. This was critical as assessing learners’ understanding after the use of manipulatives is a critical component of effective teaching. When teachers were asked how they knew that learners understood teaching with manipulatives, they shared the way they assessed. They reveal diverse approaches towards assessment. For instance, Participant 1 emphasised the importance of conducting activities related to the lesson to evaluate understanding, indicating: *“After teaching them, I give an activity related to the lesson to assess their understanding. I collect and mark the activities to see if they understand the concepts.”* Participant 3 highlighted the use of visual aids, stating, *“I assess them by asking them to draw abacuses from numbers below 1,000 on the chalkboard,”* which allowed for identifying gaps in learners’ understanding. Group activities were also mentioned as an assessment method, as Participant 4 said: *“I*

*assess learners' understanding through group activities that align with the lesson I taught."*

Teachers also expressed the necessity of immediate activities for assessment after using manipulatives. For example, as Participant 9 indicated: *"After using the abacus, I give immediate activities to assess understanding, as learners' performance will demonstrate their grasp of the material."* Several teachers pointed out that observation plays a crucial role, with Participant 5 stating, *"I assess the effectiveness of manipulatives by observing learners' interest and interactions during the activities."* Ultimately, while immediate activities showcase initial understanding, standardised tests may offer deeper insights into long-term retention, as Participant 8 revealed: *"The true effectiveness of my use of manipulatives can be measured by tests, as they reveal whether learners retain information days later."*

#### **4.1.6 Suggestions and recommendations on the use of manipulatives**

In addressing research objective 3, the participants were asked to give suggestions and recommendations regarding the use of manipulatives in Grade 4 Mathematics. This was necessary as it helped to understand the views and aspirations of participants on this topic.

All participants proposed some strategies on how to overcome identified challenges and how to ensure that manipulatives are used for teaching place value. Teachers have suggested manipulatives to be made available, and many in terms of quantity, which can either be at schools or at resource centres. As Participant 1 said:

*"It would be beneficial to have materials at schools or available at teacher resource centres for borrowing,"*

A few teachers (2 out of 10) have suggested that teachers should improvise and stop relying too much on the government, as alluded to by Participant 3:

*"As teachers, we must improvise and create as many teaching aids as possible, this will also reduce our dependency on government as we all know that it fails to deliver most of the time,"*

One of the teachers also suggested that parental involvement can also reduce shortages of resources as parents will either buy manipulatives or make manipulatives for their children that they can use at school as Participant 3 said:

*" As teachers, we should also involve parents in the education of their children because if parents are involved, we cannot suffer from lack of resources because those parents who can afford to buy will buy resources for their children or even make for their children like those abacus are easy to make."*

Half of the participants (5 out of 10) have recommended schools to maintain an adequate supply of teaching tools, such as abacuses, place value charts, mats, straws, and many more, as Participant 2 expressed:

*"Schools should always make sure all the resources needed for teaching and learning are available and are enough to be used by all learners."*

Many (9 out 10) teachers have suggested manageable class sizes to make a learning environment more effective. As Participant 6 indicated:

*"Our classrooms are too full. We should try to separate our learners into a number that we are able to work with, and possible for us to use teaching aids*

*where everyone can see from in front. Because having 70 learners does not really make sense at all.”*

That means the number of learners to be reduced to make learning more meaningful.

Moreover, Participant 8 communicated that:

*“I think we should take the teacher to learner ratio strictly and seriously; however, it is beyond our control, and I do not know how we will do it.”*

In addition, Participant 9 said:

*“The government must reduce the number of learners in the class, but I don’t know how it will do it...”*

Furthermore, many (7 out of 10) participants have suggested that lesson durations should be changed because 30 to 40 minutes are not enough. As Participant 1 stated:

*“Adjusting the duration of lessons is very much needed to Grade 4 learners, as 40 minutes often isn’t enough for teaching, disciplining learners, and giving feedback in overcrowded classrooms.”*

All 10 participants have recommended workshops and training for their professional development. Because it is important for workshops to be conducted more often for the expert to share their best practices with novice teachers. As Participant 2 expressed:

*“I’m suggesting that they should offer more workshops to support us, especially us novice teachers, to get experience from others, like in my case, this is my fourth year in teaching, but I never attended a workshop....”*

Furthermore, teachers have complained that they need more workshops to put ideas together and grow each other as Participant 3 hinted:

*“More workshops must be conducted here in Rundu to learn from each other how to improvise and use available materials instead of every time buying, yet the economy is against us. We need to put our minds together, put the syllabus down and tackle on each topic for example if we are teaching place value, which tools should we use and how to go about and possible challenges as well as to broaden teachers' minds out there because some teachers are just alone teaching that grade in the whole school, and no one is assisting them.”*

Participant 6 said:

*“Like me, in my 8<sup>th</sup> year of working I did not attend any workshop, so is advise for workshops to be made many for us to attend and renew our knowledge because workshops are not really, I think circuits or subject advisors must do something because no we kind of abandoned more especially novice teachers need more help.”*

Adding on, Participant 7 said:

*“The only thing that is disappointing me is the lack of workshops, we have people who are more experienced and people who are studying again, they might have better knowledge that we need I think is best they bring up workshops, so we engage with each other instead of us focusing on the one we are struggling.”*

Furthermore, Participant 9 said:

*“Workshops must be there always; I suggest every year for mathematics teachers to meet and learn from each other and share ideas on how to use certain topics. Because you might graduate from the University, and you might end up struggling even if teaching aids/ manipulatives are there because you do not know how to use them.”*

Furthermore, one of the teachers has indicated a lack of current opportunities for growth, showing the need for ongoing professional development the way it used to happen in the past. As Participant 8 narrated:

*“I remember back then teachers' resource centre used to call us for workshops where we go and learn from one another. I think the Unam centre should also assist in offering workshops. I think they should also call for workshops where we can make teaching aids and show each other how to use them effectively so that the learning process can go smoothly.”*

All 10 participants have called on policymakers to support these initiatives by ensuring adequate resources are allocated to schools and encouraging the sharing of strategies related to effective manipulative use in classrooms. As Participant 1 mentioned:

*"Policymakers to support annual subject-specific conferences to equip teachers with new tools and strategies."*

Additionally, recommendations included guidelines for the appropriate number of teaching tools needed for each topic to enhance learning. As Participant 2 said:

*“I’m also suggesting the policymakers to make policies on manipulatives to be used and for the school to provide different manipulatives for me as a teacher to explore them and see what is best for my learners.”*

One of the teachers suggested that policymakers should do something regarding the medium of instruction because language barriers are a major issue in grade 4. As Participant 4 said:

*“I think it is best for learners to be prepared in Grade 3 maybe be given a course on Mathematics or how, but something must be done by policymakers because language barriers are really a major issue or maybe Mathematics to be taught in English in Grade 3 that will be far better.”*

## **4.2 Discussion of the data**

This subsection presents the discussion of data as it is presented in subsection 4.1. First, it discusses manipulatives used when teaching place value. Second, factors that influence the selection and implementation of manipulatives, followed by challenges faced when teaching with manipulatives and assessing progress on teaching place value with manipulatives. Last, it discusses suggestions and recommendations made by Grade 4 teachers on how to overcome challenges and improve the use of manipulatives.

### **4.2.1 Manipulatives used when teaching place value**

The range of manipulatives reported by participants underscores the varied approaches teachers adopt to facilitate understanding of place value. While some teachers rely mainly on the abacus, others use multiple tools such as place value charts, flashcards, and beads. This difference suggests a lack of uniformity in resource availability and teacher training,

reinforcing Shulman's (1986) concept of Pedagogical Content Knowledge (PCK). Teachers' varying levels of familiarity with different manipulatives likely impact their teaching choices, as seen in Participant 2's hesitance to use unfamiliar tools. This aligns with Miranda and Adler (2010) and Hamukonda (2021) that many Namibian teachers are reluctant to the use manipulative in their teaching. Participant 3's statement about the importance of tactile learning aligns with Piaget's (1896) Constructivist theory, which posits that hands-on experiences are essential for cognitive development. However, the limited use of manipulatives by several participants raises concerns about the effectiveness of teaching strategies employed in overcrowded classrooms, as noted by various participants.

#### **4.2.2 Factors influencing the selection and implementation of manipulatives**

Several factors were identified as influencing teachers' selection and implementation of manipulatives, notably teachers' pedagogical content knowledge and preparedness, knowledge of learners, language barriers, and learners' behaviours. The findings reveal that teachers' knowledge and preparedness were the main factors that influenced the use of manipulatives. A lack of confidence in using certain manipulatives can lead to their underusage. This aligns with the findings of Maseko's et al. (2022) which indicated that a lack of curriculum knowledge leads to poor lesson planning and reduces teachers' confidence during instruction. This reflects the critical need for targeted professional development to enhance teachers' understanding of effective manipulative use.

Language barriers emerged as a major obstacle, complicating the learning environment and hindering learners' understanding. Teachers have mentioned code-switching, which shows that language is a problem faced by teachers in a multilingual context, further

complicating the teaching of abstract mathematical concepts. This is because grades 1-3 are taught through their mother tongues or the predominant local language (Shuukwanyama, 2021).

#### **4.2.3 Challenges experienced by Grade 4 teachers**

The challenges reported by participants are overcrowded classrooms, lack of training, inadequate materials, and time constraints, which are consistent as multiple difficulties teachers face in using manipulatives. Overcrowded classrooms, highlighted by multiple teachers, hinder individual attention and meaningful engagement with manipulatives. This concern is consistent with literature indicating that large class sizes adversely affect learning outcomes (Maseko et al., 2022; MoEAC, 2021; Uugwanga, 2023).

The lack of training on the use of manipulatives is particularly alarming this aligns with Pharm and Tjandra's findings (Pham, 2015; Tjandra, 2023). Many teachers rely on basic manipulatives like the abacus and resort to improvisation when other resources are unavailable. This reliance on limited materials may restrict learners' opportunities for experiential learning. The agreement among teachers regarding the need for adequate materials indicates a challenge that requires immediate attention from educational policymakers.

Teachers consistently indicated limited teaching time as a major challenge, often feeling that the 30 to 40-minute lesson durations were too short to allow for meaningful engagement with manipulatives. This aligns with Odum (2022), who observed that the time allocated for Mathematics is insufficient for effective manipulative use. The time constraints further complicate the need to balance mathematics curriculum content

coverage with ensuring that learners have sufficient opportunities for hands-on learning, as highlighted by Pham (2015). Therefore, adjustments to lesson durations or curricular restructuring may be necessary for more effective implementation of manipulatives in teaching.

#### **4.2.4 Assessing the effectiveness of manipulatives on teaching place value**

The varied approaches to assessing learners' understanding of place value underscore the necessity of aligning assessment methods within teaching strategies. The emphasis on immediate activities following the use of manipulatives highlights a practical approach to assessing learners' comprehension. Yet, the reliance on observation as a primary assessment tool may limit the depth of understanding teachers can achieve. As some teachers indicated, while observational methods provide insights, uniform testing offers a more comprehensive view of learners' retention over time. This suggests a need for developing a balanced assessment outline that incorporates both formative and summative assessments.

#### **4.2.5 Suggestions and recommendations on manipulatives usage**

Participants offered valuable recommendations for overcoming the challenges faced in teaching with manipulatives. Their suggestions for improving resource availability, managing class sizes, and increasing training opportunities reflect a holistic understanding of the systemic barriers impacting Mathematics education. The call for greater accessibility to teaching materials and resources aligns with existing literature advocating for resource equity in educational settings (Odum, 2022). Moreover, the emphasis on workshops and professional development underscores the importance of ongoing support for teachers, particularly novices who may feel isolated in their practice (Maboya, 2014;

Maseko et al., 2022). This aligns with the findings of Shulman (1986), who suggests that effective teaching requires an active interplay between content knowledge, pedagogical understanding, and practical experience.

#### **4.2.6 Conclusion**

The data highlights the main challenges faced by Grade 4 teachers in the Rundu Circuit, underscoring the need to address systemic issues such as resource availability, training, and classroom management to improve Mathematics instruction through manipulatives. While manipulatives offer valuable opportunities for enhancing learner understanding of concepts like place value, persistent challenges linked to teachers, learners, and systemic factors create a complex environment that necessitates a comprehensive approach to meet the needs of Mathematics education. By recognising these dynamics, stakeholders can take actionable steps to support effective teaching practices and foster better learning outcomes. Future research should continue to explore these issues, incorporating learners' perspectives to enrich the educational dialogue and drive meaningful change.

## **CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS**

This chapter presents a summary of the findings, the conclusion from the findings and recommendations from the conclusions. In the end, this chapter also provides suggestions for future studies. The chapter gives an overview of the Grade 4 teachers' challenges in using manipulatives to teach place value in Rundu Circuit, Kavango East, Namibia.

### **5.1 Summary of the research process**

This study was exploratory in nature and used interviews schedule and document analysis as instruments for data collection. The aim of the study was to address the following objectives:

- To identify the factors influencing the selection and implementation of manipulatives in teaching place value among Grade 4 teachers in the Rundu circuit.
- Identify challenges that Grade 4 teachers in the Rundu circuit experience when using manipulatives to teach place values.
- To suggest strategies and recommendations to support Grade 4 teachers in overcoming these challenges and improving their use of manipulatives to teach place value in Rundu Circuit.

The sample consisted of 10 Grade 4 Mathematics teachers from Rundu Circuit, Kavango East Region. These teachers were purposively sampled because of their experience which was more than two years of teaching Grade 4 and are currently teaching Grade 4. They were interviewed and gave their documents for analysis including lesson plans (see

Appendix 10) and 3 books of their learners (see Appendix 10) as well as samples of manipulatives made by learners (see Appendix 10). The data collected from both interviews and document analysis was analysed using thematic analysis.

## **5.2 Summary of findings**

The major findings from the study as per the research objectives of the study are as follows:

### **5.2.1. Manipulatives used when teaching place value**

Teachers employed a variety of manipulatives, including abacuses, place value charts, beads, and flashcards. However, the usage of manipulatives varied significantly among teachers, often limited by their familiarity and comfort levels with these tools.

### **5.2.2. Factors influencing selection and implementation**

The main factors influencing the selection and successful application of manipulatives included:

- Teachers' pedagogical content knowledge and preparedness: some teachers expressed a lack of confidence in their understanding of how to effectively utilise manipulatives due to inadequate training.
- Knowledge of learners: learners' prior knowledge influences the use of manipulatives
- Language barriers: influence both comprehension of place value and the effective integration of manipulatives.

- Learners' behaviours: influenced the use of manipulatives as learners failed to see the link between manipulatives and content, which resulted in them playing in the class.

### **5.2.3 Challenges experienced by Grade 4 teachers**

- Overcrowded classrooms: this was indicated consistently as a main barrier to effective teaching, as it hindered individual attention and engagement with manipulatives.
- Lack of training: participants reported insufficient training in using manipulatives, leading to reliance on one basic manipulative, which is an abacus, and reluctance to explore new resources.
- Availability of manipulatives: a critical shortage of adequate teaching materials limited teachers' ability to implement hands-on learning effectively.
- Time constraints: strict lesson durations restricted teachers' capacity to incorporate manipulatives meaningfully into their lessons, often resulting in a focus on rote learning instead of conceptual understanding.
- Lack of professional development opportunities for novice teachers: participants reported a lack of professional development in the circuit, and this resulted in novice teachers feeling isolated.
- Lack of guiding policies: some teachers reported a lack of guidelines or policy on the type of manipulatives to be used and how they are used.

#### **5.2.4 Assessing the effectiveness of manipulatives on teaching place value**

Teachers used various approaches to assess learner understanding, emphasising immediate activities after manipulatives use but acknowledging the limitations of observational assessment.

#### **5.2.5 Suggestions for improvement in the usage of manipulatives**

Teachers proposed for the Ministry of Education, Arts and Culture to offer workshops where they can learn practical strategies, including improving resource availability, reducing class sizes, enhancing training opportunities, and fostering greater collaboration among teachers to share best practices.

### **5.3 Conclusion**

The findings indicate that while manipulatives hold a high possibility for enhancing conceptual understanding of place value, numerous challenges impede their usage in the classroom. Challenges such as lack of training, overcrowded classrooms, and limited resources create an environment where teachers struggle to implement hands-on learning effectively. This study underscores the importance of addressing these major barriers to improve Mathematics teaching in the Rundu circuit.

### **5.4 Recommendations on addressing challenges**

Based on the findings of this study, the following recommendations are made in an attempt to address the challenges Grade 4 teachers face in Rundu Circuit:

- The Ministry of Education, Arts and Culture through professional development sub-divisions in educational regions should implement ongoing professional development workshops focusing on the use of manipulatives, explicitly tailored

for Grade 4 Mathematics teachers. These workshops should cover not only the practical use of various manipulatives in teaching place value competencies but also teaching strategies aligned with present Grade 4 mathematics curricular expectations.

- Educational authorities should prioritise the allocation of adequate resources to schools, ensuring that a variety of manipulatives are available for teachers to enhance their teaching practices, and senior education officers should follow up to monitor how teachers are using those resources in the classrooms.
- The government should hire additional staff or create smaller class environments, facilitating individualised attention and engagement with manipulatives and come up with strategies for how teachers can manage classroom sizes.
- Policymakers and curriculum developers (NIED) should consider restructuring the Mathematics curriculum to allow for longer lesson durations, providing teachers the necessary time to effectively incorporate manipulatives into their instruction and assessment practices.
- Senior education officers should encourage regular collaboration among teachers within schools and across the district and organise workshops for teachers to share the best practices, resources, and experiences related to the use of manipulatives in teaching.
- Ministry of Education, Arts and Culture should make provision for resource centres and should ensure that they equipped with relevant resources for Mathematics teachers.

- Parents and other stakeholders should be involved in the education of the learners by helping to address the shortage of necessary resources in Mathematics. This can be done through educating them on the importance of mathematical topics to learners personal and professional lives.

By addressing the challenges faced by teachers, these recommendations aim to create a more supportive teaching and learning environment that improves both teachers' confidence and learners' understanding of essential mathematical concepts like place value.

### **5.5 Recommendations for future research**

- Further studies should explore the perspectives of learners on the use of manipulatives to further enrich the understanding of the effectiveness of manipulatives in fostering mathematical comprehension.
- A comparative study should be carried out to compare the effect of class sizes on Mathematics teachers use of manipulatives. This is to confirm or reject the notion that class sizes influence teachers' choices and use of manipulatives.
- This study can be replicated to other regions and expanded to measure teachers' PCK on the use of manipulatives in similar settings such as same teaching duration and overcrowded classroom settings.

## REFERENCES

- Adendorff, S. A., Mntunjani, L. M., & Siyepu, S.W. (2018). Foundation phase teachers' use of manipulatives to teach number concepts: A critical analysis. *South African Journal of Childhood Education* 8(1), 1- 9.  
<https://doi.org/10.4102/SAJCE.V8I1.495>
- Ahmed, S. K. (2024). The pillars of trustworthiness in qualitative research. *Journal of Medicine, Surgery, and Public Health*, 2, 100051.  
<https://doi.org/10.1016/j.glmedi.2024.100051>
- Amin, M. E. K., Nørgaard, L. S., Cavaco, A. M., Witry, M. J., Hillman, L., Cernasev, A., & Desselle, S. P. (2020). Establishing trustworthiness and authenticity in qualitative pharmacy research. *Research in social and administrative pharmacy*, 16(10), 1472-1482. <https://doi.org/10.1016/j.sapharm.2020.02.005>
- Andrews, P., & Sayers, J. (2014, February 5-6). *Foundational number sense: A framework for analysing early number-related teaching*. In MADIF 9, The Ninth mathematics Education Research Seminar, Umeå. <https://www.diva-portal.org/smash/get/diva2:776015/FULLTEXT01.pdf>
- Association for Supervision and Curriculum Development (ASCD) & National Council of Teachers of Mathematics (NCTM). (2015). Principles and standards for school Mathematics: *Journal of Mathematics Teaching in the Middle School*, 24 (7), 288-316.
- Awasthy, R. (2019). Nature of qualitative research. In *Methodological issues in management research: Advances, challenges, and the way ahead* (pp. 145-161). Emerald Publishing Limited. <https://doi.org/10.1108/978-1-78973-973-220191010>

- Back, J. (2016). Manipulatives in the primary classroom. *nrich University of Cambridge*.  
<http://nrich.maths.org/10461>.
- Bada, S. O., & Olusegun, S. (2015). Constructivism learning theory: A paradigm for teaching and learning. *Journal of Research & Method in Education*, 5(6), 66-70.  
<https://doi.org/10.9790/7388-05616670>
- Benton, L., Saunders, P., Kalas, I., Hoyles, C., & Noss, R. (2018). Designing for learning mathematics through programming: A case study of pupils engaging with place value. *International journal of child-computer interaction*, 16, 68-76.  
<http://doi.org/10.1016/j.ijcci.2017.12.004>
- Braun, V., & Clarke, V. (2014). What can “thematic analysis” offer health and wellbeing researchers?. *International journal of qualitative studies on health and well-being*, 9(1), 26152. <https://dx.doi.org/10.3402/qhw.v9.26152>
- Brooks, J., Reed, D. M., & Savage, B. (2016, June). Taking off with a pilot: The importance of testing research instruments. In *ECRM2016-Proceedings of the 15th European Conference on Research Methodology for Business Management": ECRM2016. Academic Conferences and publishing limited* (pp. 51-59).
- Carbonneau, K. J., & Marley, S. C. (2015). Instructional guidance and realism of manipulatives influence preschool children's mathematics learning. *The Journal of Experimental Education*, 83(4), 495-513.  
<https://doi.org/10.1080/00220973.2014.989306>
- Carbonneau, K. J., Wong, R. M., & Borysenko, N. (2020). The influence of perceptually rich manipulatives and collaboration on mathematic problem-solving and

perseverance. *Contemporary Educational Psychology*, 61, 101846.

<https://doi.org/10.1016/j.cedpsych.2020.101846>

Cockett, A., & Kilgour, P. W. (2015). Mathematical manipulatives: Creating an environment for understanding, efficiency, engagement, and enjoyment. *TEACH COLLECTION* of Christian Education, 1(1), 47-54. Retrieved from

<https://research.avondale.edu.au/teachcollection/vol1/iss1/5>

Connelly, L. M. (2016). Trustworthiness in qualitative research. *Medsurg nursing*, 25(6), 435.

<https://www.proquest.com/openview/44ffecf38cc6b67451f32f6f96a40c78/1?pq-origsite=gscholar&cbl=30764>

Creswell, J. W. (2014). *Research design: qualitative, quantitative, and mixed-methods approaches, vol. 1 (1)*. <https://doi.org/10.5539/elt.v12n5p40>

Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.

<https://d1wqtxts1xzle7.cloudfront.net/55010759>

Crowe, S., Cresswell, K., Robertson, A., Huby, G. A., & Avery, A. A. & Sheikh, A.(2011). The case study approach. *BMC medical research methodology*, 11(1),

100. <https://doi.org/10.1186/1471-2288-11-100>

D'Angelo, F., & Iliev, N. (2012). Teaching Mathematics to Young Children through the use of Concrete and Virtual manipulatives. *Online submission*

<https://files.eric.ed.gov/fulltext/ED534228.pdf>

- Danilovic, N. (2021). Application of the Document Analysis Method in the Social Sciences. *Social Communications: Theory and Practice*, 13(2), 13-27.  
<https://doi.org/10.51423/2524-0471-2021-13-2-12>
- Debout, C. (2016). Qualitative case study. *Soins; la revue de reference infirmiere*, (806), 57-60. <https://doi.org/10.1016/j.soin.2016.04.018>
- Demetriou, L. (2015, February). The use of virtual and concrete manipulatives in kindergarten school. In *CERME 9-Ninth Congress of the European Society for Research in Mathematics Education* (pp. 1911-1917). <https://hal.science/hal-01288463v1>
- George, T. (2023). Exploratory research: Definition, Guide, & Examples. Retrieved from Scribbr: <https://www.scribbr.com/methodology/exploratoryresearch>.
- Habiyaremye, H. T., Ntivuguruzwa, C., & Ntawiha, P. (2023, November, 28). Rwandan teacher training college's mathematics teachers' pedagogical content knowledge for teaching: assessment toward competency-based curriculum. In *Frontiers in Education* (Vol. 8, p. 1214396). Frontiers Media SA.  
<https://doi.org/10.3389/feduc.2023.1214396>
- Haimbodi, F. N. (2019). Exploring the Incorporation of mental Arithmetic into primary into primary school mathematics: A case of Oshana Region, Namibia  
[https://etd.uwc.ac.za/bitstream/handle/11394/7171/Haimbodi\\_PhD\\_edu\\_2019.pdf?sequence=1&isAllowed=y](https://etd.uwc.ac.za/bitstream/handle/11394/7171/Haimbodi_PhD_edu_2019.pdf?sequence=1&isAllowed=y)
- Hamukonda, P. (2021). Teaching of the number concept at junior primary phase in the Oshana region of Namibia. University of Johannesburg (South Africa).  
<https://hdl.handle.net/10210/498128>

- Ijeh, S. B., & Nkopodi, N. N. (2013). Developing a theoretical model for investigating the mathematics and science teachers' PCK in South Africa and Zimbabwe. *Mediterranean Journal of Social Sciences*, 4(14), 473-479.  
<https://pdfs.semanticscholar.org/fb86/a0bd5460dce80afcb37b02301f60cf9cb9dc.pdf>
- Ilukena, A. M., Utete, C.N., & Kasanda, C. (2020). Strategies Used by Grade 6 Learners in Multiplication of Whole Numbers in Five Selected Primary Schools in the Kavango East and West Regions. *International Education Studies*, 13(3), 65-78.  
<https://doi.org/10.5539/ies.v13n3p65>
- Ilukena, M. A., Haimbodi, F. N., & Sirinji, R. A. (2019). The historical development of number systems in Namibia. *Namibia Educational Reform Forum Journal*, 26(1), 4–12. Retrieved from <https://journals.nied.edu.na/index.php/nerfj/article/view/125>
- Jones, J. P., & Tiller, M. (2017). Using concrete manipulatives in mathematical instruction. *Dimensions of Early Childhood*, 45(1), 18-23. <https://eric.ed.gov/?id=EJ1150546>
- Jorgensen, R., & Dole, S. (2011). *Teaching mathematics in primary schools*. Allen & Unwin Pty. Ltd..  
<http://www.allenandunwin.com/default.aspx?page=94&book=97811741757231>
- Josua, L., Miranda, H., & Auala, R. (2022). A social realist perspective of challenges facing educators in implementing the revised curriculum in Ompundja Circuit in Namibia. *African Journal of Education and Practice*, 8(4), 63-87.  
<https://doi.org/10.47604/ajep.1613>
- Kale, V. (2019). *Digital transformation of enterprise architecture*. CRC Press.  
<https://doi.org/10.1201/9781351029148>

- Kangungu, J. C. F. (2024, July 26) *Welcoming remarks*. Rundu Circuit Educators' Conference: striving to become educators of excellence. Rundu, Namibia.
- Kapenda, H. M., Kasanda, C., & Nawaseb, T. F. (2018). Teachers' understanding of the use of everyday contexts in the teaching of Mathematics at three selected urban Junior Secondary Schools in Windhoek, Namibia. *Namibia CPD Journal for Educators*. <https://doi.org/10.32642/ncpdje.vi.1277>
- Khan, N. I. (2019). Case study as a method of qualitative research. In *Qualitative Techniques for Workplace Data Analysis* (pp. 170-196). IGI Global. <https://doi.org/10.4018/978-1-5225-5366-3.CH008>
- Klinger, C. M. (2010). Challenging negative attitudes, low self-efficacy beliefs, and math-anxiety in pre-tertiary adult learners. *Connecting voices: Practitioners, researchers & learners in adult mathematics and numeracy*, 164-171. <https://www.alm-online.net/images/ALM/proceedings/alm-05-proceedingsalm12.pdf#page=164>
- Lange, J. (2021). The importance of using manipulatives in math class. [https://nwcommons.nwciowa.edu/education\\_masters](https://nwcommons.nwciowa.edu/education_masters)
- Larbi, E., & Mavis, O. (2016). The Use of Manipulatives in Mathematics Education. *Journal of Education and practice*, 7(36), 53-61. <https://files.eric.ed.gov/fulltext/EJ1126428.pdf>
- Laski, E. V., Jor'dan, J. R., Daoust, C., & Murray, A. K. (2015). What makes mathematics manipulatives effective? Lessons from cognitive science and Montessori education. *SAGE Open*, 5(2), 2158244015589588. <https://doi.org/10.1177/2158244015589588>

- Lawton, F. & Hansen, A. (2011). Number and the number system. In Hansen, A.(Ed.). (2011). *Children's Errors in Mathematics: Understanding Common Misconceptions in Primary Schools*. (2nd Ed.). Bell & Bain Ltd. Glasgow.  
<https://api.semanticscholar.org/CorpusID:63254573>
- Levy, P. S., & Lemeshow, S. (2013). *Sampling of populations: methods and applications*. John Wiley & Sons. <https://doi.org/10.2307/2348995>
- Liggett, R. S. (2017). The Impact of Use of Manipulatives on the Math Scores of Grade 2 Students. *Brock Education: A Journal of Educational Research and Practice*, 26(2), 87-101. <https://files.eric.ed.gov/fulltext/EJ1160704.pdf>.
- Lowe, N. K. (2019). What is pilot study?. *Journal of obstetric, Gynecologic & Neonatal Nursing*, 48(2), 117-118. <https://www.jognn.org>
- Luwango, L., Karupu, E.,& Mangundu, A.F.(2023). Analyzing Grade 4 learners' Mathematics books in pursuit of quality basic education in Namibia. *The Namibia CPD Journal for Educators*, 8(1), 1-14  
<https://www.researchgate.net/publication/372474865>
- Maboya, M. J. (2014). *The relationship between teachers' mathematical knowledge and their classroom practices: a case study on the role of manipulatives in South African primary schools* (Doctoral dissertation, University of the Free State).  
<https://scholar.ufs.ac.za/server/api/core/bitstreams/7a17881a-ace6-4667-ac56-3bc07c09ce2e/content>
- Maboya, M. J., Jita, L. C., & Chimbi, G. T. (2020). South African teachers' beliefs and the use of manipulatives to resolve the concept-symbol schism in mathematics

learning. *Universal Journal of Educational Research*, 8(11), 5414-5424.

<https://doi.org/10.13189/ujer.2020.081144>

Marshman, M. (2015). *Course Design Considerations for Enhancing Pedagogical Content Knowledge in Primary Pre-Service Mathematics Teachers*. In Proceedings of the 2015 Conversations on Knowledge for Teaching Conference (pp. 1-5).

Conversations on Knowledge for Teaching Conference.

<https://research.usc.edu.au/esploro/outputs/conferencePaper/Course-Design-Considerations-for-Enhancing-Pedagogical/99449312902621>

Maseko, T., Bhebhe, S., & Thabiso, M. (2022). Exploring how science teachers use Manipulative teaching materials in the classroom: A case of schools in Manzini Region. <https://doi.org/10.37602/IJSSMR.2022.5315>

Mateya, M., Utete, C. N., & Ilukena, A. M. (2016). Factors that cause poor performance in mathematics at National School Secondary Certificate level compared to Junior Secondary Certificate level in four selected schools in the two Kavango Educational regions. *Journal for studies in humanities and social sciences*, 158-168. Retrieved from

<https://journals.unam.edu.na/index.php/JSHSS/article/view/1044>

McCombes, S. (2023). How to Write a Literature Review| Guide, Examples, & Templates. Scribbr. Retrieved May, 16, 2023, from

<https://www.scribbr.com/dissertation/literaturereview/>

Miranda, H. & Adler, J. (2010). Re-sourcing Mathematics Teaching Through Professional Development. *Pythagoras*, 2010(72), 14-26.

<https://doi.org/10.4102/PYTHAGORAS.V0I72.17>

- Monday, T. U. (2020). Impacts of interview as research instrument of data collection in social sciences. *Journal of Digital Art & Humanities*, 1(1), 15-24.  
[https://doi.org/10.33847/2712-8148.1.1\\_2](https://doi.org/10.33847/2712-8148.1.1_2)
- Monte, J. (2021). An Exploration of Manipulatives in Math Education. *Undergraduate Review*, 16, 200 -213. [https://vc.bridgew.edu/honors\\_proj/485](https://vc.bridgew.edu/honors_proj/485)
- Mutuku, E. (2015). *National Assessment in Namibia. A case study*. Windhoek  
<https://www.umalusi.org.za/docs/presentations/2015/emutuku.pdf>
- Namibia, Ministry of Education Arts and Culture [MoEAC]. (2021). *Education Management Information System*. Retrieved from  
[https://moe.gov.na/?page\\_id=2775](https://moe.gov.na/?page_id=2775)
- Namibia, Ministry of Education, Arts and Culture [MoEAC]. (2015). *Junior Primary Phase Mathematics Syllabus*. Retrieved from <http://www.nied.edu.na>
- Namibia, Ministry of Education, Arts and Culture [MoEAC]. (2024). *Senior Primary Phase Mathematics Syllabus*. Retrieved from <http://www.nied.edu.na>
- Namibira, G. (2016). Analyzing the determinants of teachers' mathematics teaching competencies in upper primary phase: Evidence from Namibia. *International journal of Innovation and Economic Development*, 2(4), 35-47  
<https://dx.doi.org/10.18775/ijied.1849-7551-7020.2015.24.2004>
- Natow, R. S. (2020). The use of triangulation in qualitative studies employing elite interviews. *Qualitative research*, 20(2), 160-173.  
<https://doi.org/10.1177/1468794119830077>

- Nghipondoka, E. A. (2022). *Provisional results of NSSC Ordinary and Advanced Subsidiary levels full-time and part-time candidates: 2022*. Ministry of Education, Arts and Culture, Press Statement: Eenhana, Namibia.
- Nora V. Marasigan, Elsie Mae M. Balba, Cris-Anne D. Dela Cruz and Jerome S. Manalo. 2019. Utilizing Manipulatives in Mathematics Classroom. *International Journal of Recent Innovations in Academic Research*, 3(10): 72-79.  
<https://www.researchgate.net/profile/Nora-Marasigan/publication/363797762>
- Nyimbili, F., & Nyimbili, L. (2024). Types of Purposive Sampling Techniques with Their Examples and Application in Qualitative Research Studies. *British Journal of Multidisciplinary and Advanced Studies*, 5(1), 90-99.  
<https://doi.org/10.37745/bjmas.2022.0419>
- Odum, J. K. (2022). Manipulative materials in teaching mathematics among junior high school teachers: A literature review. *Scholars Journal of Science and Technology*, 3(4), 787-795. <https://doi.org/10.53075/ijmsirq/56567853>
- Özdemir, B. G., & Soylu, Y. (2017). Examination of the pedagogical content knowledge of mathematics teachers. *International Online Journal of Primary Education*, 6(1), 26-39. <https://dergipark.org.tr/en/pub/iojpe/issue/69826/1113758>
- Pathiranage, Y. L., Jayatilake, L. V., & Abeysekera, R. (2020). Case study research design for exploration of organizational culture towards corporate performance. *Review of International Comparative Management*, 21(3), 361-372.  
<https://www.cceol.com/search/article-detail?id=1047258>
- Peters, B. I. (2016). *Realistic mathematics education and professional development: A case study of the experiences of primary school mathematics teachers in*

*Namibia* (Doctoral dissertation, Stellenbosch: Stellenbosch University).

<https://scholar.sun.ac.za>

Pham, S. (2015). Teachers' perceptions on the use of Math Manipulative in elementary classrooms.

[https://tspace.library.utoronto.ca/bitstream/1807/68723/1/PhamSon\\_H\\_201506\\_M\\_T\\_MTRP.pdf](https://tspace.library.utoronto.ca/bitstream/1807/68723/1/PhamSon_H_201506_M_T_MTRP.pdf)

Pickard, A. J. (2013). *Research methods in information*. Facet publishing.

[https://books.google.com.na/books?hl=en&lr=&id=hcdnDQAAQBAJ&oi=fnd&pg=PR1&dq=Pickard,+A.J.+\(2013\)](https://books.google.com.na/books?hl=en&lr=&id=hcdnDQAAQBAJ&oi=fnd&pg=PR1&dq=Pickard,+A.J.+(2013))

Potgieter, E. C. (2015). *Exploring the use of manipulatives in teaching number sense in Grade 2: Oshana region, Namibia* (Doctoral dissertation, University of Namibia).

<https://repository.unam.edu.na/server/api/core/bitstreams/0be53b96-d7fc-4ca9-9efc-188c7fb2d7e3/content>

Ronden, J. (2012). *The primary curriculum: A creative approach*. London: SAGE

Salleh, I. S., Ali, N. S. M., Yusof, K. M., & Jamaluddin, H. (2017). Analysing qualitative data systematically using thematic analysis for deodoriser troubleshooting in palm oil refining. *Chemical Engineering Transactions*, 56, 1315-1320.

<https://doi.org/10.3303/CET1756220>

Sarı, M. H., & Aydoğdu, Ş. (2020). The effect of concrete and technology-assisted learning tools on place value concept, achievement in mathematics and arithmetic performance. <https://files.eric.ed.gov/fulltext/EJ1249483>

Shigwedha, A.N., Nakashole, L., Auala, H., Amakutuwa, H., & Ailonga, I. (2017). *The SACMEQ IV project in Namibia. A study of the conditions of schooling and the*

*quality of primary education in Namibia.* Windhoek.

[https://www.seacmeq.org/sites/default/files/sacmeq/publications/final\\_sacmeq\\_iv\\_namibia-compressed\\_-compressed.pdf](https://www.seacmeq.org/sites/default/files/sacmeq/publications/final_sacmeq_iv_namibia-compressed_-compressed.pdf)

Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard educational review*, 57(1), 1-23. <https://people.ucsc.edu/~ktellez/shulman.pdf>

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational researcher*, 15(2), 4-14. <http://www.jstor.org/stable/1175860>

Shuukwanyama, T.T. (2021). *Challenges Faced by Newly Graduated Teachers in Using Mother Tongue to Teach Mathematics in the Oshana Region of Northern Namibia.* University of Johannesburg (South Africa). <https://hdl.handle.net/102000/0002>

Stalmeijer, R. E., Brown, M. E., & O'Brien, B. C. (2024). How to discuss transferability of qualitative research in health professions education. *The Clinical Teacher*, e13762. <https://doi.org/10.1111/tct.13762>

Stephanus, G. H. (2014). Effective teaching practices from the perspective of Kilpatrick, Swafford and Findell's (2001) model: A video-based case study analysis of the teaching of geometry in Namibia. <https://repository.unam.edu.na/server/api/core/bitstreams/94ad2dbc-1b8b-4834-8160-425bca28ad03/content>

Tahir, T., Khan, K., & Aurangzeb, W. (2019). Effective use of classroom management techniques in overcrowded classrooms. *Global Social Sciences Review*, 4(1), 196-206. [https://doi.org/10.31703/gssr.2019\(iv-i\).18](https://doi.org/10.31703/gssr.2019(iv-i).18)

Tandon, T. (2021). Qualitative Research: An Overview. <https://doi.org/10.25215/0903.065>

- Themane, K. M., & Luneta, K. (2021). Misconceptions and associated errors in the learning of mathematics place value in south african primary schools: a literature review. <https://doi.org/10.20944/PREPRINTS202105.0456.V1>
- Thouless, H. (2014). *Whole-number place-value understanding of students with learning disabilities* (Doctoral dissertation). <https://eric.ed.gov/?id=ED568446>
- Tjandjara, C. (2023). Effectiveness of using manipulatives in Mathematics teaching in Inclusive Education Programs in an elementary school. *Dharmas Education Journal (DE\_Journal)*, 4(1), 168-178.  
[http://ejournal.undhari.ac.id/index.php/de\\_journal](http://ejournal.undhari.ac.id/index.php/de_journal)
- Uugwanga, J. S. (2023). *Factors that influence learners' learning outcomes in Namibian schools*. [www.nied.edu.na](http://www.nied.edu.na)
- Van de Walle, J., Karp, K., Lovin, L. & Bay-Williams, J.(2014). *Teaching learner centered mathematics: Developmentally appropriate instruction for grades 3-5*. Pearson
- Van de Walle, J.A., Karp, K.S. & Bay Williams, J.M. (2013). *Elementary and middle school mathematics: Teaching developmentally* (8<sup>th</sup> ed.). Pearson
- Westaway, L., Vale, P., Graven, M., Larkin, K., Ladel, S., Kortenkamp, U. (2024). *A comparison of place value across four African primary school curricula*.  
[https://www.researchgate.net/publication/377586867\\_A\\_Comparison\\_of\\_Place\\_Value\\_Across\\_Four\\_African\\_Primary\\_School](https://www.researchgate.net/publication/377586867_A_Comparison_of_Place_Value_Across_Four_African_Primary_School)
- Yusof, J., & Lusin, S. (2013). The role of manipulatives in enhancing pupils' understanding on curricula fraction concepts. *International Journal for Infonomics*

(*IJI*), 6(4), 750-755 <https://doi.org/10.20533/IJI.1742.4712.2013.0087>

## APPENDIX 1: ETHICAL CLEARANCE CERTIFICATE



### ETHICAL CLEARANCE CERTIFICATE

**Ethical Clearance Reference Number: WKC0054**

**Date: 11 July 2024**

This Ethical Clearance Certificate is issued by the University of Namibia Decentralized Ethics Committee (DEC) in accordance with the University of Namibia's Research Ethics Policy and Guidelines. Ethical approval is given in respect of undertakings contained in the Research Project outlined below. This Certificate is issued on the recommendations of the ethical evaluation done by the **School of Education (Windhoek & Khomasdal Campuses) Decentralized Ethics Committee**.

**Title of Project:** Exploring grade 4 teachers' challenges in using manipulatives to teach place value: the case of Rundu Circuit, Kavango East.

**Researcher:** Rakkell Hailulu

**Student number:** 201704534

Take note of the following:

1. Any significant changes in the conditions or undertakings outlined in the approved Proposal must be communicated to the ethics committee. An application to make amendments may be necessary.
2. Any breaches of ethical undertakings or practices that have an impact on ethical conduct of the research must be reported to the ethics committee.
3. The Principal Researcher must report issues of ethical compliance to the ethics committee (through the Chairperson) at the end of the Project or as may be requested by the ethics committee.
4. The ethics committee retains the right to:
  - i) Withdraw or amend this Ethical Clearance if any unethical practices (as outlined in the Research Ethics Policy) have been detected or suspected,
  - ii) Request for an ethical compliance report at any point during the course of the research.

The ethics committee wishes you the best in your research.

Dr. Job U. Hengari (Chairperson, Windhoek & Khomasdal Campuses Decentralized Ethics Committee)

Prof. Davis Mumbengegwi (Head, Multidisciplinary Research)

## APPENDIX 2: RESEACH PERMISSION LETTER

Student Name: RAKKEL HAILULU

Student Number: 201704534

Programme: MASTER OF EDUCATION

**Approved Research Title:** Exploring grade 4 teachers' challenges in using manipulatives to teach place value: the case of Rundu Circuit, Kavango East.

### TO WHOM IT MAY CONCERN:

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

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

Best Regards



Dr. AEE Shikongo  
Head: Postgraduate Research Support Services  
Tel: +264 61 206 3129  
E-mail: [aeshikongo@unam.na](mailto:aeshikongo@unam.na)



### **APPENDIX 3: LETTER TO EDUCATION DIRECTOR - Kavango East Region**

Hailulu Rakkell K

P.O B Windhoek

05 August 2024

The Director: Education

Kavango East Regional Council

Private Bag 2134, Rundu

Dear Mrs. C. Shilima

#### **REQUEST FOR PERMISSION TO CONDUCT EDUCATIONAL RESEARCH STUDY IN KAVANGO EAST REGION**

My name is **Rakkell Kulaumone Hailulu**, Student no: 201704534, as part of the requirements for a Master's Degree in Education (Mathematics Education) at the University of Namibia; I am conducting a study on “Exploring *Grade 4 teachers' challenges in using manipulatives to teach place value: the case of Rundu circuit, Kavango East Region*”.

- Identifying the factors influencing the selection and implementation of manipulatives in teaching place value among Grade 4 teachers in Rundu circuit.
- Identifying challenges that Grade 4 teachers in Rundu circuit, experience when using manipulatives to teach place values.
- Suggesting strategies and recommendations to support Grade 4 teachers in overcoming these challenges and improving their use of manipulatives to teach place value in Rundu Circuit.
- Assessing the influence of teachers' pedagogical knowledge on their effectiveness in integrating manipulatives for teaching place value.

The contribution of this study lies in adding to the existing body of knowledge on effective utilization of manipulatives in teaching place value concepts. The findings are expected to benefit teachers by providing insights on overcoming challenges and improving teaching practices. Additionally, the results will be valuable for informing policymakers and curriculum designers in enhancing support for teachers in utilizing manipulatives.

Therefore, I am writing to kindly seek for permission to conduct a study in your schools, especially at primary schools in Rundu circuit. First, data will be collected through interviews with Mathematics teachers teaching Grade 4. Second, these teachers will be asked to complete the questionnaires. The interviews will last approximately 40 minutes while the questionnaires will take 20 minutes. Third, I will analyze documents such as learners' books, assessment sheets, lesson plans and learners' May/June Tests' answer scripts. I will assure the participants that their participation in the study is voluntary, and they will use pseudonyms to ensure their identities and that of their schools are confidential. Teachers will also sign consent forms before taking parts in the study. Data collection will take place after school to avoid disruption of normal schools' operation. In addition, I will wait to obtain letters of approval from schools before entering their premises.

Moreover, I assure you the confidentiality and anonymity of the schools, documents and participants in the study will be maintained. The study requires that I collect data for at least a week, and I would like to begin collecting data end of August. However, I am open for any arrangements.

Attached please find a copy of ethical clearance certificate and a copy of my research permission letter from the University of Namibia.

Would you need more clarifications, please contact me at 0818322461 or my supervisor Dr Kanandjebo at [ikanandjebo@unam.na](mailto:ikanandjebo@unam.na) .

Yours sincerely

.....

**Rakkel Kulaumone Hailulu (M.Ed Student)**

0818322461

**APPENDIX 4: PERMISSION LETTER FROM THE EDUCATION DIRECTOR**



**REPUBLIC OF NAMIBIA  
KAVANGO EAST REGIONAL COUNCIL**

**DIRECTORATE OF EDUCATION, ARTS AND CULTURE**

**OFFICE OF THE DIRECTOR**

Tel. (066) 258.9000 / 258.9201.....  
Fax (066) 267-707.....  
Enquiries: S. Mpepo

Private Bag 2134  
RUNDU  
Namibia

Email: mpeposesilia@yahoo.com

Date: 07 August 2024

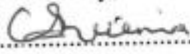
Rakkel K. Hailulu  
P O Box 96259  
Windhoek

Dear Ms. Hailulu

**SUBJECT: REQUEST FOR PERMISSION TO CONDUCT EDUCATIONAL RESEARCH  
STUDY IN KAVANGO EAST REGION**

1. The above matter bears reference.
2. This letter serves to inform you that permission is hereby granted to you to carry out a research to grade 4 teachers at selected schools in Rundu Circuit, Directorate of Education, Arts and Culture, Kavango East Region, on exploring grade 4 teacher's challenges in using manipulatives to teach place value.
3. However, necessary arrangements should be made with the management of the selected schools as well as the Inspectors of Education.
4. You are kindly requested to report yourself to the office of the Inspector of Education before undertaking the research.
5. The Inspector of Education, Principals and management of the identified schools are therefore requested to accord their usual support.

Yours sincerely,

  
Christine S. Shilima  
Regional Director  
Directorate of Education, Arts and Culture: KERC



07/8/2024  
Date

**APPENDIX 5: LETTER TO PRINCIPALS**

Rakkel K. Hailulu

P.O Box 962 Windhoek

27 August 2024

To: The school principal

.....School

Kavango East Regional Council

Dear Sir/madam

**REQUEST FOR PERMISSION TO CONDUCT EDUCATIONAL RESEARCH  
STUDY IN SCHOOL**

My name is **Rakkel Kulaumone Hailulu**, Student no: 201704534, as part of the requirements for a Master’s Degree in Education (Mathematics Education) at the University of Namibia; I am conducting a study on “Exploring *Grade 4 teachers’ challenges in using manipulatives to teach place value: the case of Rundu circuit, Kavango East Region*”. I write to kindly seek for permission to conduct a study in your school, especially at primary schools in Rundu circuit. The study will mainly involve interviews and questionnaires to be filled by mathematics teachers that are teaching Grade 4 and analyzing documents such books, assessment sheets, lesson plans and May/ June Tests’ answer scripts. Attached please find a copy of the permission letter from the University of Namibia and the office of the Director of Education, Kavango East Region.

I assure you the confidentiality and anonymity of the school and participants in the study will be maintained. The study requires that I collect data for at least a week, and I would like to begin collecting data from now until mid-September 2024.

Would you need more clarifications, please contact me at 0818322461 or my supervisor Dr LN Kanandjebo at [kanandjebo@unam.na](mailto:kanandjebo@unam.na) .

Yours sincerely

.....

**Rakkel Kulaumone Hailulu (M.Ed Student)**

**0818322461**

**APPENDIX 6: INFORMATION SHEET -Teachers**

Dear Teacher,

You are invited to participate in a research study entitled “Exploring *Grade 4 teachers’ challenges in using manipulatives to teach place value: the case of Rundu circuit, Kavango East Region*”. This study aims to investigate the difficulties faced by Grade 4 teachers when incorporating manipulatives in their teaching practices.

The researcher is Rakkell K. Hailulu, a student from University of Namibia.

If you choose to participate, you will be interviewed and asked to complete a questionnaire and possibly give your lesson plan, assessment sheet and some learners examinations answer scripts and books. Your contribution will help in understanding the challenges teachers encounter with the use of manipulatives in the classroom.

Your participation is voluntary, and all information provided will be kept confidential. Your name will not be linked to any findings. If you have any concerns or questions, please do not hesitate to contact [rachelkulaumone@gmail.com](mailto:rachelkulaumone@gmail.com) or 08183322461.

Thank you for considering participation in this study.

Yours Sincerely

.....

**Rakkell Kulaumone Hailulu (M. Ed Student)**

**0818322461**

## APPENDIX 7: CONSENT FORM- Teachers

### Teachers' Consent Form

**Name of Researcher:** Rakkell K. Hailulu

**Title of study:** “Exploring *Grade 4 teachers' challenges in using manipulatives to teach place value: the case of Rundu circuit, Kavango East Region*”.

#### AGREEMENT

I acknowledge that:

- ❖ My participation in this study is confidential. My responses will be anonymized and will only be used for research purposes and my identity will not be disclosed in any reports or publications resulting from this research.
- ❖ Participation in this study is voluntary. I have the right to withdraw from the study at any time without any consequences.
- ❖ There are no anticipated risks in participating in this study. However, the benefits include contributing to the understanding of Grade 4 teachers' challenges in using manipulatives, which may help improve teaching practices in the future.

I have read and understood the information provided above regarding this research study titled “Exploring *Grade 4 teachers' challenges in using manipulatives to teach place value: the case of Rundu circuit, Kavango East Region*”. I agree to participate in this study voluntarily.

NB: Signing your name below means you agree to be in this study. You will get a copy of this form.

**NAME OF THE TEACHER**

\_\_\_\_\_

\_\_\_\_\_

## APPENDIX 8: SEMI- STRUCTURED INTERVIEW QUESTIONS

### Teacher's Interview Guide (Semi-structured questions)

Participant: .....

Date:.....

#### Introduction

My dear participant, how are you today? Thank you for accepting to participate in this study. My name is Rakkell K. Hailulu, and I am a student at the University of Namibia, Main Campus. I am conducting research on *Grade 4 teachers' challenges in using manipulatives to teach place value in Rundu Circuit, Kavango East Region*. You are kindly requested to spare some of time to answer few questions, which I have for you. Our discussion will be audiotaped.

*Manipulatives are physical objects used as teaching tools to engage learners in hands-on learning of mathematics and helping learners to increase their understanding of abstract concepts (Kennedy, 1986; Boggan, 2011; Ligget, 2017). In the context of teaching place value, manipulatives can include objects such as, base-ten blocks, place value charts, place value mats, straws, paper clips, unifix cubes and abacus.*

The purpose of this interview is to explore Grade 4 teachers' challenges in using manipulatives to teach place value in Rundu Circuit. The objective of this interview is to identify factors influencing the section and implementation of manipulatives, discover challenges faced by teachers, and propose strategies for improvement.

#### Ethical considerations

Your participation in this study is voluntary and your responses will be kept confidential. Pseudonyms will be used in ensuring your identity and that of your school is confidential. In addition, you have the right to withdraw from participating in this research study at any time during this interview. Please respond the questions I will ask with all honesty.

#### Personal information

1. Name:

2. School:
3. Teaching Experience (in years):
4. Professional Development Training on Mathematics Manipulatives (Yes/No):
5. Familiarity with Manipulatives (Scale: Very familiar, Somehow familiar and Not familiar):

### **Interview questions**

#### **Use of Manipulatives**

1. How often do you incorporate manipulatives in your teaching of place value concepts to Grade 4 learners?
2. What types of manipulatives do you usually use to teach place value? Please provide specific examples.

#### **Challenges**

3. What challenges do you experience when using manipulatives to teach place value to Grade 4 learners at your school?
4. Have you encountered difficulties in selecting appropriate manipulatives for teaching place value? If yes, please elaborate.
5. What obstacles do you face while implementing manipulatives in teaching place value?
6. Do you feel that the learners struggle to understand place value when manipulatives are used? If yes, please explain the challenges.
7. How do you assess the effectiveness of using manipulatives to teach place value?
8. Have you ever felt that the use of manipulatives hindered rather than enhanced learners' understanding of place value? If so, please provide examples and discuss the reasons behind it.

9. Have you faced any resistance from learners in using manipulatives for teaching place value? If yes, please elaborate.

10. How does lack of resources affect your ability to effectively use manipulatives in teaching place value?

11. What are the factors that influence the selection and implementation of manipulatives for teaching place value?

### **Suggestions and Recommendations**

12. Drawing from your experience, what strategies do you recommend for overcoming the challenges encountered when using manipulatives to teaching place value?

13. What resources do you feel would be beneficial for Grade 4 teachers in Rundu Circuit to improve their use of manipulatives in teaching place value?

14. Are there any professional development opportunities or workshops you believe would improve teachers' proficiency in utilizing manipulatives for teaching place value?

15. In your opinion, how can educational policymakers support Grade 4 teachers in effectively using manipulatives to teach place value?

**We have come to the end of our interview. Thank you very much. Is there anything else you would like to add or talk about?**

## APPENDIX 9: DOCUMENT ANALYSIS GUIDE

### Document Analysis Guide

#### Name of the school

.....

Research topic: Exploring Grade 4 teachers' challenges in using manipulative to teach place value: The case of Rundu Circuit, Kavango East Region

The purpose of this data analysis guide is for analyzing teachers' lesson plans on how they plan place value topic and Grade 4 learners' performance in place value tests, topic tasks, examinations, and books at the sampled schools.

**Table 1: Teachers' lesson plans on place value**

Month	Manipulatives used	Teacher's reflections on place value lesson

**Table 2: Place value test marks for Grade 4**

Number of tests given	Total marks scored in the tests given	Marks in percentage

**Table 3: Place value topic task marks for Grade 4**

Number of topic tasks given	Total marks scored in the topic tasks given	Marks in percentage

**Table 4: May/June examination marks on place value questions for 2024**

<b>Number of questions</b>	<b>Total marks scored on place value questions</b>	<b>Percentage</b>

**APPENDIX 10: RAW DATA: Teachers' lesson plans, manipulatives used, and learners' works**

*The lesson plan for participant 3*

Lesson Preparation

Teacher: \_\_\_\_\_ Grade: \_\_\_\_\_ Date: 6 March 2017 Week: \_\_\_\_\_

THEME AND TOPIC: Whole number: Place value

TEACHING AIDS AND RESOURCES TO BE USED: place value chart

LEARNING OBJECTIVES: Learners will understand the positional notation of the base ten number system

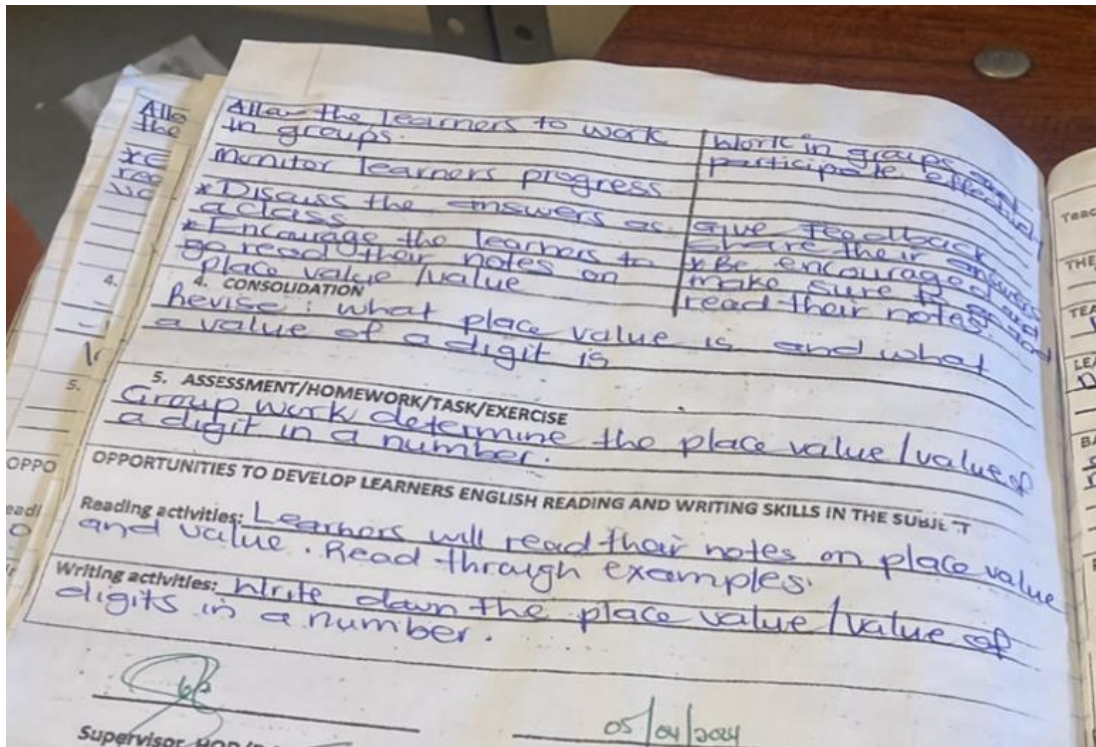
BASIC COMPETENCIES: Learners should be able to recognise the place value and the value of the digit in a four digit number 0-9999

PRESENTATION OF LESSON:

- Monitoring of homework done:
- An appropriate short introduction:  
Write down the numbers on the board  
a) 56 b) 392 c) 7518 d) 3586  
place the place value chart on the board ask  
for volunteers to place each digit for each number  
under the correct place value. Make room for  
feedback and correct the learners;
- Presentation of subject content and learning task:

TEACHER ACTIVITIES	LEARNERS ACTIVITIES
<u>Ask the learners: can you all see the place value chart and say the place value digit on the place value chart?</u>	<u>Look on the place value chart and say the place value for each digit in the number 7582.</u>
<u>Let learners talk at the number 7582.</u>	<u>Discuss the answers and give feedback</u>
<u>Explain to the learners that you can use the place value of a digit to find the value of the digit in a number.</u>	<u>The value for 7 = 7000 5 = 500 8 = 80 2 = 2.</u>

TEACHER ACTIVITIES	LEARNER ACTIVITIES									
<p>3. Presentation of subject content and learning task</p> <p>Problem question: What is the value of each digit in the number 2</p> <p>Correct the learners' feedback.</p>	<p>- Listen attentively to the teacher.</p>									
<p>Explanation: The place value of each digit in the number 2222 is shown on the place value chart drawn on the board.</p> <table border="1" data-bbox="406 546 779 651"> <tr> <td></td> <td>T</td> <td>U</td> </tr> <tr> <td>Th</td> <td>H</td> <td>2</td> </tr> <tr> <td>T</td> <td>5</td> <td>8</td> </tr> </table>		T	U	Th	H	2	T	5	8	<p>* Work out the place value table and understand on how to use the place value table to find the value of each digit.</p>
	T	U								
Th	H	2								
T	5	8								
<p>Explain:</p> <p>- To determine the value of each digit in a number do the following</p> <p>Explain using a place value chart. Draw on the board.</p>	<p>* Take note that to find the value of a digit in a number they have to multiply with 1 if the digit is under the place value of units</p>									
<table border="1" data-bbox="406 819 779 903"> <tr> <td>Th</td> <td>H</td> <td>T</td> <td>U</td> </tr> <tr> <td>1000</td> <td>100</td> <td>10</td> <td>1</td> </tr> </table> <p>* Emphasize that units is the same as ones.</p> <p>* Do few more examples for learners to fully understand on how to determine the place value used in the numbers they used in the previous lesson.</p>	Th	H	T	U	1000	100	10	1	<p>* 10 if the digit is under the place value of Tens</p> <p>* 100 if the digit is under the place value of hundreds</p> <p>* 1000 if the digit is under the place value of thousands</p>	
Th	H	T	U							
1000	100	10	1							
<p>* Write on the board</p> <p>Example a) 4790 b) 145</p> <p>Ask the learners the place value for each digit:</p>	<p>* Take note that units is the same as ones</p> <p>* Go through examples</p> <p>* Look at the numbers a) 4790 and b) 1450 and say the place value for each digit</p>									
<p>* Let the learners try to do letter (a to e) to exercise</p>	<p>* Learners find the value for each digit.</p>									
	<p>Try to do letter c, d, e to find the value of the digits in the numbers</p>									



One of the abacuses made by participant number 3's learners



*The first lesson plan for participant 7*



~~XXXXXXXXXX~~ PRIMARY SCHOOL



Private Bag 2134  
Rundu, Namibia

DEPARTMENT OF MATHEMATICS AND NATURAL SCIENCES

LESSON PREPARATION FORM

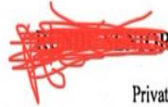
Teacher: <del>XXXXXXXXXX</del>	Grade: 4ESF	Date: 5/03/24
Subject: Mathematics		Time: 40min
Topic: Whole numbers		
Sub-topic: Place value		
Teaching materials and resources to be used: Textbook		
Lesson Objectives: Learners will understand the positional notation of the base ten number system.		
Basic Competencies (Refer to the syllabus): Learners should be able to recognise and write down the missing numbers on the number chart and number line.		
<b>PRESENTATION OF THE LESSON</b>		
1. Monitoring of homework done:		
2. An appropriate short introduction: For every digit in a number, its found on a place that gives it its value.		
3. Presentation of subject matter and learning activities		
<b>Teacher's activities</b>	<b>Learners' activities</b>	
Place value the value of a digit depends on its place value in the number. Example: In H T U 56      3   9   2 392     7   5   1   0 7518	copy down the notes	

<p><b>Class activity</b></p> <p>1. write the number chain on each placard.</p> <p>9   7   4   2   1   0</p> <p>↓   ↓   ↓   ↓   ↓</p> <p>- 4 2 3 4</p>		<p>copy down the questions and answer</p>
<p><b>4. Consolidation</b></p> <p>easy way to identify the place value is to always start on the right from units on words.</p>		
<p><b>5. Assessment/Homework/Tasks/Exercises</b></p> <p>Class activity</p>		
<p><b>English across the curriculum</b></p>		
<p><b>Reading activities</b></p> <p>Read the H place values on the chalkboard.</p>	<p><b>Writing activities</b></p> <p>Write the digits in the appropriate place values.</p>	
<p><b>Compensatory teaching:</b></p>		
<p><b>Reflections</b></p>		

Checked by: H.D.

Date: 11/03/2024

**The second lesson plans for participant 7**



PRIMARY SCHOOL



Private Bag 2134  
Rundu, Namibia

DEPARTMENT OF MATHEMATICS AND NATURAL SCIENCES

LESSON PREPARATION FORM

Teacher: <del>XXXXXXXXXX</del>	Grade: 4ESF	Date: 6-7-2024
Subject: Mathematics		Time: 40 min
Topic: Whole numbers		
Sub-topic: Place value		
Teaching materials and resources to be used: Textbook		
Lesson Objectives: Learners will understand the positional notation of the base-10 number system		
Basic Competencies (Refer to the syllabus): Learners should be able to: recognise and identify the place value and the value of the digit in a four-digit number (0-9 999)		
<b>PRESENTATION OF THE LESSON</b>		
1. Monitoring of homework done:		
2. An appropriate short introduction: use the four place values: Th, H, T, U to indicate the place value of a digit		
3. Presentation of subject matter and learning activities		
<b>Teacher's activities</b>	<b>Learners' activities</b>	
Place value example What's the place value of the 3 in 739 is tens	Come in front and write the answers	
the place value of 2 in 2119 is thousands		

<p>class activity</p> <p>write the place values of the underlined digit</p> <p>a) 8 <u>9</u> 4 → Thousands</p> <p>b) 9 <u>1</u> 6 → Units</p> <p>c) <u>5</u> 5 8 → hundred</p> <p>d) 3 <u>9</u> 2 → hundred</p> <p>e) <u>7</u> 6 1 8 → Thousands</p>		<p>copy down the questions and answer them.</p>
<p>4. Consolidation</p>		
<p>5. Assessment/Homework/Tasks/Exercises</p> <p>class activity</p>		
<p>English across the curriculum</p>		
<p>Reading activities</p> <p>read the place values</p>	<p>Writing activities</p> <p>write the place values of the underlined digit</p>	
<p>Compensatory teaching:</p>		
<p>Reflections</p>		

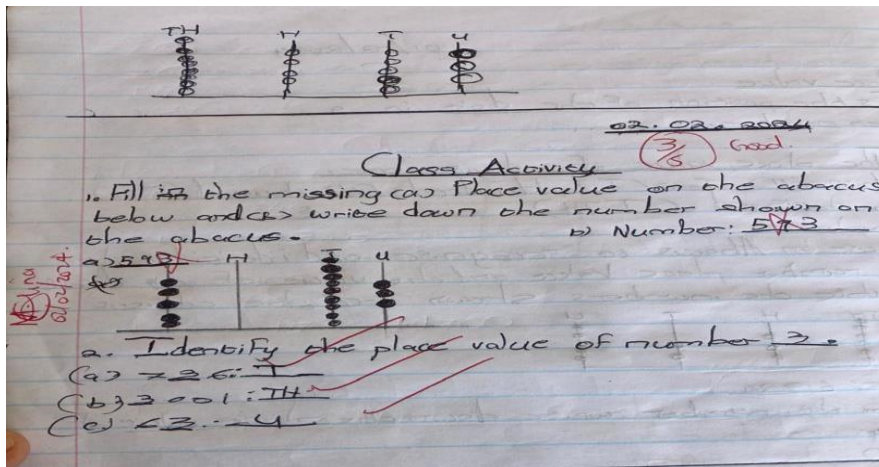
Checked by: HOD

Date: 11/03/2024

**One of the manipulatives used by participant number 8**



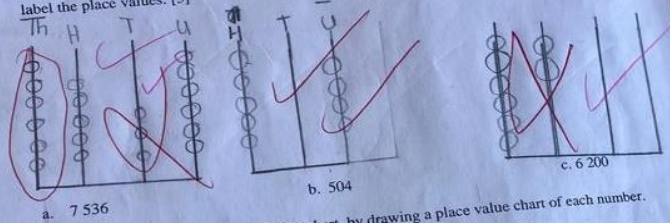
**Samples of learners' works**



160  
2 a 160  
160  
5.9800  
9.

**Questions**

1. Represent the numbers below on an abacus. Your drawing should be in pencil / colour and label the place values. [5]

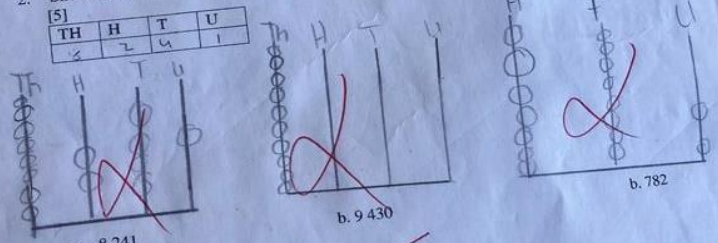


a. 7 536

b. 504

c. 6 200

2. Show these numbers on a place value chart, by drawing a place value chart of each number. [5]



a. 8 241

b. 9 430

b. 782

3. Complete the number chart below. [5]

450	460	470	480	490
500	510	520	530	540
550	560	570	580	590
600	610	620	630	640
650	660	670	680	

1.6 What is the place value of 4 in each number below?

a) 2400 = 400 (1)

b) 4230 = 4000 (1)

[10]

**QUESTION 2**

2.1 What is the value of the underlined digit?

a) 8905 = 900 (1)

2.2 What is the value of 8 in each number below?

a) 2780 = 80 (1)

b) 4810 = 8000 (1)

## APPENDIX: LANGUAGE EDITING DECLARATION LETTER



### IMMA HALLELUJAH TRADING CC

---

P O Box 95335  
Soweto  
Katutura  
Windhoek

4 November 2024

**Declaration of a professional edit of the thesis titled “Exploring Grade 4 Teachers’ Challenges in Using Manipulatives to Teach Place Value: The Case of Rundu Circuit, Kavango East Region”**

I declare that I have edited and proofread this thesis. My involvement was restricted to language usage and spelling, completeness and consistency, referencing style. I did not do structural re-writing of the content.

I am qualified to have done such editing, being in possession of a bachelor’s degree with a major in English, Master of Arts in English Studies and PhD in English Studies and I teach English at the university level.

Yours faithfully

Dr Rauna Mwetulundila

