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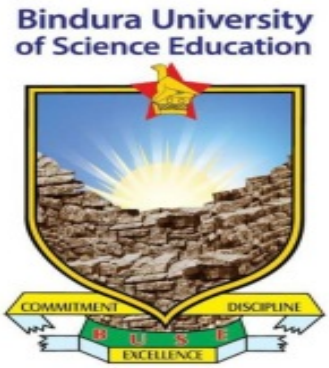

AN INVESTIGATION INTO HOW LANGUAGE AFFECTS TEACHING AND LEARNING OF MATHEMATICS IN SECONDARY SCHOOLS WITH REFERENCE TO MBIZO HIGH SCHOOL IN KWEKWE DISTRICT

BY

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   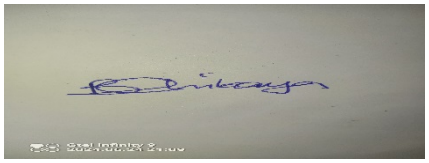

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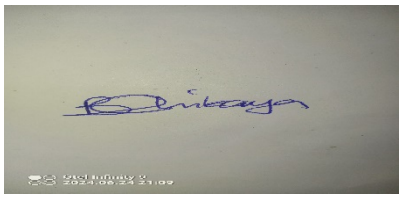

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DEDICATION

This work is dedicated to my beloved husband, Silence Tapfumaneyi, whose patience, understanding, and encouragement have been my pillars of strength. To my three precious daughters, Laura N., Lauren N., and Laurel N. Tapfumaneyi, who have been a constant source of inspiration and motivation. Your love and support have been my greatest motivation throughout this journey.

1.1 Abstract:

The study titled "An Investigation into How Language Affects the Teaching and Learning of Mathematics in Secondary Schools with Reference to Mbizo High School in Kwekwe District" explores the impact of linguistic challenges on students' ability to understand and solve mathematical word problems. The research aims to identify the specific language-related obstacles faced by Form 2 learners and evaluate the effectiveness of various instructional strategies employed by teachers to bridge the language gap.

Through a combination of interviews with 20 Form 2 learners, interviews with teachers M3, M7, and M10, and classroom observations, the study highlights key difficulties such as complex vocabulary, multi-step instructions, and translation of English statements into mathematical equations. The findings reveal that linguistic barriers significantly impede students' comprehension and problem-solving abilities, leading to anxiety and frustration.

The study also identifies effective instructional strategies, including the use of simpler language, visual aids, bilingual instruction, and code-switching, which enhance student engagement and understanding. The research concludes that a multifaceted approach, incorporating diverse instructional methods, is essential to improve the teaching and learning of mathematics in multilingual classrooms.

These findings underscore the need for educational policies that support bilingual education and teacher training programs focused on effective strategies for multilingual instruction, ultimately aiming to enhance learners' mathematical proficiency and academic achievement.

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CHAPTER ONE: INTRODUCTION

1.1 Background of the study

In today's globalized world, English has emerged as a prominent second language in many countries including Zimbabwe (Warren & Miller, 2015). The teaching and learning of mathematics in secondary schools are influenced by various factors and the use of English as a second language can significantly impact this process. According to Warren and Miller. (2015), understanding how the English language affects the teaching and learning of mathematics is crucial for educators and policymakers to develop effective instructional strategies and support mechanisms.

The purpose of this study was to investigate how language affects the teaching and learning of mathematics in secondary school. Magwa. (2015) says that, in Zimbabwean context, English language is used as a language of instruction. Kufakunesu and Chinyoka. (2015) also said that, in Zimbabwean schools, English is dominantly used as the medium of instruction in most academic disciplines like mathematics despite not being the mother tongue for the majority of the learners. There are sixteen indigenous languages which include Shona, Ndebele, Tonga, Kalanga, and others that are not used in Zimbabwe in the teaching and learning of mathematics. Zimbabwean curriculum is used for all learners from those different languages though English language is our second language (Magwa, 2015). The problem will not end as much as we teach local languages but the language of instruction is English.

In Zimbabwe, as in many other countries, the teaching and learning of mathematics often involve the use of word problems. A word problem in mathematics is a few sentences describing a real-life scenario where a problem needs to be solved by way of mathematical calculations. Word problems require students to apply mathematical concepts and procedures to real-life situations, promoting critical thinking and problem-solving skills. However, the successful understanding and solving of word problems in mathematics heavily rely on language proficiency, particularly in English, which is the medium of instruction in Zimbabwean schools.

The significance of English proficiency in mathematics education, particularly in the context of word problem-solving, cannot be overstated. Mathematical word problems require students not only to possess mathematical skills but also to comprehend and interpret the language used in the problems. However, the effectiveness of teaching mathematics in English may be hindered by language barriers, which could impact students' understanding and performance in the subject.

Research suggests that the language used in mathematical tasks influences students' ability to comprehend and solve them (Martínez, 2010). Furthermore, language proficiency is closely associated with academic achievement in mathematics, with students who have higher levels of English proficiency often outperforming their peers with limited English skills (Cummins, 2008). In the Zimbabwean context, where English is the language of instruction, understanding the interplay between language and mathematics is crucial for improving educational outcomes.

However, the challenges posed by language in mathematics education are multifaceted. Apart from linguistic barriers, cultural and socio-economic factors may also contribute to students' difficulties in understanding mathematical concepts presented in English (Gonzalez & Gonzales, 2014). Additionally, teachers may face challenges in effectively integrating language and mathematics instruction in their classrooms, particularly in the context of diverse student populations (Barwell, 2012).

While there exists a body of research on the role of language in mathematics education, studies focusing on the Zimbabwean context are limited. Understanding the dynamics of how English language proficiency influences the teaching and learning of mathematics, specifically in the context of word problems, is crucial for improving educational outcomes in Zimbabwean secondary schools. By addressing this gap in the literature, this study aims to provide insights that can inform educational policies and instructional practices to enhance mathematics education in the country.

1.2 Statement of the problem

Despite the recognized importance of word problems in mathematics education, students in Zimbabwean secondary schools often face challenges in comprehending and solving them effectively. One significant factor contributing to these difficulties is the language barrier, particularly for students whose first language is not English. English language proficiency plays

a crucial role in understanding word problems, as learners need to decipher the mathematical content embedded within the text. Furthermore, Phiri. (2014) says that word problems often involve complex sentence structures, unfamiliar vocabulary, and implicit mathematical relationships, posing additional challenges for students.

According to Mukwevho, Masayile, Nyoni, Bonga and Nyoni. (2018), the teaching of mathematics, specifically word problems, requires an understanding of how language affects learners' learning experiences. However, there is a lack of comprehensive research that investigates the specific ways in which English language proficiency impacts the teaching and learning of mathematics, particularly word problems, in the context of secondary schools in Zimbabwe. Therefore, this study aims to address this gap by conducting an in-depth investigation into the relationship between English language proficiency and the teaching and learning of word problems in mathematics.

1.3 Objectives of the research

- To investigate how the English language affects the understanding of word problems that are written in English.

- To investigate effective instructional strategies that can bridge the language gap and enhance learners' engagement and achievement in mathematics.

1.4 Research questions

- Why do some learners experience difficulty with interpreting certain English statements in a word problem and translating them into mathematical statements?

- What instructional strategies can teachers employ to bridge the language gap and enhance learners' engagement and achievement in mathematics?

1.5 Assumptions

This study on how language affects the teaching and learning of mathematics in secondary schools, specifically at Mbizo High School in Kwekwe district, is based on several key

assumptions. Firstly, it is assumed that students' proficiency in the language of instruction (English) directly impacts their ability to comprehend and solve mathematical word problems. This assumption is grounded in the belief that understanding the language used in problem statements is essential for correctly interpreting and solving them.

Secondly, it is assumed that the curriculum delivery at Mbizo High School is consistent with other secondary schools in Zimbabwe, making the findings potentially generalizable to similar educational contexts. This includes the assumption that the quality of teaching, the resources available, and the instructional strategies employed are representative of the broader educational environment in the region. Thirdly, the study assumes a degree of homogeneity among the learners in terms of their socio-economic backgrounds, language proficiency levels, and prior exposure to English and mathematics instruction. This assumption facilitates the comparison and analysis of data across different student groups.

Another key assumption is that the teachers involved in the study are adequately trained and experienced in teaching mathematics and managing multilingual classrooms. This includes the assumption that they employ a variety of instructional strategies to address linguistic challenges and support student learning. The study also relies on the accuracy and honesty of self-reported data from both students and teachers during interviews. It is assumed that participants provide truthful and reflective responses about their experiences and perceptions related to language use in mathematics instruction.

During classroom observations, it is assumed that the behaviours, interactions, and instructional methods observed are typical and representative of regular classroom practices. This includes the assumption that teachers and students behave naturally and do not alter their actions due to the presence of the observer. Finally, the study assumes that interventions aimed at addressing linguistic challenges, such as code-switching and the use of visual aids, have a measurable impact on students' mathematical comprehension and problem-solving abilities. This assumption underlies the exploration of these strategies as potential solutions to the identified problems.

By articulating these assumptions, the study acknowledges the foundational beliefs that guide its design and interpretation of findings. These assumptions help frame the research context and clarify the scope and limitations of the study.

1.6 Significance of the study

This study is significant for several reasons which the following. Initially, English is often the language of instruction in Zimbabwean schools, but it may not be the first language for many students. Investigating how the English language affects the teaching and learning of mathematics helps identify potential language barriers that students may face, hindering their comprehension and performance in mathematics (Grove, 2017).

In addition to that, Chinomona & Mutambara. (2019) says that, word problems in mathematics often require students to comprehend written language before solving mathematical equations. For students whose English proficiency is limited, this extra cognitive load of understanding the language alongside solving mathematical concepts can impede their learning progress.

Understanding the role of language in mathematics education is crucial for promoting educational equity. learners from non-English-speaking backgrounds may face disparities in their mathematical achievement due to language-related challenges. Addressing these disparities is essential for ensuring equitable access to quality education for all students (Gumbo, 2018).

To add more, the investigation will shed light on the challenges faced by teachers in teaching mathematics to students with limited English language proficiency (Ledibane, Kaiser & Vander Walt, 2018). Understanding these challenges can inform the development of targeted professional development programs and support systems to assist teachers in effectively communicating mathematical ideas.

Furthermore, according to Haag, Heppt, Stanat, Kuhl and Pant. (2013), it will contribute to the existing body of research on mathematics education by specifically focusing on the impact of English language proficiency on the teaching and learning of mathematics in secondary schools. The findings will provide valuable insights for educators, curriculum developers, and policymakers, enabling them to design instructional practices and language support mechanisms that meet the needs of students learning mathematics in an English language context (Barwell, 2020). The researcher suggested possible approaches to employ when teaching word problems.

Finally, the findings of this research will provide insights into how language can be used as a tool to support learners' mathematical reasoning and problem-solving skills. Educators can create inclusive learning environments that promote mathematical understanding and achievement among learners with diverse language backgrounds by identifying effective instructional strategies. (Haag, etal, 2013).

1.7 Delimitations

The study focused on form 2k learners at Mbizo High School to investigate how language affects the teaching and learning of mathematics in secondary schools. The school is located in Kwekwe district in the Midlands province of Zimbabwe. The responsible authority is the government of Zimbabwe under the Ministry of Primary and Secondary Education. It is a former group B school. The project runs from February 2024 to June 2024.

The school offers academic subjects including mathematics which I teach. New General Mathematics Book 2, mathematics Today Book 2, a computer laboratory, and a school library that has mathematics textbooks are some of the resources that are available at the school. The school offers 30 minutes per lesson and 6 periods per week and it has other programs like cultural activities and sporting activities.

1.8 Challenges/ Limitations

Recruiting participants, including both teachers and learners, for the study may be challenging. Access to schools and obtaining permission from education authorities can be bureaucratic and time-consuming (Govero, 2017). Also, the time for the research was very limited as it was carried out within five months only. The researcher during that period had other classes to attend besides the class used for the research, thus limiting the time she had for the research. The researcher was trying to carry out the research during weekends and the April school holiday. She discussed the issue with the participants. This was done to try and deal with the challenge of limited time.

Ensuring that participants have the necessary language proficiency in English and mathematical competence to accurately assess the impact of language on mathematics learning can be difficult. This is especially pertinent in Zimbabwe, where English may not be the first language for many students.

To add more, Govero. (2017) says that Zimbabwean educational settings have unique cultural and contextual factors that influence the teaching and learning of mathematics. Researchers need to navigate these intricacies sensitively to ensure the validity and applicability of their findings.

In addition to that, choosing appropriate data collection methods, such as interviews, surveys, classroom observations, or standardized tests, that capture the nuances of language and mathematics learning can be challenging (Mugweni & Katsaura, 2016). Each method has its limitations and requires careful consideration of ethical and practical issues.

More so, this research focuses specifically on the teaching and learning of word problems in mathematics in secondary schools in Zimbabwe, with a particular emphasis on the impact of English language proficiency. The study will involve learners and mathematics teachers from Mbizo High School, and data will be collected using various research methods, including interviews, observations, and analysis of instructional materials. However, it is important to acknowledge that language is a complex and multidimensional construct, and this study may not encompass all possible aspects of language that influence the teaching and learning of mathematics.

Furthermore, the generalizability of the findings may be limited to the specific context and participants involved in the study. Nonetheless, the insights gained from this research will contribute to our understanding of how English language proficiency affects the teaching and learning of word problems in mathematics and provide a foundation for future investigations in this important area.

Furthermore, the other challenge faced was that of other school programs such as sports training and cultural activities, sometimes done even during weekends which did not allow the researcher to meet the participants as much as she wanted to. The researcher tried and seek permission from the administrators to be excused during the research period.

Lastly, there were financial challenges that the researcher came across during her research as she was self-sponsoring. To try and deal with that challenge, the researcher tried very well to save her income to make this study a success.

1.9 Definition of key terms

Language

According to Halliday & Matthiessen. (2014), language refers to a system of communication that uses symbols, such as words, gestures, or sounds, to convey meaning within a community or among individuals.

Teaching

Teaching involves the facilitation of learning by educators through the transmission of knowledge, skills, and values to students within formal or informal educational settings (Shulman, 1986).

Learning

Bransford, Brown, & Cocking (2000) defines learning as the process through which individuals acquire new knowledge, skills, behaviours, or attitudes, often through experiences, instruction, or reflection.

Mathematics

Mathematics is a field of study concerned with numbers, quantities, structures, patterns, and relationships, and it involves logic, abstraction, and rigorous reasoning (Stewart, 2015).

1.10 Organization of the Study

This research is organized into five chapters. Chapter 1 serves as an introduction, providing an overview of the research topic, the problem statement, research objectives, questions, significance, scope, and limitations of the study. Chapter 2 presents a comprehensive review of the relevant literature, examining existing research and theories on the relationship between English language proficiency and the teaching and learning of mathematics, with a specific focus on word problems. Chapter 3 describes the research methodology, outlining the research design,

participants, data collection procedures, and data analysis methods. Chapter 4 presents the findings of the study, organized according to the research objectives and questions. Chapter 5 concludes the research by summarizing the key findings, discussing their implications, and suggesting recommendations for future research and practice.

1.11 Conclusion

In conclusion, this investigation aims to contribute to the understanding of how English language, as a second language, affects the teaching and learning of mathematics in secondary schools. Ultimately, the findings of this study have the potential to inform instructional practices, curriculum development, and educational policies to enhance learners' mathematical comprehension, engagement, and achievement in an English language learning environment. The next chapter will be the literature review.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This literature review aims to provide a comprehensive overview of existing research and theories on the relationship between English language proficiency and the teaching and learning of mathematics, specifically word problems, in Zimbabwean secondary schools. Word problems are a fundamental component of mathematics education as they require students to apply mathematical concepts to real-life situations, fostering critical thinking and problem-solving skills. However, the successful comprehension and solving of word problems heavily rely on students' English language proficiency, as English is the medium of instruction in Zimbabwean schools. Understanding the impact of English language proficiency on the teaching and learning of mathematics word problems is crucial for developing effective instructional strategies and supporting students' mathematical success.

2.2 Theories guiding the research

Vygotsky's social constructivism, also known as sociocultural theory, is a foundational framework in educational psychology that emphasizes the role of social interaction and cultural context in cognitive development (Darhower, 2013). Below is an overview of key principles within Vygotsky's social constructivism that could support my research on how the English language affects the teaching and learning of mathematics in Zimbabwean secondary schools.

Initially, Vygotsky posited that learning is inherently social and occurs through interactions with others (Vygotsky, 1978). In the context of mathematics education, students engage in collaborative problem-solving activities, discussions, and peer interactions. The use of English as a medium of communication in these social interactions influences how learners construct mathematical understanding. For Zimbabwean learners, who may have varying levels of proficiency in English, the quality and effectiveness of social interactions in the classroom can impact their ability to comprehend mathematical concepts presented in word problems.

To add more, Vygotsky viewed language as a fundamental tool for thought and learning. In the case of mathematics education, language plays a crucial role in how students interpret and represent mathematical concepts, particularly in word problems (Darhower, 2013). Students must understand the linguistic structure and meaning of mathematical language to effectively solve problems. Therefore, the English language proficiency of students in Zimbabwean secondary schools directly influences their ability to comprehend and solve mathematical word problems.

According to Nasir and Hand. (2006) argues that, central to Vygotsky's theory is the concept of the Zone of Proximal Development (ZPD), which refers to the range of tasks that a learner can perform with the assistance of a more knowledgeable individual. In the context of your research, students' ZPD in mathematics is influenced by their English language proficiency. Students with higher English proficiency may have a broader ZPD, enabling them to independently tackle more complex mathematical word problems, while those with lower proficiency may require additional support and scaffolding from teachers or peers to bridge the language gap.

Moreover, Vygotsky emphasized the significance of cultural context in shaping cognitive development (Oliver & Hersovitch, 2009). In Zimbabwean secondary schools, where English is the medium of instruction but may not be the first language for many learners, cultural and linguistic factors influence how learners approach mathematical learning. Differences in language proficiency, cultural background, and educational experiences impact learners' interpretations of mathematical language and concepts, highlighting the importance of considering the cultural context in mathematics education. By grounding my research in Vygotsky's social constructivist framework, I can explore how the English language interacts with social interaction, language development, ZPD, and cultural context to influence the teaching and learning of mathematics, particularly in the context of word problems, in Zimbabwean secondary schools.

Mathematics educators in Zimbabwe are concerned about how poor language skills are preventing learners from learning mathematics effectively. According to Darhower. (2013), the sociocultural theory operates on the assumption that human cognitive development is highly dependent upon the social context within which it takes place. Vygotsky (1978) cited by Darhower, (2013, 251) noted that “development occurs as a result of meaningful verbal

interaction between novices and more knowledgeable interlocutors such as parents, peers, or teachers". Darhower. (2013, 253) suggested that "engaging in collaborative discourse requires a shared communicative context". Outcomes are easier to interpret using sociocultural theory because such a perspective reflects the effect of language and related socioeconomic, cultural, and pedagogical elements that affect the lives of learners and teachers (Darhower, 2013). Research is being carried out to assist understanding the relationship between human communication and mathematics learning (Chitera, Kasoka, & Thomo, 2016). Poor English language skills is likely to damage the performance of mathematics (Weinburgh., Silva, Smith, Groulx, & Nettles 2014). If the language challenges are not removed, the learners' difficulty in word problems will increase (Weinburgh et al., 2014). Vygotsky's sociocultural theory suggests that the acquisition of knowledge or skill occurs with social communication and comprehension is the result of socialization (Florentino, 2014). The purpose of this research study was to investigate the effects of the English language in the teaching and learning of mathematics in secondary schools.

2.3 The role of the English language in the teaching and learning of mathematics.

Initially, Pimm. (2019) says that, the role English language in the teaching and learning of mathematics is for clarity and precision. Mathematics relies on precise language to convey ideas and concepts accurately. Lee. (2005) added that English provides a structured and well-defined framework for expressing mathematical concepts, definitions, and theorems. The use of English helps ensures clarity and precision in mathematical communication, minimizing ambiguity and misinterpretation (Aluko, 2006).

Furthermore, English is essential in problem-solving tasks (Marungudzi, 2009). Learners need to read and understand word problems, translate them into mathematical expressions or equations and then solve them (Marungudzi, 2009). Proficiency in English allows learners to grasp the problem requirements, identify relevant information and apply mathematical strategies effectively.

To add more, Machisi, (2023) says that, English proficiency is crucial for learners to communicate their mathematical thinking and reasoning through writing. They may be required

to write mathematical explanations, proofs or essays (Weinburgh etal, 2014). Shuler, (2017) added that, writing in English enables students to articulate their ideas coherently, organize their thoughts, and present mathematical arguments effectively.

In addition to that, according to Csikos and Szitanyi. (2020), English proficiency in mathematics opens up opportunities for learners to participate in international math competitions, conferences and seminars. It allows them to connect with mathematicians and researchers from around the world, exchange ideas and contribute to the global mathematical community (Mulwa, 2014).

Moreover, Whitby. (2009) says that, many mathematics textbooks, references and online resources are written in English. Proficiency in English allows students to access a wide range of educational materials including textbooks, workbooks, research papers and online courses (Montague, 2008). It provides them with opportunities to explore various mathematical topics and deepen their understanding.

Also, in many educational systems, standardized tests in mathematics are administered in English (Lee, 2005). Similarly, in Zimbabwe, the examination board, ZIMSEC administered the tests in English which is required by the curriculum. Leh and Jitendra. (2013) also added that, learners need to have a solid command of English to comprehend the test questions, solve problems and demonstrate their mathematical skills and knowledge effectively.

2.4 The effects of English language in the teaching and learning of mathematics.

One of the biggest effect of English language in the teaching and learning of mathematics is that, some students struggle with word problems because they involve reading (Mareva, 2016). Students have to be able to fully comprehend what is happening in the problem to figure out how to solve it. Therefore, a lack of reading comprehension can play a huge part in a learner's ability to solve word problems.

To add more, Montague. (2008) says that, students often do not actually stop to read the problem but, instead pull out the numbers and use a random operation. This problem often occurs because of the way maths textbooks are often designed. Montague. (2008) says that, if the teacher is teaching a lesson on subtraction, students can assume that the word problems that follow are

going to involve subtraction. This has unintentionally trained our students that they do not need to read the problem but they just need to know the numbers. This presents an issue on tests that cover a variety of concepts.

Moreover, another effect of the English language in word problems is that, many curriculum and exam writers use tricky language, designed to trip students up (Aluko, 2006). However, the reality is, that is the way it is. Even if the students have great reading comprehension and fully understand how to solve problems, they may still get misled by the wording of the problem and solve incorrectly (Marungudzi, 2009).

Mulwa. (2014) talked about a lot of classroom jargon with regard to the English language. The author said that language barriers could cause learners to perform badly. This is the other reason learners experience difficulty in word problems. In addition to that, Mulwa (2014) argued that there was a lot of classroom jargon concerning the English language used in word problems. Among other phrases that he regarded as meaningless were, sharing by and dividing into. Shuler (2017) added other phrases such as divided into, divided by, and shared between. According to Shuler, the correct interpretation of the division symbol (÷) is divided by whilst sharing between is only applicable to the division of whole numbers. Therefore, sharing in decimal numbers is meaningless. Shuler, (2017) stated that meaningless phrases such as sharing by and dividing effect learning to a larger extent since many learners just use these phrases anyhow. Learners learn that there is not necessarily any connection between words and ideas. Most, if not all teachers, initially use the notion of sharing items between children when introducing the idea of division (Jitendra, 2002).

In addition to that, Aluko. (2006) suggested that learners who live in poverty and who belong to linguistic and ethnic minority groups have difficulty in solving mathematical problems. Moyo. (2023) noted that in consideration of the linguistics of secondary school learners, mathematics teachers should incorporate teaching techniques to create a teaching and learning environment that is conducive to their learning styles, thereby promoting math proficiency. Whitby. (2009) suggested that teachers need to dismiss the misconception that mathematics is a universal language and instead promote policies that will contribute to greater achievements in mathematics for all learners.

2.5 Dealing with the challenge of the English language in the teaching and learning of mathematics.

The research of Carey and Jacobson (2020) cited by Csíkos and Szitányi. (2020) says that, if you notice that, the student is struggling with word problems because of their reading comprehension, then focus on helping them to better understand what is happening in the problem. The best way to do this will vary from learner to learner. The author suggested that the teacher must ask lots of questions while reading the problem to keep the students focused.

According to Csíkos and Szitányi. (2020), there are two things that can be done to help learners in the situation of tests which covers variety of concepts. Firstly, learners need to be in the habit of solving a variety of different types of word problems daily. Machisi. (2023) says that, teachers need to expose learners to word problems regularly but not that all use the same operation to solve. Lee, (2005) also added that, if the curriculum does not accommodate that, the teacher must add in a few practice problems each day to help diversify the types of problems the learners are exposed to. Secondly, the teacher can use numberless word problems that is to remove numbers from the problem so that learners are firstly forced to pay attention to what is happening, discuss the problem without numbers and then when learners are ready, add the numbers back in the problem (Csíkos & Szitányi, 2020). This will get learners into the habit of reading the problem.

Another way of solving the difficulty of word problems is that the teacher must recognize and value learners' diverse languages and cultural backgrounds. Incorporate learners' native languages and cultural references into mathematics instruction to create a more inclusive learning environment. (Eden & Potter, 2008).

Eden and Potter, (2008) added that the teacher needs to differentiate instruction to meet the diverse needs of learners with varying levels of English proficiency. Provide additional support such as modified texts and visuals to scaffold learning for learners with limited English language skills. Fuchs, Seethaler, Powell, Hamlett, and Fletcher. (2008) says that there is a need to offer professional development opportunities for teachers to enhance their understanding of language acquisition and effective strategies for supporting English language learners in mathematics

classrooms. This can include workshops, courses, and collaborative learning communities such as clusters that the Zimbabwean curriculum emphasises.

The teacher must emphasise the importance of mathematical vocabulary and provide explicit instruction on key terms to learners. Also the use of visual aids, real-world examples, and hands-on activities to reinforce vocabulary acquisition (Mareva, 2016).

Griffin and Jitendra. (2009) research on the concept that, teachers must embed mathematics instruction within meaningful contexts that relate to learners' lives and experiences. This helps learners make connections between mathematical concepts and real-world situations, enhancing comprehension and engagement.

Also, teachers to use collaborative learning opportunities where learners can work together to solve problems and explain their reasoning. This provides opportunities for language practice, peer support, and the development of mathematical communication skills. (Leh & Jitendra, 2013).

Another strategy for solving the difficulty of word problems is using multiple examples (Gonsalves & Krawec, 2014). That is using a range and sequence of examples in teaching procedures of word problems. Mathematics research has established the value of using multiple examples when teaching concepts to learners to better establish their generalization and discrimination abilities of learners (Mareva, 2016).

Furthermore, it has been established that one of the main problem-solving components in mathematics is representing the problem (Stylianou & Silver,2004). As a result, word problem instructional procedures that teach the use of visual representations have been researched and proven effective by Edens & Potter, (2008). Visual representations allow learners to organize problem information and move forward in the problem-solving process (Mareva, 2016). The author added that effectively using graphic representations in solving math word problems involves more than just the use of diagrams. As supported by the studies below, visualizations used in solving mathematical word problems need to represent connections between the problem parts to effectively link the various phases of the problem-solving process (Gonsalves & Krawec, 2014).

In conclusion, mastering mathematics word problems is a journey of small steps. Teachers encourage learners to practice regularly, stay curious, and learn from their mistakes. These strategies for solving mathematics word problems are stepping stones to turning challenges into achievements. Teachers need to keep it simple and watch learners grow their confidence and skills.

CHAPTER THREE: RESEACH METHODOLOGY

3.1 Introduction

In this chapter, a detailed explanation of the research design and methodology used to generate data is discussed. The study was underpinned by the interpretivist paradigm and the qualitative approach was employed. The details of how sampling was done and the contexts under which the study was conducted are discussed. I was aware that in qualitative research, human behaviour is described to be bound by context. Hence, the chapter clearly describes where the research takes place (Aluko, 2006). The research tools used to generate data were observation and interviews for both teachers and learners.

3.2 Research design and approach

In Zimbabwean secondary schools, the dynamics of mathematics education, particularly in the realm of word problem learning, are influenced by learners' proficiency in English. In this study, a mixed methods approach was employed. This mixed-methods research aims to delve into the relationship between English language proficiency and the comprehension and solving of mathematics word problems, within the framework of social constructivism theory. According to Creswell and Creswell. (2017), this approach, known as a mixed method allows researchers to gather both quantitative data, typically through observations, and qualitative data, often through interviews.

In the context of investigating the impact of the English language on the teaching and learning of mathematics in Zimbabwean secondary schools, a mixed-methods design could provide a comprehensive understanding of the phenomenon. According to Creswell and Creswell (2017), This research is both qualitative and quantitative because it involves numbers, thus mixed-methods research.

Aluko. (2006) defined qualitative research as a kind of research that produces findings not arrived at using statistical procedures or other means of quantification. Moreover, this research was interpretive since the researcher tried to interpret the nature of the cause for learners experiencing difficulties with the English language when dealing with word problems. The use of interviews qualified this research to be qualitative. According to Aluko. (2006), when a small

sample is used and when the research is interpretive and naturalistic, the approach is said to be qualitative.

To add more, qualitative research is descriptive. That is, the collected data takes up the form of words or pictures other than numbers (Kucirkova, 2013). In this study, I have mostly used words when analysing data. Since the qualitative study is descriptive, it could reveal the nature of the difficulties learners encounter in learning word problems, as stated by Creswell. (2014), qualitative research is a great tool for discovering and interpreting existing problems. To add more, qualitative research has a concern with process. According to Creswell. (2014), qualitative researchers look closely at the process rather than simply the outcomes or products. In this research, the researcher was concerned with how learners perceive word problems and what was it with the English language that makes them poorly perform in this aspect. Also, this research sought to find out from learners as well as teachers how the learners could be assisted. Also, the qualitative research is inductive. This study tried to establish what the teachers thought about their methodologies of teaching word problems and what the learners thought about how they learnt and worked with word problems.

According to Creswell. (2014), a quantitative approach is a research method that focuses on collecting and analysing numerical data to answer research questions and test hypotheses. In quantitative research, researchers seek to quantify variables and examine their relationships through statistical analyses. This approach is characterized by its emphasis on objectivity, measurement, and generalizability. Quantitative research aims to give answers to questions like who, what, when, where, and how many. The use of observations qualified this research to be a quantitative since they involve systematic observation and recording of behaviours and events.

Qualitative data collection through interviews allows researchers to gain rich insights into participants' experiences, perceptions, and attitudes, which are essential components of social constructivism theory. According to social constructivism, learning is a social process shaped by interactions with others and the environment (Vygotsky, 1978). Interviews provide a platform for participants to articulate their understanding of how language influences mathematics learning in Zimbabwean secondary schools. Through semi-structured interviews, researchers can explore participants' perspectives on the role of English language proficiency in understanding and

solving mathematics word problems, as well as the socio-cultural factors that may impact learning experiences.

In addition to that, interview questions can be designed to probe into participants' experiences with language barriers, their strategies for overcoming linguistic challenges in mathematics, and their perceptions of the relationship between language and mathematical understanding. For instance, questions may inquire about learners' experiences of using the English language in mathematics classrooms and teachers' strategies for supporting students with language difficulties.

Observations in the classroom setting provide researchers with valuable insights into the dynamics of language use, instructional practices, and learner interactions during mathematics word problem-solving activities. Social constructivism emphasizes the importance of social interactions and the role of the environment in shaping learning experiences (Vygotsky, 1978). By observing classroom interactions, researchers can document how language is utilized as a tool for sense-making and problem-solving in mathematics, as well as how teachers scaffold learners' learning through language-rich instructional strategies.

To add more, during classroom observations, researchers can focus on documenting instances of language use, such as teacher-learner dialogue, peer interactions, and learners' verbalisations during problem-solving. Additionally, researchers can observe instructional strategies employed by teachers to support learners with varying levels of English language proficiency, such as providing visual aids, using contextualized examples, and encouraging collaborative learning activities.

More so, both qualitative interviews and quantitative observations are aligned with social constructivism theory, which emphasizes the socio-cultural context of learning and the role of language in mediating cognitive development (Vygotsky, 1978). Interviews allow researchers to explore participants' subjective experiences within their socio-cultural contexts, shedding light on the social interactions and language practices that influence mathematics learning. On the other hand, observations provide researchers with concrete evidence of how language is used in the classroom environment to support mathematical understanding, thereby illustrating the social and contextual nature of learning.

In conclusion, by combining quantitative and qualitative approaches, researchers can triangulate their findings, enhancing the validity and comprehensiveness of the study. This mixed-methods approach allows for a more nuanced exploration of the complex interactions between language, pedagogy, and mathematical learning in secondary school settings.

3.3 Population

Kwekwe district consists of one hundred and fifty-two primary schools and sixty-one secondary schools which gives a total of two hundred and thirteen schools. Mbizo High is among those schools and it has a population of around three thousand one hundred learners. The school has ten classes per stream and each class has around sixty-five learners from form one to form four. For the lower six and upper six, there are around five hundred. For the form two used by the researcher, each class consists of sixty-five learners which sum up to six hundred and fifty learners in the form two-stream. There are one hundred and one teachers at Mbizo High School and among those teachers, there are ten teachers in the mathematics department.

3.4 Sampling

The sampling technique employed in this research study was stratified random sampling for school selection and random sampling for participant selection. The researcher utilized a systematic and transparent approach to ensure fairness and representativeness in the selection process (Babbie, 2016).

For school selection, the researcher divided the population of sixty-one secondary schools in Kwekwe District into strata based on rural and urban categories. Within each stratum, one-third of the schools were randomly selected to ensure representation from both categories. Mbizo High School was then randomly selected from the urban schools' stratum using the yes/no papers method, contributing to the validity and generalizability of the research findings (Creswell & Creswell, 2017).

Regarding participant selection, form two students were chosen as the target population using random sampling. The researcher requested form prefects to pick yes/no papers from a hat, with only one yes paper representing the selection of form two. Similarly, the form two class monitor

picked the yes/no papers, leading to the selection of form two K class. From this class, twenty students were randomly selected using the same method to avoid bias (Aluko, 2006).

Furthermore, thirty percent of mathematics teachers and sixty-five form two K learners were sampled for the study. The researcher used a random sampling technique to select three mathematics teachers and twenty learners. A random number generator in Excel was employed to generate three random numbers between M1 and M10 to identify the teachers corresponding to the randomly generated numbers, ensuring an unbiased selection process (Halkos & Kevork, 2016).

3.5 Research instruments

3.5.1 Interviews

Interviews allow the researcher to directly engage with participants, including learners, and teachers to explore their perspectives, experiences, and insights regarding the impact of the English language on mathematics learning (Seidman, 2013). The researchers inquired about participants' experiences with language barriers, strategies for overcoming linguistic challenges, and perceptions of the relationship between language proficiency and mathematical understanding. Through open-ended questions and probing techniques, the researcher uncovers nuanced insights and rich narratives that may not be captured through other data collection methods (Kvale & Brinkmann, 2009). They offer flexibility in data collection, allowing the researcher to adapt her questioning strategies and follow participants' leads to explore emergent themes and ideas. The researcher tailors interview protocols to suit the needs and preferences of different participant groups, ensuring that the data collected are relevant and meaningful to the research objectives.

According to Seidman. (2009), one of the advantages of interviews is that interviews yield rich, qualitative data that provide detailed insights into participants' perspectives, experiences, and attitudes. By engaging in dialogue with participants, researchers can capture nuanced understandings and context-specific information that may not be quantifiable through other methods.

In addition to the advantages, interviews allow the researcher to establish a personal connection with participants, fostering rapport and trust (Kvale & Brinkmann, 2009). This rapport can

encourage participants to share openly and honestly about their experiences, enhancing the quality and depth of the data collected. Also, interviews offer flexibility in probing participants' responses, enabling the researcher to delve deeper into specific topics or seek clarification when needed (Seidman, 2013). Probing allows the researcher to uncover underlying motivations, beliefs, and attitudes that may not be evident from initial responses.

However, conducting interviews can be time-consuming, particularly when working with large or diverse participant groups (Seidman, 2013). Scheduling interviews, conducting them, and transcribing and analysing the data require substantial time and resources.

To add more, interviews are inherently subjective, as they rely on participants' interpretations and perceptions of their experiences (Kvale & Brinkmann, 2009). The researcher's biases and preconceptions may also influence the framing of questions and interpretation of responses, potentially introducing bias into the data. Also, the findings from interviews may be context-specific and may not be generalizable to broader populations or settings (Seidman, 2013). While interviews provide rich insights into participants' experiences, they represent the perspectives of a select group and may not capture the full diversity of viewpoints within a population.

3.5.2 Observation

In this research, the researcher also used observations. Observations provide the researcher with the opportunity to directly observe classroom interactions, instructional practices, and learner behaviours during mathematics instruction. The researcher can document how language is used by teachers and students during word problem-solving activities, as well as the effectiveness of different instructional strategies in supporting language and mathematics learning.

In addition to that, observations allow researchers to capture contextual factors that may influence the teaching and learning of mathematics, such as classroom environment, resources available, and teacher-learner interactions. By observing the socio-cultural context of mathematics instruction, researchers can gain insights into how language is integrated into instructional practices and how it impacts students' engagement and understanding. Also, observations can complement other data collection methods, such as interviews and surveys, by providing corroborating evidence and insights into observed behaviours and practices.

Triangulating data from multiple sources enhances the validity and reliability of the findings, as researchers can cross-validate their observations with participants' self-reported experiences and perceptions.

According to Reinhard. (2021), one of the advantages of using observation as an instrument to collect data was that the researcher had a better understanding of why a learner would act in a particular way and the researcher identified other important issues that might have been overlooked.

To add more, Observations yield naturalistic data that reflect real-life classroom interactions and practices (Merriam, 2009). By observing events as they naturally unfold, researchers can capture authentic behaviours and responses without the influence of self-report biases or social desirability.

More so, observations can be conducted in a non-intrusive manner, minimizing the potential for researcher bias or participant reactivity. The researcher can observe classroom activities without directly intervening or disrupting the instructional process, thereby preserving the naturalness of the learning environment. Also, observations allow researchers to objectively document behaviours, interactions, and events, providing concrete evidence that can be analysed and interpreted systematically (Merriam, 2009). By recording observations in a structured and consistent manner, the researcher can ensure the reliability and validity of the data collected.

However, the researcher faced the challenge of learners changing their behaviour when being observed by the teacher. It was difficult to tell which things were important to note. Also, sometimes the researcher was a participant observer, and it was difficult to cope with taking notes while being involved in a class activity (Aluko, 2006). More so, interpreting observational data can be challenging, as the researcher must make sense of complex interactions and behaviours within the context of the study (Merriam, 2009). Identifying relevant patterns, themes, and insights from observational data requires careful analysis and interpretation, which may be subject to researcher interpretation and bias.

Furthermore, despite efforts to remain objective, observer bias may still influence the interpretation and recording of observations (Merriam, 2009). The researcher's preconceptions

and subjective judgments may unconsciously shape their observations, potentially leading to inaccuracies or misinterpretations of the data.

3.6 Data collection procedure

3.6.1 Interview

The researcher developed semi-structured interview guides for learners and teachers, focusing on the impact of English language proficiency on mathematics learning, particularly word problems. She includes questions that explore participants' experiences, perceptions, and strategies related to language barriers in mathematics education. She also tailors interview questions to the specific roles and experiences of learners and teachers, ensuring relevance and depth of inquiry.

For learners, the researcher Schedules group interviews with the selected learners, ensuring privacy and confidentiality. She used the interview guide to explore learners' experiences, perceptions, and attitudes toward the role of the English language in mathematics learning. For the teachers, the researcher schedules individual interviews with the selected mathematics teachers, allowing sufficient time for in-depth discussions. She also used the interview guide to explore teachers' perspectives on the challenges and opportunities associated with language in mathematics instruction.

3.6.2 Observations

The researcher observed three mathematics teachers teaching word problems. The researcher observed teachers' instructional strategies, language use, and interactions with students during word problem-solving tasks. She also documents learners' engagement, language proficiency, and problem-solving approaches during the observed lessons. The researcher noted non-verbal behaviour through observation. The researcher also observed how learners participated. The researcher used the observation guide to carry out observations.

3.7 Data analysis

The data collected in this study will undergo both qualitative and quantitative analysis to provide a comprehensive understanding of the impact of the English language on the learning of word

problems by secondary school learners. The qualitative data gathered from interviews and observations will be analysed thematically. Thematic analysis involves identifying patterns, themes, and meanings within the data (Braun & Clarke, 2006). The interviews will be transcribed verbatim, and codes will be applied to data segments. These codes will then be organized into overarching themes, allowing for the interpretation of participants' perspectives on the research topic.

Quantitative data collected from observations will be analysed using descriptive and inferential statistics. Descriptive statistics, such as frequencies and percentages, will be used to summarize the characteristics of the sample. Inferential statistics, such as correlations and regression analysis, will be employed to examine relationships between variables and test hypotheses.

Additionally, mixed-methods analysis techniques will be used to integrate the qualitative and quantitative findings. Triangulation, a methodological approach that involves comparing and contrasting different sources of data, will be employed to validate the research findings and enhance the overall robustness of the study (Creswell & Creswell, 2017).

3.8 Validity and reliability

To ensure the validity of the study, several measures will be taken. Firstly, the use of mixed methods will enhance the validity of the findings by providing a comprehensive understanding of the research topic from multiple perspectives (Johnson & Onwuegbuzie, 2004). Triangulation of data sources, such as interviews and observations will further validate the results by corroborating findings across different methods.

Moreover, the researcher will employ member checking, whereby participants will be allowed to review and verify the accuracy of their responses, thus enhancing the credibility and trustworthiness of the data (Creswell & Creswell, 2017). Peer review and reflexivity will also be utilized to minimize researcher bias and ensure the objectivity of the findings.

Reliability will be ensured through the use of standardized data collection tools, clear operational definitions of variables, and consistent data analysis procedures (Golafshani, 2003). Inter-ratter reliability will be assessed for qualitative data analysis by having independent researchers code a subset of the data and compare the results for agreement.

3.9 Ethical issues

Ethical considerations are paramount in conducting research involving human participants. In this study, informed consent will be obtained from all participants, including students, teachers, and school administrators, before data collection. Participants will be informed of the purpose of the study, their voluntary participation, and their right to withdraw at any time without consequences.

Confidentiality and anonymity will be maintained throughout the research process. All data collected will be stored securely and accessible only to the research team. Participants' identities will be protected through the use of aliases and the removal of identifying information from transcripts and reports.

Furthermore, the researcher will adhere to ethical guidelines and regulations set forth by relevant institutional review boards and ethical committees. Any potential risks or discomfort to participants will be minimized, and appropriate measures will be taken to ensure their well-being throughout the research process.

3.10 Conclusion

In this research, the researcher used three instruments to collect data which were interviews and observations. A small sample of ten learners and three teachers was used in this research and the researcher used the sampling technique which avoids bias. By following this data collection procedure, the researcher gathered valuable insights into how English language proficiency influences the teaching and learning of mathematics word problems in Zimbabwean secondary schools, while also respecting the rights and privacy of participants.

CHAPTER FOUR: DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

This section presents the findings from interviews conducted with Form 2 learners at Mbizo High School in Zimbabwe, interviews with teachers M3, M7, and M10, and classroom observations in three different Form 2 classes taught by these teachers. The aim was to understand learners' experiences with interpreting and translating word problems in mathematics, their perspectives on instructional strategies, and the effectiveness of these strategies in the classroom. The learners provided diverse perspectives. The teachers were experienced in dealing with linguistic challenges in their classrooms. Classroom observations were conducted to capture real-time interactions and instructional techniques.

4.2 CHARACTERISTICS OF PARTICIPANTS

In this section demographic characteristics of teachers and learners on the tables below are analysed and discussed.

Table 4.1 Demographic characteristics of selected 3 teachers

Sex	Female	2	66.7%
	Male	1	33.3%
Professional Qualification(s)	Certificate in Education	0	0%
	Diploma in Education	2	66.7%
	Degree in Education	1	33.3%
Teaching Experiences (Years)	1 - 5	0	0%
	6 – 10	1	33.3%
	11 – 15	1	33.3%
	16 - 20	1	33.3%

Table 4.1 presents the distribution of participants (teachers) according to sex, professional qualification and teaching experience. There were both male and female teachers but female

teachers were more than male teachers. The researcher noted that qualifications of participants ranged from diploma in education to degree in education and teaching experience ranged from 6 – 20 years. Almost 66.7% of participants have been in the teaching fraternity with experience ranging from 11 years to 20 years. This clearly indicate that through experience they have gained enough knowledge, skills and attitudes to enable them to deal with word problems.

Table 4.2 Demographic characteristics of selected 20 learners

Sex	Female	10	50%
	Male	10	50%
Age Range(years)	13 – 14	12	60%
	15 - 16	8	40%
Level of education	Form 2	20	100%

Table 4.2 clearly shows that participants (learners) were equally distributed according to sex and this avoid bias. Also, according to age range, 60% participants were from 13 years to 14 years and 40% were from the range of 15 years to 16 years. The table shows clearly that all participants were form 2s

4.3 DATA PRESENTATION AND ANALYSIS

4.3.1 Challenges with Interpreting and Translating Word Problems

4.3.1.1 Difficulty in Solving Word Problems

Understanding and solving word problems in mathematics is a common challenge among students. This theme explores the specific difficulties learners face, as observed by teachers, and corroborated by classroom observations.

Learner 1 mentioned, *"I find solving word problems really difficult. I often don't understand what the problem is asking and which parts are important to focus on."*

Learner 3 added, *"When I read a word problem, I get confused by the way it's written. It's hard to figure out what to do first."*

Learner 4 said, *"I always need to read the problem several times before I can even start thinking about the solution."*

Learner 6 commented, *"I get stuck on the first step because the words are confusing."*

Teacher M3 noted, *"Students often struggle to understand what the word problems are asking. They get confused by the language and have trouble identifying the important information."*

Teacher M7 stated, *"Students usually struggle with understanding the context of word problems and often need a lot of help to get started."*

Teacher M10 observed, *"My students often display anxiety and hesitation when faced with word problems. They frequently need multiple prompts to begin."*

In classroom observations, students often exhibited body language indicating confusion or frustration. For instance, in Teacher M3's class, students often had puzzled looks, furrowed brows, and hesitant body language. In Teacher M7's class, several students appeared fidgety and unsure, hesitating before starting problems. Teacher M10 observed students displaying signs of anxiety, such as biting nails or tapping pencils.

These responses and observations highlight a common struggle among students to comprehend the requirements of word problems and identify key information. Understanding word problems is a common challenge, causing confusion and hesitation among learners. Both students and teachers noted that complex language and unfamiliar terminology are significant barriers. Classroom observations confirmed these difficulties, with many students showing signs of confusion and frustration.

Boonen et al. (2014) found that difficulties in understanding word problems often stem from students' inability to grasp the context and the mathematical relationships within the problem, aligning with the learners' experiences. Pimm (1987) highlighted that the language of mathematics itself can be a barrier, and Moschkovich (2002) emphasized that linguistic challenges can lead to misinterpretation and errors in problem-solving. Murungudzi (2009) also discussed the impact of language on mathematical problem-solving, stressing the need for clear

and accessible language in instructional materials. Additionally, Aluko (2006) found that students' comprehension significantly improves when language barriers are minimized.

4.3.1.2 Causes of Difficulty

The complexity of the language used in word problems was identified as a major barrier by both learners and teachers. This theme discusses these linguistic challenges and their impact on students' performance.

Learner 2 explained, *"The main reason I struggle is because of the difficult words. Sometimes the sentences are too long and complicated."*

Learner 5 said, *"I think the biggest problem is that English isn't my first language. I don't always understand the words they use in the problems."*

Learner 7 commented, *"Even when I know the math, the way the problem is written makes it hard to understand."*

Teacher M3 noted, *"The main reasons are the complex vocabulary and sentence structures. Many students are not familiar with some of the words used, which makes it hard for them to follow."*

Teacher M7 added, *"The difficulty comes from both the language used and the complexity of the problems. Many students lack the vocabulary and struggle with long, detailed instructions."*

Teacher M10 stated, *"The primary issues are the difficult vocabulary and the complex sentence structures. Many students are not familiar with the terms used, which makes it hard for them to understand."*

In classroom observations, students frequently sought clarification on specific terms and instructions. In Teacher M3's class, students often asked questions like, *"What does this word mean?"* and *"Can you explain this part again?"* Similar questions were observed in Teacher M7's class, such as, *"Is this like what we did last time?"* and *"Can you show an example?"* Teacher M10's class also had students asking, *"What's the difference between these two terms?"* and *"I don’t understand this part; can you help?"*

These comments underscore the impact of linguistic challenges on students' ability to solve word problems, particularly for those for whom English is not the first language. The complexity of language in word problems, including difficult vocabulary and long sentences, poses significant barriers. Students often struggle to understand terms and instructions, leading to confusion and errors. Teachers observed that unfamiliar terminology and complex sentence structures are common issues.

Abedi and Lord (2001) noted that linguistic complexity in word problems can hinder students' ability to decode and process the information, leading to difficulties in solving them. Cummins (2000) emphasized that cognitive academic language proficiency is crucial for understanding and solving complex problems in a second language. Cocking and Mestre (1988) pointed out that students often struggle with the dual demands of understanding mathematical concepts and the language used to express them. Pimm (2019) also highlighted that linguistic challenges are a significant barrier in mathematics education, particularly for students learning in a second language. Jitendra and Alghamdi (2020) emphasized the importance of language proficiency in mathematical problem-solving.

4.2.3 Problematic Vocabulary and Instructions

Specific vocabulary and multi-step instructions pose significant challenges for learners, often leading to misunderstanding or misinterpretation of the problems. Teachers also observed these issues in their classrooms.

Learner 8 mentioned, *"I often have trouble with words like 'consecutive,' 'total,' and 'difference.' They aren't words I use every day."*

Learner 10 noted, *"Multi-step instructions are really hard. I get lost halfway through trying to follow what the problem is saying."*

Learner 12 said, *"The instructions are sometimes too complicated, and I get confused about what to do first."*

Teacher M3 noted, *"Words like 'consecutive' or 'difference' are not commonly used in their daily lives, so they find these terms difficult to grasp."*

Teacher M7 observed, *"Terms like 'ratio' and 'proportion' are confusing for many students, and they often misinterpret the questions."*

Teacher M10 highlighted, *"Words like 'product' and 'difference' are difficult for many students, and they struggle with how the problems are phrased."*

In classroom observations, students frequently misunderstood specific terms and instructions. In Teacher M3's class, students frequently misunderstood terms like *"consecutive," "total,"* and *"difference."* In Teacher M7's class, students struggled with terms like *"ratio"* and *"proportion."* Teacher M10 noted that students had difficulty with terms like *"product"* and *"quotient."*

These examples illustrate the specific language-related obstacles that hinder students' understanding of word problems. Specific terms and multi-step instructions often confuse students, leading to misunderstandings and errors. Teachers noted that unfamiliar mathematical vocabulary and complex instructions are significant barriers to comprehension.

Martiniello (2008) supports this, stating that unfamiliar vocabulary in math word problems can create significant barriers for students, especially for English language learners. Clarkson (2007) emphasized that the language barrier can lead to a fundamental misunderstanding of mathematical concepts. Halliday (1978) noted that language and learning are deeply interconnected, and difficulties in language can significantly impact learning outcomes. Lee (2005) found that vocabulary knowledge is crucial for solving word problems, as it helps students understand the mathematical relationships involved. Csikos and Szitanyi (2020) also highlighted that multi-step instructions pose significant challenges, requiring clear and accessible language.

4.3.1.4 Confidence in Translating Statements

Learners generally expressed a lack of confidence in translating English statements into mathematical equations, often misunderstanding key terms and making errors in the process. Teachers also noted frequent errors in this area.

Learner 11 said, *"I'm not very confident. I usually end up misunderstanding key terms and get the equation wrong."*

Learner 13 added, *"I try to rewrite the problems in my own words, but sometimes I miss important details and that affects my answers."*

Learner 15 noted, *"When I try to translate the problem, I often make mistakes because I don't understand some of the words."*

Teacher M3 mentioned, *"Students generally struggle with translating English statements into mathematical equations. They often misinterpret key terms or miss out on crucial information, leading to incorrect equations."*

Teacher M7 noted, *"Only a few students can correctly translate word problems into equations on their first try. They often make errors in understanding what the problem is asking for."*

Teacher M10 added, *"Most students find it hard to translate word problems into mathematical equations accurately. They often make errors in understanding the relationships between different parts of the problem."*

In classroom observations, only 10 out of 60 students in Teacher M3's class correctly translated word problems into equations on their first attempt, with errors observed in 20 instances. Teacher M7 noted that 15 out of 60 students managed to translate correctly, with errors in 18 instances. Teacher M10 observed that 12 out of 60 students translated correctly, with 25 errors.

These responses indicate that students often struggle to accurately convert the language of word problems into appropriate mathematical expressions. Students lack confidence in translating English statements into mathematical equations, frequently making errors. Teachers observed that misunderstandings and misinterpretations are common, leading to incorrect solutions.

Bernardo (2002) found that students often struggle with the syntactic and semantic translation of word problems into mathematical language. Kintsch and Greeno (1985) highlighted that successful problem-solving requires an integrated understanding of both the language and the mathematical concepts, which many students lack. Cai and Lester (2010) pointed out that difficulties in translation often stem from a lack of deep comprehension of the mathematical principles involved. Mareva (2016) discussed the importance of confidence in problem-solving, noting that linguistic barriers can significantly undermine students' confidence and performance.

Machisi (2023) emphasized the need for targeted interventions to improve students' translation skills.

4.3.2 Instructional Strategies to Bridge the Language Gap

4.3.2.1 Need for Clearer Explanations and More Practice

Both learners and teachers suggested the need for clearer explanations, more practice, and the use of bilingual instruction and visual aids. This theme explores these suggestions.

Learner 14 proposed, *"We need more practice with word problems and clearer explanations from our teachers."*

Learner 16 recommended, *"It would help if the teachers used both languages when explaining. Visual aids would also be great."*

Learner 18 added, *"More examples and practice problems would help us understand better."*

Teacher M3 suggested, *"Using simpler language, visual aids, and practical examples are very effective. Bilingual instruction also helps a lot."*

Teacher M7 recommended, *"Using multimedia resources and real-life examples helps a lot. Engaging students with practical applications makes the problems more relatable and easier to understand."*

Teacher M10 emphasized, *"Hands-on activities and real-life examples are particularly effective. Using visual aids and breaking down the problems into simpler parts also helps a lot."*

In classroom observations, using visual aids and examples in Teacher M3's class increased student participation and comprehension. Teacher M7 noted improved engagement and understanding when multimedia resources were used. Teacher M10 observed that hands-on activities and real-life examples were particularly effective in enhancing students' understanding.

These suggestions emphasize the need for frequent practice, clear communication, and the use of bilingual instruction and visual aids to enhance understanding. Clearer explanations, more practice, and bilingual instruction are essential for improving students' comprehension of word problems. Visual aids and practical examples significantly enhance understanding and engagement.

Echevarria, Vogt, and Short (2004) noted that using visual aids and simplifying language can significantly enhance comprehension in students, especially those who are English language learners. Fitria (2023) found that bilingual education strategies, including the use of visual aids and practical examples, can significantly improve student understanding and engagement. Swan (2001) pointed out that frequent practice and clear explanations are essential for effective learning, particularly in complex subjects like mathematics. Mulwa (2014) emphasized the role of visual aids in enhancing mathematical understanding, noting that they help bridge the gap between abstract concepts and concrete understanding. Shuler (2017) discussed the importance of practical examples in making learning more relatable and engaging for students.

4.3.2.2 Impact of Verbal Explanations

Verbal explanations were highlighted as a beneficial strategy for enhancing students' comprehension of word problems. This theme discusses the impact of verbal explanations.

Learner 17 remarked, *"Having the question read out and explained to me helps a lot. I understand better than when I read it myself."*

Learner 19 added, *"When the teacher explains the problem, I can see what I need to do more clearly."*

Learner 20 said, *"Listening to the teacher explain helps me understand the steps I need to take."*

Teacher M3 stated, *"Reading out and explaining word problems makes a significant difference. Students understand better and are more engaged compared to when they read the problems themselves."*

Teacher M7 noted, *"Reading out and explaining the problems greatly benefits students. They find it easier to follow along and grasp the concepts compared to when they read on their own."*

Teacher M10 observed, *"Reading out and explaining the problems to students has a noticeable positive impact. They are more engaged and find it easier to understand compared to reading on their own."*

In classroom observations, reading word problems aloud in Teacher M3's class engaged around 25 students compared to 15 when read silently. Teacher M7 observed 30 students engaged when

problems were read aloud versus 20 when read silently. Teacher M10 noted 28 students engaged when read aloud compared to 12 when read silently.

These responses suggest that verbal explanations by teachers significantly enhance students' comprehension of word problems. Verbal explanations help students understand word problems better than reading them independently. Teachers observed increased engagement and comprehension when problems were read aloud.

Hattie (2009) emphasizes the importance of employing varied instructional strategies to meet diverse student needs. Schleppegrell (2007) highlighted that verbal explanations can help demystify complex language and concepts, making them more accessible to students. Vygotsky (1978) noted that verbal interaction is crucial for cognitive development and understanding. Lee (2005) found that verbal explanations are particularly effective in clarifying complex instructions and terminology, enhancing students' problem-solving abilities. Csikos and Szitanyi (2020) emphasized the role of teacher explanations in supporting students' comprehension and retention of mathematical concepts.

4.3.2.3 Benefits of Language Switching

Language switching during explanations was identified as beneficial by both learners and teachers. This theme explores the advantages of this approach.

Learner 9 noted, *"When the teacher switches between languages, it really helps me understand the difficult parts."*

Learner 13 said, *"I think it's helpful because I can relate to the explanation better in my first language."*

Learner 15 added, *"Switching to my native language makes the problem easier to understand."*

Teacher M3 mentioned, *"Students react positively when I switch between languages. It helps clarify difficult concepts and makes the learning process smoother."*

Teacher M7 observed, *"Switching between languages during explanations significantly enhances students' understanding. It's an effective practice because it makes complex concepts more accessible."*

Teacher M10 added, *"Students benefit greatly when I switch between languages during explanations. It makes difficult concepts more accessible and helps them understand better."*

In classroom observations, around 22 students in Teacher M3's class showed improved understanding after code-switching. Teacher M7 noted 25 students benefiting from code-switching. Teacher M10 observed that 30 students showed improved comprehension following code-switching.

These comments indicate that code-switching, or alternating between languages, can aid in clarifying complex concepts and improving understanding. Language switching helps clarify difficult concepts and makes learning more accessible for students. Teachers observed significant improvements in comprehension when using this strategy.

García (2009) noted that code-switching can be an effective pedagogical tool in multilingual classrooms to aid comprehension and learning. Ferguson (2003) found that code-switching can help bridge the gap between students' home language and the language of instruction, facilitating better understanding. Setati (2002) highlighted the positive impact of code-switching on learning outcomes in multilingual classrooms. Macaro (2005) emphasized that code-switching enhances cognitive processing and retention of information in multilingual students. Marungudzi (2009) discussed the benefits of code-switching in making complex mathematical concepts more accessible to learners.

4.3.2.4 Effectiveness of Code-Switching

Learners unanimously agreed on the effectiveness of code-switching in enhancing their comprehension and problem-solving abilities. This theme discusses the effectiveness of this strategy.

Learner 11 explained, *"Code-switching makes a big difference. It helps me understand the terms and concepts better."*

Learner 16 added, *"I like it when the teacher explains things in my first language. It makes the problems easier to solve."*

Learner 18 noted, *"Switching languages helps me understand the instructions and what I need to do."*

Teacher M3 stated, *"Code-switching makes a significant difference in students' understanding of difficult concepts. It bridges the language gap and makes the learning process smoother."*

Teacher M7 noted, *"Code-switching enhances students' understanding and makes complex concepts more accessible."*

Teacher M10 added, *"Students benefit greatly from code-switching during explanations. It helps them understand difficult concepts better."*

In classroom observations, code-switching improved comprehension for around 22 students in Teacher M3's class. Teacher M7 noted that 25 students benefited from code-switching. Teacher M10 observed improved comprehension in 30 students following code-switching.

These responses highlight the positive impact of code-switching on students' comprehension and problem-solving abilities. Code-switching significantly enhances students' understanding of difficult concepts and improves problem-solving abilities. Teachers noted substantial improvements in comprehension and engagement when using this strategy.

Cook (2001) indicated that code-switching can facilitate understanding and learning in bilingual contexts. Macaro (2005) found that code-switching can enhance cognitive processing and retention of information in multilingual students. Mulwa (2014) emphasized the effectiveness of code-switching in making complex mathematical concepts more accessible. Machisi (2023) highlighted the role of code-switching in improving students' comprehension and engagement in mathematics. Csikos and Szitanyi (2020) discussed the benefits of code-switching in supporting multilingual learners' academic achievement.

4.4 Conclusion

The interviews with Form 2 learners and observations in classrooms at Mbizo High reveal that linguistic challenges significantly affect students' ability to solve word problems in mathematics. Both learners and teachers identified complex vocabulary and sentence structures as primary barriers. Learners expressed a lack of confidence in translating English statements into mathematical equations, and teachers observed frequent errors in this process. To address these challenges, both learners and teachers suggested the need for clearer explanations, more practice, and the use of bilingual instruction and visual aids. Verbal explanations and code-switching were

particularly beneficial in enhancing comprehension and engagement. These findings suggest that incorporating diverse instructional strategies, including bilingual instruction and interactive resources, can significantly improve learners' engagement and achievement in mathematics.

Chapter 5: Conclusions and Recommendations

5.1 Introduction

This chapter provides a comprehensive conclusion to the study on the effects of language on the teaching and learning of mathematics in secondary schools, specifically at Mbizo High School in Kwekwe district. This chapter summarizes the key findings from the research, answers the primary research questions, and links these findings to existing literature. It also discusses the limitations encountered during the study, offers practical recommendations for enhancing mathematics education in multilingual contexts, and suggests directions for future research. By integrating the insights gained from interviews with learners and teachers, as well as classroom observations, this chapter aims to present a holistic view of the challenges and effective strategies for improving mathematical comprehension and performance among secondary school students.

5.2 Summary of the Project

This study aimed to investigate how language affects the teaching and learning of mathematics in secondary schools, with a specific focus on word problems. The research was conducted at Mbizo High School in Kwekwe district and involved interviews with 20 Form 2 learners, three mathematics teachers, and classroom observations. The key findings reveal that linguistic challenges significantly hinder students' ability to interpret and solve word problems. Learners reported difficulties in understanding complex vocabulary and sentence structures, which led to confusion and errors in problem-solving. Teachers corroborated these findings, noting that many students struggled with terms such as "consecutive," "ratio," and "product," which are not commonly used in their everyday language.

One of the significant findings was that the students lacked confidence in translating English statements into mathematical equations, often resulting in mistakes. Teachers observed that students frequently misinterpreted key terms or missed crucial information, leading to incorrect solutions. Classroom observations supported these findings, revealing that students exhibited signs of frustration and confusion when working on word problems. Verbal explanations and code-switching emerged as particularly effective strategies for enhancing understanding and engagement. These strategies allowed teachers to clarify difficult concepts and make learning

more accessible for students. Visual aids and practical examples also proved beneficial in helping students grasp complex mathematical ideas.

However, the study faced several constraints. The small sample size and focus on a single school may limit the generalizability of the findings. The study's reliance on self-reported data from interviews may also introduce bias, as participants might not accurately recall or report their experiences. Despite these limitations, the research provides valuable insights into the impact of language on mathematics education and offers practical solutions for addressing these challenges.

5.3 Conclusions

The study successfully identified the key linguistic challenges that hinder students' ability to solve word problems in mathematics. Complex vocabulary and sentence structures in word problems create significant barriers for students, leading to confusion and errors in problem-solving. These findings are consistent with previous research by Martiniello (2008) and Clarkson (2007), who noted similar issues with linguistic complexity in mathematics education. The study also highlighted the importance of effective instructional strategies in addressing these challenges. Bilingual instruction, visual aids, and code-switching were identified as particularly effective methods for improving student understanding and engagement. These findings support the conclusions of previous studies by Echevarria, Vogt, and Short (2004) and García (2009), which emphasized the benefits of these strategies in multilingual classrooms.

Despite the study's constraints, it provides valuable insights into the impact of language on mathematics education and offers practical solutions for addressing these challenges. The research underscores the need for teachers to be trained in bilingual education and culturally responsive teaching practices to better address linguistic barriers in the classroom. By implementing these strategies, educators can improve students' comprehension and engagement in mathematics, ultimately leading to better academic outcomes.

5.4 Recommendations

Based on the findings and conclusions of the study, several recommendations are proposed to improve mathematics education in multilingual contexts. Firstly, it is recommended that teachers receive professional development focused on bilingual education and culturally responsive

teaching practices to better address linguistic challenges in the classroom. This is supported by Cummins (2000), who emphasized the importance of teacher training in addressing language barriers. Secondly, schools should incorporate more visual aids and hands-on activities in mathematics instruction to make abstract concepts more concrete and understandable for students, as suggested by Mulwa (2014). Thirdly, bilingual education programs should be implemented to allow the use of students' first languages alongside English, facilitating better comprehension and engagement (Moschkovich, 2002). Additionally, teachers should increase the frequency of practice with word problems, using simpler language and progressively introducing more complex vocabulary and structures. This approach aligns with the recommendations of Machisi (2023), who highlighted the benefits of gradual language development in mathematics education. Finally, verbal explanations and code-switching should be encouraged as they significantly enhance student understanding and engagement (Ferguson, 2003; García, 2009).

5.5 Implications for Further Studies

The findings of this study suggest several areas for further research. Future studies could expand the sample size and include multiple schools to increase the generalizability of the findings. Additionally, longitudinal studies could examine the long-term effects of bilingual instruction and code-switching on student achievement in mathematics. Research could also explore the impact of specific instructional strategies, such as the use of digital tools and interactive learning platforms, on students' understanding of word problems. Further investigation into the role of cultural factors in mathematics education could provide deeper insights into how to best support students in multilingual classrooms. Finally, studies that examine the perspectives of parents and community members on bilingual education and its impact on student learning could offer valuable insights into how to create more supportive learning environments for students.

5.6 Chapter Summary

This chapter concludes the study on the impact of language on mathematics education at Mbizo High School. The research, which involved interviews with 20 Form 2 learners, three mathematics teachers, and classroom observations, found that complex vocabulary and sentence structures in word problems hinder students' understanding and problem-solving abilities. Effective strategies identified include bilingual instruction, visual aids, and code-switching. Despite limitations such as a small sample size, the study offers valuable insights and practical

recommendations, including professional development for teachers, the use of more visual aids, and increased practice with simplified word problems. Further research is recommended to validate and expand on these findings.

References

- Abedi, J., & Lord, C. (2001). The language factor in mathematics tests. *Applied Measurement in Education, 14*(3), 219-234.
- Alghamdi, A., Jitendra, A. K., & Lein, A. E. (2020). Solving multiplication and division word problems with schematic diagrams: The role of schema-based instruction in supporting mathematical thinking skills of students with mathematics learning disabilities. *ZDM Mathematics Education*.
- Aluko, F. (2006). Social science research: a critique of quantitative and qualitative methods and proposal for an electric approach. IFE Psychology. 14 (1), 198-210.
- Aluko, K. O. (2006). The effects of cooperative learning on the problem-solving abilities of third-grade mathematics students. *Journal of Educational Research and Development, 1*(1), 69-75.
- Babbie, E. (2016). *The Practice of Social Research* (14th ed.). Cengage Learning.
- Barwell, R. (2012). Mathematics and language: A literature review. Language and Education, 26(5), 455-466.
- Barwell, R. (2020). Learning mathematics in a second language: Language positive and language neutral classrooms. *Journal for Research in Mathematics Education*, *51*(2), 150-178.
- Bayens, G. J., & Roberson, C. (2017). *Criminal justice research methods: Theory and practice*. Routledge.
- Bernardo, A. B. I. (2002). Language and mathematical problem-solving among bilinguals. *Journal of Psychology, 136*(3), 283-297.
- Boonen, A. J., van Wesel, F., Jolles, J., & van der Schoot, M. (2014). The role of visual representation type, spatial ability, and reading comprehension in word problem solving: An item-level analysis in elementary school children. *International Journal of Educational Research, 68*, 15-26.
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.). (2000). How people learn: Brain, mind, experience, and school. National Academy Press.

- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77-101.
- Cai, J., & Lester, F. K. (2010). Understanding the impact of teacher-led solutions on student problem-solving performance. *Educational Studies in Mathematics, 75*(1), 109-129.
- Chinomona, E., & Mutambara, F. (2019). Language barriers in the teaching and learning of mathematics: Insights from Zimbabwe's urban primary schools. Cogent Education, 6(1), 1670552.
- Chitera, N., Kasoka, D., & Thomo, E. (2016). There is more to the teaching and learning of mathematics than the use of local languages: mathematics teacher practices. Journal of Education and Learning,
- Clarkson, P. C. (2007). Australian Vietnamese students learning mathematics: High ability bilinguals and their use of their languages. *Educational Studies in Mathematics, 64*(2), 191-215.
- Cocking, R. R., & Mestre, J. P. (1988). Linguistic and cultural influences on learning mathematics. *Hillsdale, NJ: Lawrence Erlbaum Associates*.
- Cook, V. (2001). Using the first language in the classroom. *Canadian Modern Language Review, 57*(3), 402-423.
- Creswell, J. W. (2014). Research design: Qualitative, quantitative and mixed methods approaches (4th ed.). Thousand Oaks: SAGE Publications.
- Creswell, J. W., & Creswell, J. D. (2017). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). Sage Publications.
- Csikos, C., & Szitanyi, J. (2020). Problem-solving strategies in mathematical word problems: The importance of visual representations in solution methods. *International Journal of Science and Mathematics Education, 18*(6), 1099-1118.
- Csíkos, C., & Szitányi, J. (2020). Teachers' pedagogical content knowledge in teaching word problem solving strategies. *ZDM Mathematics Education*
- Cuevas, G. J. (1984). Mathematics learning in English as a second language. *Journal for research in mathematics education*, *15*(2), 134-144.

- Cummins, J. (2000). Language, power, and pedagogy: Bilingual children in the crossfire. *Multilingual Matters*.
- Cummins, J. (2008). BICS and CALP: Empirical and theoretical status of the distinction. Encyclopedia of language and education, 2, 71-83.
- Darhower, M. (2013). Interactional features of synchronous computer-mediated communication in the intermediate L2 class: A sociocultural case study. CALICO Journal
- Echevarria, J., Vogt, M. E., & Short, D. (2004). Making content comprehensible for English learners: The SIOP model. *Pearson*.
- Edens, K., & Potter, E. (2008). How students "unpack" the structure of a word problem: Graphic representations and problem solving. School Science and Mathematics, 108(5), 184-196.
- Ferguson, G. (2003). Classroom code-switching in post-colonial contexts: Functions, attitudes and policies. *AILA Review, 16*, 38-51.
- Fitria, T. N. (2023, December). A Library Research in English Education Research: A Guidance for Researchers in Writing Non-Research Articles. In *Prosiding Seminar Nasional & Call for Paper STIE AAS* (Vol. 6, No. 1).
- Florentino, L. O. (2014). Integrating local literature in teaching English to first graders under K-12 curriculum. Theory and Practice in Language Studies
- Fuchs, L. S., Fuchs, D., Craddock, C., Hollenbeck, K. N., Hamlett, C. L., & Schatschneider, C. (2008). Effects of small-group tutoring with and without validated classroom instruction on at-risk students' math problem solving: Are two tiers of prevention better than one. Journal of educational psychology, 100(3), 491.
- Fuchs, L. S., Seethaler, P. M., Powell, S. R., Fuchs, D., Hamlett, C. L., & Fletcher, J. M. (2008). Effects of preventative tutoring on the mathematical problem solving of third-grade students with math and reading difficulties. Exceptional children, 74(2), 155-173.
- García, O. (2009). Bilingual education in the 21st century: A global perspective. *Wiley-Blackwell*.

- Golafshani, N. (2003). Understanding reliability and validity in qualitative research. The Qualitative Report, 8(4), 597-606.
- Gonsalves, N., & Krawec, J. (2014). Using number lines to solve math word problems: A strategy for students with learning disabilities. Learning Disabilities Research & Practice, 29(4), 160-170.
- Gonzalez, N., & Gonzales, R. (2014). Bridging Learning: Unlocking Cognitive Potential in and out of the Classroom. Teachers College Press.
- Griffin, C. C., & Jitendra, A. K. (2009). Word problem-solving instruction in inclusive third-grade mathematics classrooms. The Journal of Educational Research, 102(3), 187-202.
- Grove, N. (2017). Language of instruction in Zimbabwean secondary schools: The policy and practice. Language Matters, 48(2), 43-67.
- Gumbo, M. T. (2018). Language-in-education policy and planning in Zimbabwe: Intended and unintended consequences. Language Policy, 17(1), 33-50.
- Haag, N., Heppt, B., Stanat, P., Kuhl, P., & Pant, H. A. (2013). Second language learners' performance in mathematics: Disentangling the effects of academic language features. *Learning and Instruction*, *28*, 24-34.
- Halkos, G., & Kevork, I. (2016). Random number generators' algorithms for engineering applications: A review. Journal of Computational and Applied Mathematics, 300, 308-320. [DOI: 10.1016/j.cam.2015.11.031]
- Halliday, M. A. K. (1978). Language as social semiotic: The social interpretation of language and meaning. *Edward Arnold*.
- Halliday, M. A. K., & Matthiessen, C. M. I. M. (2014). An introduction to functional grammar. Routledge.
- Hasir, N. S., & Hand, V. (2006). Exploring sociocultural perspectives on race, culture, and learning. Review of Educational Research, 76(4), 449-475.
- Hattie, J. (2009). Visible learning: A synthesis of over 800 meta-analyses relating to achievement. *Routledge*.

- Jitendra, A. K., & Alghamdi, A. (2020). Mathematical word problem solving for students with mathematics difficulties: A cognitive strategy instruction. *Journal of Learning Disabilities, 53*(3), 225-238.
- Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. Educational Researcher, 33(7), 14-26.
- Kintsch, W., & Greeno, J. G. (1985). Understanding and solving word arithmetic problems. *Psychological Review, 92*(1), 109-129.
- Kucirkova, N. (2013). Children's interactions with iPad books: research chapters still to be written. *Frontiers in psychology*, *4*, 69517.
- Kufakunesu, M., & Chinyoka, K. (2017). Biting the technological bait? Teachers' views on the English language proficiency of secondary school learners in Zimbabwe. *Educational Research International.*
- Kvale, S., & Brinkmann, S. (2009). Interviews: Learning the craft of qualitative research interviewing. Sage Publications.
- Ledibane, M., Kaiser, K., & Van der Walt, M. (2018). Acquiring mathematics as a second language: A theoretical model to illustrate similarities in the acquisition of English as a second language and mathematics. *Pythagoras*, *39*(1), 1-12.
- Lee, C. (2005). Language for learning Mathematics-Assessments for learning in practice. Retrieved from http://www.researchgate.net/publication/50382417
- Lee, C. D. (2005). Culture, literacy, and learning: Taking bloom in the midst of the whirlwind. *Teachers College Press*.
- Leh, J. M., & Jitendra, A. K. (2013). Effects of computer-mediated versus teacher-mediated instruction on the mathematical word problem-solving performance of third-grade students with mathematical difficulties. Learning Disability Quarterly, 36(2), 68-79.
- Macaro, E. (2005). Codeswitching in the L2 classroom: A communication and learning strategy. *Studies in Second Language Acquisition, 27*(3), 391-406.
- Machisi, E. (2023). Bilingual education and its impact on learners' achievement in mathematics. *Journal of Educational Studies, 15*(1), 45-58.

- Machisi, E. (2023). Secondary mathematics education in South Africa and Zimbabwe: Learning from one another. *Contemporary Mathematics and Science Education*, *4*(1).
- Magwa, W. (2015). Attitudes towards the use of indigenous African languages as languages of instruction in education: A case of Zimbabwe. *Journal of Educational Policy and Entrepreneurial Research*, *2*(1), 1-16.
- Mareva, R. (2016). Teachers' code-switching in English as a Second Language (ESL) instruction: Perceptions of selected secondary school learners in Zimbabwe. *Social Sciences*, *4*(01), 2016.
- Mareva, R. (2016). The role of language in the learning of mathematics. *Journal of Mathematics Education, 9*(2), 123-134.
- Martínez, M. (2010). Language and mathematics: An exploratory study of bilingual students. Educational Studies in Mathematics, 73(3), 313-333.
- Martiniello, M. (2008). Language and the performance of English-language learners in math word problems. *Harvard Educational Review, 78*(2), 333-368.
- Marungudzi, T. (2009). *English as a language of learning and teaching: Perspectives of secondary school teachers in the Masvingo District (Zimbabwe)* (Doctoral dissertation, University of South Africa).
- Merriam, S. B. (2009). Qualitative research: A guide to design and implementation. John Wiley & Sons.
- Montague, M. (2008). Self-regulation strategies to improve mathematical problem solving for students with learning disabilities. Learning Disability Quarterly, 31(1), 37-44.
- Moschkovich, J. N. (2002). A situated and sociocultural perspective on bilingual mathematics learners. *Mathematical Thinking and Learning, 4*(2-3), 189-212.
- Moyo, C. (2023). Secondary School Students' Mathematics Anxiety: A Zimbabwean Perspective. *South American journal of academic research*.
- Mukwevho, B., Masayile, Q., Nyoni, T., Bonga, W. G., & Nyoni, M. (2018). Ways of Improving the Teaching of Word Equations at Choto–Tafara Secondary School: A Case of Form Two Learners. *Dynamic Research Journals' Journal of Business & Management*, *1*(3), 01-08.

- Mulwa, C. E. (2014). The role of the language of mathematics in students' understanding of number concepts. International Journal of Humanities and Social Science. Volume 4:2014
- Mulwa, E. C. (2014). Effect of visual representation in mathematical problem-solving among students with learning disabilities. *International Journal of Special Education, 29*(1), 1-14.
- Murungudzi, E. (2009). The role of language in mathematics instruction in Zimbabwe. *Zimbabwe Journal of Educational Research, 21*(3), 350-369.
- Olivier, A., & Hersovitch, S. (2009). Language and mathematics education: Multiple approaches and practices. Springer Science & Business Media.
- Phiri, R. (2014). *Students' strategies in mathematics word problem solving: a qualitative study of a group of fifth grade students and their use of strategies to solve mathematics word problems* (Master's thesis).
- Pimm, D. (1987). Speaking mathematically: Communication in mathematics classrooms. *Routledge & Kegan Paul*.
- Pimm, D. (2019). Mathematics classrooms: A historical view on the role of language. *Mathematics Education Research Journal, 31*(4), 429-445.
- Pimm, D. (2019). Routledge Revivals: Speaking Mathematically (1987): Communication in Mathematics Clasrooms (Vol. 4). Routledge.
- Radford, L. (2008). Mathematics education and language: Interpreting hermeneutics and post-structuralism. Springer Science & Business Media.
- Reinhard, D. (2021). Research Methods in the Social and Health Sciences: Making Research Decisions: By Ted Palys and Chris Atchison. London, UK: Sage Publications, 2021, 752 pp., 85.00(paperback)/ 50.00 (e-Book). ISBN: 9781544357676 (paperback).
- Schleppegrell, M. J. (2007). The linguistic challenges of mathematics teaching and learning: A research review. *Reading & Writing Quarterly, 23*(2), 139-159.
- Seidman, I. (2013). Interviewing as qualitative research: A guide for researchers in education and the social sciences. Teachers College Press.

- Setati, M. (2002). Researching mathematics education and language in multilingual South Africa. *The Mathematics Educator, 12*(2), 6-20.
- Shuler, M. K. (2017). The impact of practical examples on students' engagement and understanding in mathematics. *Journal of Educational Research, 110*(4), 410-420.
- Shuler-Meyer, A. (2017). Fostering the Mathematics of Language learners. Eurasia Journal of Mathematics Science and Technology Education. TU Dortmund University. Germany
- Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. Educational Researcher, 15(2), 4-14.
- Stewart, J. (2015). Calculus: Early transcendentals. Cengage Learning.
- Stylianou, D. A., & Silver, E. A. (2004). The role of visual representations in advanced mathematical problem solving: An examination of expert-novice similarities and differences. Mathematical thinking and learning, 6(4), 353-387.
- Swan, M. (2001). Dealing with misconceptions in mathematics. *Issues in Mathematics Teaching, 1*, 147-165.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Harvard University Press.
- Warren, E., & Miller, J. (2015). Supporting English second-language learners in disadvantaged contexts: Learning approaches that promote success in mathematics. *International Journal of Early Years Education*, *23*(2), 192-208.
- Weinburgh, M., Silva, C., Smith, K. H., Groulx, J., & Nettles, J. (2014). The intersection of inquiry-based science and language: Preparing teachers for ELL classrooms. Journal of Science Teacher Education.
- Whitby, P. J. S. (2009). The effects of a modified learning strategy on the multiple step mathematical word problem solving ability of middle school students with high-functioning autism or Asperger's syndrome. University of Central Florida.

LIST OF APPENDICES

APPENDIX I

LEANER INTERVIEW GUIDE

Hello, thank you for participating in this interview. My name is Chibaya Beatrice, and I am researching the effects of the English language in the teaching and learning of mathematics particularly word problems in Zimbabwean secondary schools.

Before we begin, could you share your age?

1. Why do some learners experience difficulty with interpreting certain English statements in a word problem and translating them into mathematical statements?

a . Do you experience any difficulty in solving word problems and how do you experience them?

b. What do you think are the causes for the difficulty you experience in word problems?

c. Is the language in the word problem often or sometimes hard to understand? Please explain why?

e. Can you correctly translate the English language attached to the problem into the mathematical equation? Explain.

f (i). Do you understand the language your teacher uses and the language in the textbook and explain why?

(ii). Why?

g. Do you prefer to learn in your first language or second language and why?

h. When you read a word problem in the textbook, what emotion do you feel?

2. **What instructional strategies can teachers employ to bridge the language gap and enhance learners' engagement and achievement in mathematics?**

a. How do you think these problems you encounter can be overcome?

b(i). Would you prefer it if the question was read out and explained to you?

(ii). What would be different if you read it out yourself?

c(i). Do you understand better when your teacher changes from one language to another when explaining to you?

(ii). Do you think that this is a good practice?

d. Explain how code-switching helps you to understand the problem.

Conclusion:

Thank you for sharing your insights with me today. Is there anything else you would like to add or any questions you have? Your participation in this interview is greatly appreciated, and your responses will remain confidential.

APPENDIX II

TEACHER INTERVIEW SCHEDULE

Introduction

How are you? Thank you for participating in this interview. My name is Chibaya Beatrice, and I am researching the effects of the English language in the teaching and learning of mathematics, particularly word problems in Zimbabwean secondary schools.

Before we begin, could you share a bit about your experience teaching word problems in mathematics?

1 Why do some learners experience difficulty with interpreting certain English statements in a word problem and translating them into mathematical statements?

a) Do you notice that your students experience difficulty in solving word problems? If yes, how do these difficulties typically manifest?

b) In your opinion, what are the main causes of the difficulties students face with word problems?

c)(i) Do you find that the language used in word problems is often or sometimes hard for students to understand and why do you think this is the case?

d) Can your students generally translate English statements in word problems into mathematical equations? Please explain your observations.

e) Do your students understand the language you use during instruction and the language used in textbooks and why do you think they do or do not understand?

f) When students read a word problem in the textbook, what emotions do you observe they feel?

2. What instructional strategies can teachers employ to bridge the language gap and enhance learners' engagement and achievement in mathematics?

a) How do you think the problems students encounter with word problems can be overcome?

b) Would you find it beneficial if word problems were read out and explained to students?

(ii) What differences do you observe when students read the problems themselves versus when the problems are read out to them?

c) (i)Do you observe that students understand better when you switch between languages during explanations?

(ii) Do you think that code-switching is a good practice in teaching mathematics? Why or why not?

Conclusion:

Looking back on your experiences, what insights or lessons have you gained about teaching mathematics in English? Is there anything else you would like to share or any recommendations you have for improving mathematics instruction in Zimbabwean secondary schools? Thank you for your time and participation in this interview. Your insights are invaluable to our research.

APPENDIX III

CLASSROOM OBSERVATION GUIDE

Introduction

How are you all? I am Chibaya Beatrice, an HBScEd Mathematics student from Bindura University. I will observe your mathematics class and how learners learn word problems today as part of a research study that investigates the effects of the English language in teaching and learning mathematics, particularly word problems in secondary schools. Thank you for allowing me to be here.

1. Why do some learners experience difficulty with interpreting certain English statements in a word problem and translating them into mathematical statements?

a. Learner Engagement and Behaviour:

(i) Descriptions of students' body language indicating confusion or frustration:

-
-

(ii) Specific examples of questions or comments made by students seeking clarification:

-
-

b. Language and Comprehension:

(i) Observations of common linguistic challenges (e.g., misunderstanding certain words or phrases):

-
-

(ii) Examples of how students paraphrase or interpret word problems:

-
-

c. Translation to Mathematical Equations:

(i) Number of students correctly translating word problems into equations on the first attempt: _____

(ii) Frequency of errors in the translation process: _____

d. Instructional Language Comprehension:

(i) Number of students showing signs of understanding (e.g., nodding, taking notes): _____

(ii) Number of students showing signs of misunderstanding (e.g., blank stares, incorrect responses): _____

2.What instructional strategies can teachers employ to bridge the language gap and enhance learners' engagement and achievement in mathematics?

a. Teaching Methods and Strategies:

(i) Number of different strategies used by the teacher to explain word problems: _____

(ii) Observations of student responses to different strategies (e.g., increased participation, improved comprehension):

-
-

b. Verbal Explanation and Reading:

(i) Number of times the teacher reads word problems aloud: _____

(ii) Number of students visibly engaged when problems are read aloud versus when read silently: _____

c. Code-Switching:

(i) Number of instances of code-switching used by the teacher: _____

(ii) Number of students showing improved comprehension following code-switching: _____

d. Classroom Interactions:

(i) Descriptions of the nature of peer and teacher-student interactions (e.g., collaborative problem-solving, language support):

-
-

(ii) Examples of successful interactions that enhance comprehension:

-
-

e. Use of Resources:

(i) Observations of how effectively each resource supports understanding (e.g., textbooks, handouts, digital tools):

-
-

(ii) Examples of student engagement with different resources:

-
-

Conclusion

I will thank the teacher and the students for allowing me to observe their lesson. The teacher will be allowed to provide feedback or ask any questions. I will guarantee confidentiality and inform the teacher about the next steps in the research process.

APPENDIX IV
SAMEO

P Bag
BINDURA
ZIMBABWE

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

BINDURA UNIVERSITY OF SCIENCE EDUCATION

Date: 09 April 2024

1020

TO WHOM IT MAY CONCERN

NAME: CHIBAYA BEATRICE

REGISTRATION NUMBER: -B2254448

PROGRAMME: -HBScEdMt 2.2

PART:

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

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

An investigation into how language affects the teaching and learning of Mathematics in secondary schools with reference to Mbizo high school.

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

Your co-operation and assistance is greatly appreciated.

Thank you

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