BINDURA UNIVERSITY OF SCIENCE EDUCATION

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TOPIC

Exploring The Employment Of Visual Aids And Their Pedagogical Justification In The Teaching And Learning Of Mathematical Concepts

BY

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IN PARTIAL FULFILLMENT FOR THE REQUIREMENTS OF THE AWARDING OF THE BACHELOR OF SCIENCE EDUCATION DEGREE IN MATHEMATICS

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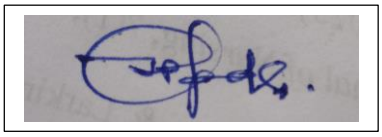
Signed: 

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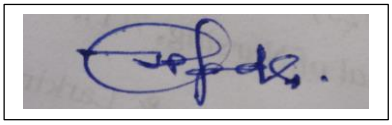
Signature: 

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DEDICATION

This work is dedicated to my mother, Cecilia Chibi, and my wife, Gracious Mutusva.

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I would like to extend my sincere and heartfelt thanks to the almighty God, for giving me power and courage to start and finish this work. Also, I want to express my profound gratitude to my supervisor, Doctor Ndemo, for the time and expertise he rendered without restraint, giving advice and support all the way through my journey. Without his assistance this work would have never been completed.

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A special thanks to my friends and workmates who gave me unwavering support in demanding times . Also, not forgetting all the others whom I have not mentioned for their contributions .

ABSTRACT

The research study sought to explore the employment of visual aids and their pedagogical justification in the teaching and learning of mathematical concepts. The research study was conducted in Sanyati District at three selected secondary schools which were accessible to the researcher. The researcher used a qualitative research approach and data was collected through interviews and classroom observations. The sample population of the research study consisted of 9 secondary school teachers from 3 secondary schools in Zimbabwe. All the respondents managed to participate in the study and the data gathered was qualitatively presented and analysed .The aim of this research was to examine how visual aids are used in the teaching and learning of mathematics, assess their effectiveness and identify the challenges faced by teachers in implementing them. The findings of the research study revealed that teachers view visual aids as a powerful instructional tool that can enhance learners' understanding of mathematical concepts. Visual aids were praised for making abstract concepts more concrete, arousing learners' interest to learn, improving learner engagement and supporting comprehension of concepts. However, teachers highlighted several challenges including limited resources, lack of training to effectively employ visual aids to teach, financial constraints to procure standard visual aids, time factor, large class size and attitude towards the use of visual aids. The study recommends the Ministry of Primary and Secondary Education to prioritise resource allocation for education and to conduct training workshops to help teachers on how to teach mathematics effectively using visual aids. Schools should provide visual aids which cannot be easily improvised and found from the local environment promptly. In addition, teachers should integrate visual aids into their lesson planning and delivery.

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ACRONYMS

CK—Content Knowledge

COVID-19 – Coronavirus Disease 2019

EMT—Environmental Media and Technology

ICT – Information and Communication Technology

MoPSE- Ministry of Primary and Secondary Education

PCK—Pedagogical Content Knowledge

PK—Pedagogical Knowledge

TCK—Technological Content Knowledge

TEFA—Technology Enhanced Formative Assessment

TK—Technology Knowledge

TPACK—Technological Pedagogical Content Knowledge

TPK—Technological Pedagogical Knowledge

VK—Visual Knowledge

VPCK-Visual Pedagogical Content Knowledge

VPK—Visual Pedagogical Knowledge

CHAPTER ONE

1.0 RESEARCH PROBLEM AND ITS CONTEXT

1.1. Introduction

This chapter provides the foundation for this research which occurred in Sanyati district in Mashonaland West in Zimbabwe and its major purpose was to explore the employment of visual aids and their pedagogical justification in teaching and learning mathematics in secondary schools. It sets the stage by outlining the global and African context for the study .Zimbabwe to achieve its vision 2030 needs education that transforms human minds to be critical thinkers. The chapter highlights the importance of visual aids and identifies a specific research gap at the secondary level in Zimbabwe regarding their use and the reasons teachers provide for their choices. The problem statement, research questions, and objectives are clearly presented to define the focus of the study. Finally, the chapter maps out the dissertation's structure, guiding the reader through the research journey.

1.2. Background of study

Globally, mathematics educators constantly seek effective strategies to enhance student learning. One such area of focus is the utilization of visual aids, which encompass a wide range of tools and resources designed to support teaching and learning. Research internationally explores various forms of visual aids from traditional instructional media to modern instructional media. A meta-review by Carbonneau, Marley and Selig (2013) indicated that the use of objects can assist students in learning mathematics, although they noted that effective implementation by teachers is crucial. While some studies suggest that visual aids might be more effective for memorizing facts than solving complex problems, the overall consensus is that appropriate visual aids can significantly enhance learning and promote a more constructive approach to mathematics (Carbonneau et al., 2013; Marikyan, 2023). The effectiveness of visual aids is not solely dependent on the materials themselves but also on how they are chosen and implemented, highlighting a need for further research in this area (Marikyan, 2023). Furthermore, some research suggests that while visuals are helpful, students also need the skill to create mental images and some students face difficulties with visualization (Murphy, 2019). Therefore, understanding the diverse ways visual aids are used and how teachers make decisions about their use is a complex but important question being explored by researchers worldwide, making this study highly relevant.

In Africa, the importance of supporting mathematics teaching with various visual aids is also recognized. Studies, such as one in South Africa by Naidoo (2012), have examined how instructors utilize visual aids, noting that experienced teachers often use pictures and artefacts, sometimes improvising, to communicate mathematical concepts. However, another South African study by Smith and Cekiso (2020) found that some primary teachers lacked knowledge of various visual aids and predominantly used a limited range, indicating a need for training on their employment. While these studies focus on the primary level, they highlight the broader challenge within the African context regarding teacher knowledge and access to diverse visual aids. Research in higher education in Africa similarly perceives visual aids as useful for reaching students and improving comprehension, though limitations like technology access and diverse student needs exist (Fokuo, Opuku-Mensah, Asamoah, Nyarko, Agyeman and Owusu-Mintah, 2023). These African studies underscore that while the value of visual aids is recognized, challenges related to teacher expertise, access to resources, and appropriate implementation are prevalent across different educational levels.

In Zimbabwe, research reveals challenges in teaching methods, including a limited application of visual aids by teachers, possibly due to barriers related to teachers, students and resources (Mangwende and Maharaj, 2018, 2019). While some research has explored culturally relevant tools like games in early childhood education for numeracy concepts (Tarashika and Jairo, 2023), there is less focus on the diverse range of visual aids used and the rationale behind their use by teachers at the secondary school level. The transition from primary to secondary mathematics involves more abstract concepts, where the strategic use of visual aids can be particularly beneficial. However, there is a need to understand how secondary teachers in Sanyati district in Zimbabwe currently employ these media and the pedagogical justifications that inform their teaching practices.

Research suggests challenges in the use of different visual aids at various levels of education. While the potential of such tools is acknowledged, particularly for making abstract concepts accessible, there appears to be a gap in understanding the specific practices and reasoning of secondary school mathematics teachers regarding their employment of visual aids. This suggests a need to explore the current landscape of visual aids use in Zimbabwean secondary mathematics classrooms and the pedagogical thinking that underpins teachers' decisions. Therefore, this study aims to explore the employment of visual aids and their pedagogical justifications in the teaching and learning of mathematical concepts within the Zimbabwean secondary school context. By focusing on secondary schools, this research seeks to address

the identified gap in understanding teacher practices and contribute to enhancing mathematics teaching approaches at this critical level of education in Zimbabwe.

1.3. Statement of the problem

Visual aids are widely acknowledged for their potential to support mathematics learning by making abstract concepts more accessible. Research globally and within the African context highlights the value of these materials. However, studies in Zimbabwe indicate challenges in teachers' use of visual aids to teach mathematics in secondary schools. While this issue has been noted, there is a distinct lack of specific research focusing on the secondary school level regarding the types of visual aids mathematics teachers employ and crucially, the pedagogical justifications they provide for using them or choosing not to use them. It is not clear how secondary teachers in Zimbabwe navigate the integration of visual aids into their mathematics lessons, what factors influence their decisions, and the reasoning (justifications) behind their chosen practices. Understanding these aspects is essential for developing targeted support and professional development for secondary mathematics teachers. Therefore, this study is necessary to explore the employment of visual aids and the pedagogical justifications teachers provide in the teaching and learning of mathematical concepts within Zimbabwean secondary school classrooms. Exploring these areas can inform teacher support, curriculum development, and ultimately contribute to improved mathematics pedagogy at the secondary level in Zimbabwe.

1.4. Research objectives

1.4.1. To explore how secondary school teachers in Zimbabwe employ visual aids for teaching mathematics.

1.4.2. To determine what form of pedagogical justifications Zimbabwean secondary school teachers provide for their use or non-use of visual aids in mathematics teaching.

1.5. Research questions

This study will seek to answer the following questions:

1.5.1. How do secondary school teachers in Zimbabwe employ visual aids in their mathematics teaching?

1.5.2. What form of pedagogical justifications do Zimbabwean secondary school teachers provide for their use or non-use of visual aids in mathematics teaching?

1.6. Significance of study

This study holds significance for several key stakeholders within the Zimbabwean education system and beyond.

1.6.1. Secondary school learners

This research is ultimately aimed at benefiting students in Zimbabwean secondary schools. By exploring teacher practices regarding visual aids and their impact, the study seeks insights into teaching approaches that can enhance understanding and mastery of complex secondary mathematics concepts. A stronger foundation in secondary mathematics is crucial for future academic pursuits, particularly in STEM fields, and for developing critical problem-solving skills necessary for various careers and daily life. Understanding how to effectively use visual aids can contribute to more engaging, interactive, and effective mathematics learning experiences for young people.

1.6.2. Secondary school teachers

The findings of this research will directly benefit secondary school mathematics teachers in Zimbabwe. The study will provide insights into current practices regarding the employment of visual aids and the diverse pedagogical justifications teachers hold. This information can inform the design of targeted professional development programs aimed at enhancing teachers' knowledge and skills in selecting and effectively implementing a wider range of visual aids. Furthermore, identifying the challenges teachers face in using visual aids will help in determining the specific support systems, resources, and training needed to overcome these barriers.

1.6.3. Policy makers

Findings from this study will benefit Zimbabwean curriculum developers and education policymakers. The research will provide evidence-based insights into the realities of visual aids use in secondary mathematics classrooms. These results can inform policy decisions regarding the integration of visual aids into the secondary mathematics curriculum, the allocation of educational resources, and the development of teacher training standards and programs. The findings can guide the creation of appropriate teaching materials, pedagogical guidelines and policy documents that facilitate the effective integration of visual aids into secondary mathematics education.

1.6.4. Academic community

This study extends beyond the Zimbabwean setting and contributes to the broader academic discourse on mathematics education. By focusing on the specific case of visual aids employment and pedagogical justifications in Zimbabwean secondary schools, the study enhances the global literature on mathematics teaching and learning in diverse contexts, particularly in developing nations. The findings regarding teacher practices and reasoning can be valuable for researchers in other countries facing similar educational challenges and interested in understanding effective strategies for improving mathematical performance through the strategic use of visual aids.

1.7. Limitations of study

The study will be affected by several limitations. One potential limitation is the sample size, which will include a limited number of secondary schools and teachers in Zimbabwe. A small sample may not fully capture the variety of secondary schools across the country, including differences in resources, teacher training levels, student populations, and urban versus rural settings. To mitigate this limitation, the study will attempt to select as representative and diverse a sample as is financially and logistically possible within the available resources. Purposeful sampling may not allow for generalizations of findings beyond the selected schools.

Although attempts will be made to select a representative sample, the specific context of the Zimbabwean secondary school curriculum, cultural nuances, and resource limitations means that direct application of results outside secondary education systems in other countries may be limited. To acknowledge this limitation, the research will clearly define the specific context of the study and indicate that the findings are most directly applicable to similar secondary school settings in Zimbabwe and potentially other comparable developing countries. The report will also suggest that future studies investigate the employment and justification of visual aids in different settings to further broaden the understanding of their effectiveness worldwide.

This research involves collecting qualitative data through methods such as interviews and classroom observations. As such, the interpretation of the data is subject to the researcher's perspective. When analyzing interview responses or classroom observations, the researcher's own understanding and biases could potentially influence the interpretation of the data. Different researchers might interpret the same data slightly differently, which could impact

the findings. To enhance the trustworthiness and credibility of the analysis, the research will employ systematic qualitative data analysis techniques, such as thematic analysis, utilizing clear coding procedures and seeking to identify recurring patterns and themes transparently. Triangulation of data sources will also be employed where possible to corroborate findings and reduce reliance on a single source of data.

1.8. Delimitation of study

- This research is delimited to Zimbabwean secondary school education. While visual aids are utilized across all levels of education, this study will specifically focus on the secondary school level. This focus allows for a thorough examination of the specific challenges and opportunities related to the use of visual aids for teaching more abstract mathematical concepts encountered at the secondary stage. Understanding the role of visual aids at this level is particularly relevant for students' preparation for advanced studies and future careers. A comprehension of practices at this specific level enables the formulation of targeted recommendations for secondary school teachers and the curriculum.
- The scope of this research is delimited to mathematics education. While visual aids are employed in various subject areas, this study will exclusively investigate their use within the mathematics syllabus. Mathematics is a subject where abstract ideas are prevalent, and visual aids are often seen as valuable tools for enhancing comprehension and engagement in this specific domain.
- This research is delimited to the investigation of visual aids employment and the pedagogical justifications teachers provide as a specific teaching approach. While recognizing that effective mathematics instruction involves a range of pedagogical strategies, this study will intentionally focus on understanding how teachers use visual aids and why they make those choices.
- This study is delimited to investigating secondary teachers' employment of visual aids and the pedagogical justifications they offer for their practices regarding the effectiveness of visual aids in mathematics teaching and learning. While acknowledging the ultimate goal of improving student learning outcomes, the study focuses primarily on the teacher's practices, and reasoning, rather than directly measuring student learning outcomes resulting from the use of specific visual aids.

1.9. Definition of key terms

1.9.1. Visual aids

Visual aids, broadly defined as instructional materials presenting information visually to enhance learning (Shabiralyani et al., 2015), serve to bridge abstract concepts to concrete understanding, simplifying complex information (King, 2018). In the context of this study, visual aids are specifically considered as pedagogical tools used by Zimbabwean secondary school teachers to represent mathematical concepts. These tools, including manipulatives, pictures and digital resources, aim to improve mathematics teaching and facilitate student learning and comprehension.

1.9.2. Mathematical concepts

Mathematical concepts are abstract ideas that form the basis of mathematics (Jost, 2015). They are the core principles for understanding mathematics (Vergnaud, 2016). For this study, mathematical concepts refer to the specific mathematics topics in the Zimbabwean secondary education curriculum.

1.9.3. Teaching (with Visual Aids)

Teaching is helping students to learn and understand new material (Low, Tahar, and Maat, 2024). Teaching with aids means using tools to support instruction (Low, Tahar, and Maat, 2024). In this research, teaching with visual aids means how Zimbabwean secondary school teachers use visual tools in maths lessons. This includes how they choose and use visuals to explain mathematics and help students learn in their classrooms.

1.9.4. Learning (of Mathematical Concepts)

Learning is the process of gaining knowledge and understanding according to Asfar, Asmawaty et al., (2019). Learning mathematical concepts means understanding and mastering these mathematics ideas (Jost, 2015). In this study, learning of mathematical concepts refers to how well Zimbabwean secondary schools understand mathematics because of visual aids. This includes how visual aids affect their mathematics skills, problem-solving, and overall grasp of mathematics ideas at secondary level.

1.10. Chapter organisation

This dissertation is organised into five chapters.

Chapter one: Problem and its context

This chapter introduces the study. It provides background information on visual aids in mathematics education. The problem statement, research questions and objectives are presented. The chapter also outlines the study's significance, limitations and delimitations. Key terms are defined. Finally, the chapter organisation is described.

Chapter two: Literature review

This chapter reviews existing research. It examines global and African perspectives on visual aids in mathematics. It explores the theoretical framework underpinning the study. Gaps in the literature, particularly in the Zimbabwean context, are identified. This chapter provides the context for the current research.

Chapter three: Research methodology

This chapter details how the study was conducted. It describes the research design and approach. The chapter explains the data collection methods used. It outlines the sample and setting of the study. Data analysis procedures are also described. Ethical considerations are addressed.

Chapter four: Findings and Discussion

This chapter presents the research findings. It describes the data collected from teachers and classrooms. The findings are organised and presented clearly. The chapter discusses the findings in relation to the research questions. It interprets the results and explains their meaning.

Chapter five: Conclusion and Recommendations

This chapter summarises the main findings of the study. It revisits the research objectives and questions. Conclusions based on the findings are drawn. Recommendations are made for practice, policy and future research. The chapter reflects on the study's contribution to the field.

1.11. Chapter summary

Chapter One has established the context and rationale for this study on the employment of visual aids and their pedagogical justifications in Zimbabwean secondary schools. It presented the background to the research problem, emphasizing the global and African

relevance, and identifying the specific need to understand teacher practices and reasoning at the secondary level in Zimbabwe. The chapter clearly stated the research objectives and questions that this study aims to address, focusing specifically on how teachers employ visual aids and the justifications they provide. Furthermore, it outlined the study's significance for various stakeholders, its limitations, delimitations, and defined key terms relevant to visual aids, pedagogical justifications, and mathematics education at the secondary level. This introductory chapter provides a comprehensive framework for understanding the research that follows in this dissertation. Chapter two will provide a literature review for the study.

CHAPTER TWO

2.0. LITERATURE REVIEW

2.1. Introduction

This literature review explores existing research on visual aids in mathematics education. It focuses specifically on secondary schools in Sanyati district in Mashonaland West, Zimbabwe. The review examines how teachers use visual aids. It also investigates the reasons teachers give for using or not using these tools. Furthermore, it considers teachers' beliefs about how well visual aids help students learn mathematics. Finally, this review aims to provide a foundation for recommendations to improve media use.

2.2. Theoretical framework

The Visual Pedagogical Content Knowledge (VPCK) framework guides this study. Mahler, Grobschedl, Kleickmann and Harms (2019) developed VPCK. It emphasizes on the importance of teachers' ability to effectively use visual representations in teaching. They argue that VPCK is a critical component of a teacher's professional knowledge particularly in subjects like biology and mathematics where visual tools are essential for explaining concrete concepts. VPCK views effective visual aids integration as a combination of three main types of knowledge. These are Visual Knowledge (VK), Content Knowledge (CK) and Pedagogical Knowledge (PK). The framework also identifies four areas where these types of knowledge overlap. These lead to the full concept of VPCK.

Visual Knowledge (VK) is the type of knowledge the teacher gains from visual aids or through visual means such as images, diagrams, videos, graphs and other visual representations .This empowers teachers to teach more clearly, inclusively and effectively (Mahler, Grobschedl, Kleickmann and Harms ,2019). Content Knowledge (CK) is a teacher's understanding of the subject. For this study, it means a Zimbabwean mathematics teacher's deep knowledge of mathematical concepts. It includes procedures, facts, and the nature of mathematics itself (Mahler, Grobschedl, Kleickmann and Harms ,2019). This involves knowing different ways to show mathematical ideas. It also includes understanding how they connect. Pedagogical Knowledge (PK) is a teacher's general knowledge about teaching and learning. This covers classroom management, student assessment, and various teaching methods. These methods are useful for any subject (Mahler, Grobschedl, Kleickmann and Harms, 2019).

The VPCK framework highlights how these core knowledge areas combine. They create new, integrated forms of knowledge vital for teaching with visual aids. Pedagogical Content Knowledge (PCK) is one such area. It combines pedagogy and content. It shows how teachers teach specific subjects to make them clear to students (Shulman, 1986). For mathematics teachers, PCK means understanding common student errors. It also means knowing effective ways to explain difficult concepts. It includes designing suitable learning activities.

Visual Content Knowledge (VCK) is another intersection. It shows how visual aids can improve or change subject matter. This involves choosing the best visual aids for teaching particular mathematical concepts. It also means understanding how visual aids can represent content (Mahler, Grobschedl, Kleickmann and Harms ,2019). For example, a mathematics teacher using number lines , visual models or animations to explain fractions or algebraic expressions demonstrates (VCK).Visual Pedagogical Knowledge (VPK) combines visual and pedagogy. It covers how different visual aids can be used in teaching, regardless of the subject. A teacher with strong VPK knows how to use visual aids effectively to support teaching and enhance student learning.

The main part of the framework is Visual Pedagogical Content Knowledge (VPCK). This is the blend of all three knowledge types and their connections. It is the knowledge needed to effectively use technology in teaching a specific subject. This must be done in a way that helps students learn (Mahler, Grobschedl, Kleickmann and Harms ,2019). For this study, it means a teacher's ability to choose and use visual aids (VK). They must use them to teach mathematical concepts (CK). They must also use them in ways that improve student understanding and engagement (PK).

The VPCK framework is very relevant to this study. VPCK encompasses not only the selection and use of visual aids but also the understanding of how these visual aids can support teaching and learning. This includes recognizing the potential of visual aids representations to enhance comprehension and the ability to adapt these tools to meet diverse teaching and learning needs.

Mahler, Grobschedl, Kleickmann and Harms (2019) suggest that developing VPCK should be a focus in teacher education training as it plays a significant role in effective teaching and learning of mathematics .By fostering VPCK teachers can better facilitate student understanding through the strategic use of visual aids. This means that strong VPCK, which

is key for using visual aids effectively, relies heavily on practical training. Therefore, the VPCK framework is a strong theoretical base for this study. It will help examine how Zimbabwean secondary mathematics teachers see visual aids' effectiveness.

2.3. Employment of visual aids by secondary school mathematics teachers in Zimbabwe

The use of visual aids in mathematics teaching varies among secondary school teachers in Zimbabwe. This section examines how teachers integrate different forms of media into their lessons. It considers the types of media used and the strategies employed.

2.3.1. Use of digital media as visual aids in mathematics teaching

Research shows that the use of digital media, for example , digital charts, interactive whiteboards and digital flash cards as visual aids to enhance teaching and learning in Zimbabwean mathematics classrooms is limited. Mangwende and Maharaj (2018) found that many Ordinary Level mathematics teachers did not use digital media as visual aids in teaching and learning of mathematics. This suggests a restricted understanding and application of digital media. A later study by Mangwende and Maharaj (2020) identified barriers to digital media use as visual aids. These included teacher preparedness, curriculum demands, and a lack of resources. They recommended training and resource mobilization to improve on digital media use.

Challenges also impact the use of available digital media as visual aids in mathematics learning. Oyedele, Rwambiwa, and Mamvuto (2018) observed trainee teachers at Africa University. They found that while trainees valued educational media and technology (EMT), they used it rarely. This was due to insufficient or non-working facilities in schools.

More recent studies highlight some efforts to use digital tools, especially during the COVID-19 pandemic. Mutambara and Tsakeni (2022) explored the use of digital media as visual aids in teaching mathematics. The issue of teacher preparedness was one of the issues that hindered effective employment of visual aids in teaching mathematics. Many teachers were not adequately trained to use digital media as visual aids for mathematics learning.

2.3.2. Cultural and Out-of-School Resources as instructional media

Beyond digital tools, teachers can use cultural and real-life experiences as instructional resources. Chikodzi (2022) explored integrating cultural practices into primary school mathematics. The study showed that connecting mathematics to children’s cultural

experiences is possible. However, teachers needed more training in managing cultural diversity.

Sunzuma and Maharaj (2020) also explored how in-service teachers integrated ethnomathematics into geometry. They found teachers used cultural approaches as learning materials, resources, and context. They suggested using films or educational videos to incorporate ethnomathematics.

Mashingaidze (2017) examined the use of students' out-of-school experiences in transformation geometry. This study, focusing on rural schools, found that while curricula promote contextualized teaching, teachers often started with formal definitions. This limited connections with students' lived experiences. Mangwende (2019) also explored teachers' use of student learning styles. This research found teachers had basic knowledge but faced limitations. Lack of tools, resources, and training restricted personalized instruction. This again points to challenges in fully using all available resources, including students' everyday lives, as part of instructional media.

2.4. Pedagogical justifications for the use or non-use of visual aids in mathematics teaching in Zimbabwe

Zimbabwean secondary school teachers consider various pedagogical factors when deciding to use or not use visual aids in mathematics. Their justifications often balance perceived benefits for student learning with practical challenges in the classroom. This section explores these reasons.

2.4.1. Justifications for using visual aids

Teachers often use visual aids because they believe it improves student learning and engagement. One key reason is the ability of visual aids to cater to diverse learning styles. Ocampo et al. (2023) highlight that interactive media can enhance learning for students with different learning preferences, suggesting the need for tailored pedagogy. This aligns with teachers who believe that visual aids can help students grasp abstract mathematical concepts more easily.

Visual aids are also seen as a way to enhance student engagement. When visual aids are attractive and interactive, students often become more interested in the lesson. Koyuncu (2024) found that creating digital media, like a newspaper, deepened student engagement and

made classes more interactive. This idea supports the use of visual aids to make mathematics lessons more dynamic and meaningful.

Another significant justification is the potential for improved understanding of mathematical concepts. Complex topics can be simplified through visual representations. According to Sunzuma and Maharaj (2021), teachers found that visual aids such as diagrams, local shapes and culturally relevant patterns enhanced learners' comprehension of mathematical concepts by making lessons more concrete and relatable. These aids supported learners in visualising abstract ideas particularly in topics like geometry. This connected abstract geometry to students' lived experiences, making concepts more relatable and understandable. Such culturally relevant media can enhance meaning-making and learner engagement.

Furthermore, employing technology enhanced visual aids is seen as a way to develop students' technological skills and prepare them for a digital world (Getenet, 2017). Teachers recognize that students need to be familiar with digital tools for their future. Using visual aids in mathematics can help achieve this goal. This also includes supporting multilingual learners and addressing perceived deficits. Cavalcante et al. (2023) showed how language-friendly digital tools empowered teachers to address student needs and use linguistic strengths. This supported multilingual instruction and promoted culturally relevant mathematics learning.

During challenging times, teachers find innovative pedagogical justifications for using available media. Mutambara and Tsakeni (2022) observed teachers shared educational videos, diagrams, pictures, graphs and worked examples via social media tools like WhatsApp and Telegram during the COVID-19 pandemic. Although this was often a workaround for infrastructure issues, teachers argued that sharing worked examples via social media supported learner autonomy and cognitive engagement. This was important when no alternative media was available, showing an adaptive pedagogical justification driven by necessity.

2.4.2. **Justifications for non-use of visual aids**

Despite the benefits, many Zimbabwean teachers do not use visual aids. A primary reason is a lack of confidence in visual pedagogical content knowledge (VPCK). Teachers may feel they do not have the skills to effectively integrate visual aids into their mathematics lessons. Sunzuma and Luneta (2022) found that pre-service teachers, despite understanding learner-centered methods, often reverted to traditional teaching. This was because they lacked access to digital media and had low confidence in using them.

Insufficient training is another major barrier. If teachers are not properly trained on how to use specific media or integrate it pedagogically, they are less likely to employ it. Sunzuma and Maharaj (2021) noted that a lack of training was a reason for inconsistent use of ethno mathematics approaches, even when teachers saw their value.

Concerns about the relevance and effectiveness of certain visual aids for specific mathematical topics also play a role. Teachers might believe that some visual aids tools are not suitable for particular concepts or that traditional methods are more effective for certain learning outcomes. Institutional factors heavily influence these decisions. Curriculum demands can limit the time or flexibility teachers have to experiment with new media. If the curriculum is prescriptive or heavily focused on content coverage, teachers may prioritize traditional methods. Resource availability is a significant practical challenge. Schools may lack computers, projectors, internet access, or even basic materials needed for certain types of visual aids. Oyedele, Rwambiwa, and Mamvuto (2018) highlighted that trainees rarely used educational media and technology due to inadequate and non-functioning facilities.

2.5. Summary

The review highlights that Zimbabwean secondary school mathematics teachers have varied experiences with visual aids. Many recognize the potential of visual aids to boost student engagement and improve conceptual understanding. However, actual use is often limited. Key barriers include a lack of necessary infrastructure, insufficient resources, financial constraints, and a critical absence of formal teacher training in integrating visual aids. While some teachers adapt by using readily available visual aids, a systemic approach is needed.

CHAPTER 3

3.0. RESEARCH METHODOLOGY

3.1. Introduction

This chapter outlines the research methodology used to explore the employment of visual aids and their pedagogical justification in the teaching and learning of mathematical concepts at secondary level. It outlines the research approach, philosophical underpinnings, design, population, sample and sampling procedures. Furthermore, it describes the data collection methods, the procedure for gathering data, how the data will be presented, and the methods used for data analysis. Finally, the chapter addresses the ethical considerations that guided this study. The data used in this study were collected from three secondary schools in Sanyati district in Mashonaland West ,Zimbawe.

3.2. Research Approach

A research approach is a general plan for how a researcher will answer their research questions. It guides the entire research process from beginning to end. Research approaches are broadly categorized into quantitative, qualitative, and mixed methods (Flick, 2018).

This study employs a qualitative research approach. A qualitative approach aims to understand human experiences, perspectives, and meanings in their natural settings (Creswell & Poth, 2018). It focuses on gaining in-depth understanding of a phenomenon rather than measuring variables or testing hypotheses. Qualitative research is particularly suited for exploring complex social issues and for answering "how" and "what" questions about experiences, perceptions, and practices (Mohajan, 2018).

The choice of a qualitative research approach is justified by the nature of the research questions. The study seeks to understand how secondary school teachers employ visual aids, what form of pedagogical justifications they provide, and how they perceive the effectiveness of these aids. These questions require a deep exploration of teachers' lived experiences, beliefs, and reasoning, which cannot be adequately captured through numerical data or statistical analysis. A qualitative approach allows the researcher to gather rich, descriptive data that provides insights into the teachers' perspectives, offering a clear understanding of their practices and rationales concerning visual aids in mathematics teaching. This approach enables the researcher to capture the complexity of human behaviour and thought in a way that quantitative methods cannot (Patton, 2015).

3.3. Research Philosophy

Research philosophy refers to the set of beliefs and assumptions about the nature of reality and knowledge that guides a research study. It influences how a researcher approaches the research questions and interprets findings (Denzin & Lincoln, 2018).

This study is underpinned by an interpretivist research philosophy, which is often associated with constructivism. Interpretivism suggests that reality is socially constructed and subjective, meaning that people create their own understandings of the world through their experiences and interactions (Aspers and Corte, 2019). It emphasizes understanding phenomena from the perspective of those involved, rather than seeking universal laws or objective truths. Constructivism, a related philosophy, posits that knowledge is not discovered but actively constructed by individuals as they make sense of their experiences (Denzin and Lincoln, 2018).

The interpretivist philosophy is justified for this study because the research aims to understand the subjective experiences, justifications, and perceptions of secondary school mathematics teachers. The study is not looking for a single, objective truth about the use of visual aids. Instead, it recognizes that teachers' practices and beliefs are shaped by their unique contexts, training, and personal interpretations. By adopting an interpretivist stance, the researcher acknowledges that teachers' understandings of "effectiveness" or "justification" are personal constructions. This philosophy allows for the exploration of multiple realities and diverse viewpoints, which is crucial for answering questions about individual practices and rationales. It aligns with the qualitative approach by seeking to understand the meanings that participants attribute to their actions and experiences (Flick, 2018).

3.4. Research Design

A research design is a detailed plan that outlines the structure and strategy for conducting a research study. It provides a framework for collecting, measuring, and analyzing data. The research design connects the philosophical assumptions to the specific methods of data collection and analysis (Creswell and Poth, 2018).

This study employs a descriptive phenomenological research design. Phenomenology is a qualitative research design that focuses on understanding the common lived experiences of individuals regarding a particular phenomenon (Creswell and Poth, 2018). Descriptive phenomenology specifically aims to describe the "what" of an experience, focusing on the essential structure of consciousness as it relates to the phenomenon, often through detailed

accounts from participants (Smith, Flowers and Larkin, 2009). It seeks to identify the shared meanings and common elements of an experience as perceived by a group of individuals.

The choice of a descriptive phenomenological design is justified by the study's research questions. The questions are centered on understanding the experiences and perceptions of secondary school teachers regarding their employment of visual aids, their pedagogical justifications, and their views on effectiveness. This design allows the researcher to explore the teachers' lived worlds and to gain a deep understanding of their perspectives without imposing pre-conceived notions. By focusing on the "how" and "what form" of their experiences, phenomenology provides a suitable framework for uncovering the essence of their engagement with instructional media. It enables the researcher to gather rich, first-person accounts that reveal the teachers' unique insights and shared understandings (Tomaszewski, Zarestky and Gonzalez, 2020). This design is particularly strong for exploring subjective experiences and the meanings individuals attach to them.

3.5. Population

The population in research refers to the entire group of individuals, objects, or events that the researcher is interested in studying. It is the larger group from which a sample is drawn (Patton, 2015).

The target population for this study comprises all secondary school mathematics teachers in Zimbabwe. To ensure feasibility and depth of inquiry within the qualitative framework, the study will focus on an accessible population drawn from a specific cluster of three secondary schools within one geographical area in Zimbabwe. These three schools have been chosen because they each employ at least three mathematics teachers who teach Forms 1 to 4, making them suitable for in-depth investigation. Therefore, the accessible population for this study from this cluster would be a minimum of nine teachers (three schools multiplied by at least three teachers per school). This focused approach allows for detailed exploration of the phenomenon within a manageable context, while still providing insights relevant to the broader Zimbabwean secondary school system.

3.6. Sample

A sample is a smaller, manageable group of individuals selected from the larger population to participate in a research study. The characteristics of the sample should be relevant to the research questions and the overall study objectives.

For this qualitative study, the sample consists of 9 secondary school mathematics teachers drawn from the accessible population of three selected secondary schools in Sanyati district in Zimbabwe. This sample size is typical for qualitative research, which prioritizes depth of understanding over statistical generalizability (Patton, 2015). The aim is to gather rich, detailed information from a smaller number of participants rather than broad, superficial data from a large number.

This sample size of 9 teachers is based on the principles of qualitative inquiry and the composition of the accessible population. Given that each of the three selected schools employs at least three mathematics teachers teaching Forms 1 to 4, the total accessible population from these schools is a minimum of nine teachers. By aiming for a sample of 9 teachers, the study seeks to include all accessible mathematics teaching staff from these three schools, assuming each has exactly three such teachers. This allows for in-depth interviews and observations, enabling the researcher to spend significant time with each participant to explore their experiences comprehensively. This depth is crucial for a phenomenological study aiming to uncover the essential structures of teachers' experiences. This sample size is deemed appropriate to provide rich and varied perspectives on the employment of visual aids and their pedagogical justifications in mathematics teaching within the selected cluster of schools.

3.7. Sampling Procedure

The sampling procedure is the specific method used to select participants from the population for inclusion in the study. The choice of sampling procedure in qualitative research is often non-random, focusing on selecting information-rich cases.

This study employs purposive sampling, specifically criterion sampling. Purposive sampling is a non-probability sampling technique where the researcher intentionally selects participants who are most likely to provide relevant and rich information related to the research questions (Creswell and Poth, 2018). Criterion sampling, a type of purposive sampling, involves selecting participants who meet a predetermined set of criteria (Patton, 2015).

To effectively answer the research questions, it is essential to recruit secondary school mathematics teachers who actively teach mathematics and who have experience with, or at least exposure to, instructional media. The specific criteria for inclusion in this study are: currently teaching mathematics at a secondary school in Zimbabwe; having at least two years

of teaching experience in mathematics; willingness to participate in interviews and classroom observations; and accessibility to the researcher for data collection.

This sampling procedure ensures that the selected teachers can provide valuable insights into the phenomenon under investigation. Random sampling, while suitable for quantitative studies aiming for statistical generalization, would not be appropriate here as the goal is to gain deep understanding from specific individuals, not to make generalizations about the entire population. Purposive sampling allows the researcher to target individuals who possess the specific knowledge and experiences necessary to address the research questions effectively (Flick, 2018).

3.8. Data Collection Methods

Data collection methods are the systematic ways in which researchers gather information for their study. In qualitative research, these methods are designed to capture rich, descriptive data that reveals participants' perspectives and experiences.

For this study, two primary data collection methods will be utilized: semi-structured interviews and classroom observations. These methods are chosen to provide a comprehensive understanding of teachers' reported practices, justifications, and perceptions, as well as their actual classroom behaviours.

3.8.1. **Semi-structured Interviews**

Semi-structured interviews are a flexible qualitative data collection method where the researcher has a list of predetermined questions or topics to cover, but also allows for new questions to emerge during the conversation based on the interviewee's responses (Patton, 2015). This approach balances consistency across interviews with the flexibility to explore unique insights.

Interviews allow the researcher to explore teachers' experiences, beliefs and pedagogical justifications in detail. They provide an opportunity for teachers to articulate their thoughts in their own words, offering rich qualitative data that directly addresses the "how" and "what form" research questions. The semi-structured nature allows the interviewer to probe for more information, clarify responses, and follow up on unexpected but relevant points that emerge during the conversation. This ensures that the researcher can gain a comprehensive understanding of the teacher's perspective. Interviews can capture the subtle aspects of

teachers' perceptions and rationales that might be missed by other methods. They allow for the exploration of complex issues related to the use or non-use of visual aids.

On the other hand, data collected through interviews relies on what participants say, which may not always align perfectly with their actual practices. Teachers might present an idealized version of their teaching or forget specific details. Conducting and transcribing interviews is a labour-intensive process, requiring significant time and resources from the researcher. The interviewer's presence and questioning style can unintentionally influence participants' responses, leading to social desirability bias where participants give answers they believe the researcher wants to hear.

Semi-structured interviews are justified because they are the most direct way to access teachers' subjective experiences, pedagogical justifications, and perceptions. They directly address research questions by providing a platform for teachers to articulate their practices, reasons and views on effectiveness. While acknowledging the limitations, the depth of information gained from interviews is crucial for a phenomenological study seeking to understand lived experiences (Creswell and Poth, 2018).

3.8.2. **Classroom Observations**

Classroom observations involve directly observing teachers' instructional practices in their natural teaching environment. This method provides firsthand insights into how teachers actually employ instructional media in mathematics lessons (Creswell and Poth, 2018). The researcher takes detailed field notes during the observation, focusing on the use of visual aids, teacher-student interactions, and student engagement.

Observations provide empirical data on the actual use of visual aids, complementing the self-reported data from interviews. This helps to address research question 1.5.1. by showing how teachers employ these media in practice. Observing teachers in their classroom environment allows the researcher to understand the contextual factors that influence their decisions regarding visual aids, such as available resources, classroom dynamics, and student responses. Observations can reveal practices that teachers may not explicitly mention or may not be fully aware of during an interview, thus providing a more complete picture of their teaching.

On the negative side, teachers might alter their behaviour or teaching practices when they know they are being observed. This could lead to a less authentic representation of their

typical teaching style. Conducting observations requires significant time commitment, including travel to schools and spending full lesson periods in classrooms. A single observation or a few observations may not fully capture the teacher's entire repertoire of instructional media use, as practices might vary across different topics or classes. The researcher's interpretation of observed behaviours might be subjective, requiring careful reflection and triangulation with interview data.

Classroom observations are justified as a complementary data collection method because they provide a vital direct perspective on teachers' actual practices. While interviews capture what teachers say they do, observations reveal what they actually do. This triangulation of data from different sources enhances the credibility and trustworthiness of the findings (Lincoln and Guba, 1985; Tracy, 2010). Observing the real-world application of visual aids is essential for answering the "how" question (1.5.1) and for contextualizing the justifications and perceptions gathered through interviews.

3.9. Data Collection Procedure

The data collection procedure outlines the systematic steps taken to gather information from the chosen sample. A clear procedure ensures consistency, rigor, and ethical conduct throughout the research process.

The data collection procedure for this study will involve a systematic approach to gather information from the chosen sample, ensuring consistency, rigor and ethical conduct. Initially, a research letter will be sought for from the Faculty of Education office before any data collection commences. Following this, formal permission will be obtained from the Ministry of Primary and Secondary Education in Zimbabwe and the heads of the selected secondary schools. This comprehensive process ensures that the study adheres to all necessary regulations and respects institutional protocols.

Once institutional permissions are secured, the researcher will approach potential participants, who are secondary school mathematics teachers meeting the study's criteria. This will involve contacting school heads to identify suitable teachers and then directly approaching those teachers. The researcher will provide a clear explanation of the study's purpose, what participation entails, and the voluntary nature of their involvement. For each willing participant, a detailed informed consent form will be provided. This form will explain the study's objectives, the data collection methods including interviews and observations, the time commitment required, assurances of anonymity and confidentiality, the right to

withdraw at any time without penalty, and how the data will be used and stored. Participants will be given ample time to read and understand the form before signing it.

Upon obtaining informed consent, the researcher will work with each participating teacher to schedule suitable times for both the semi-structured interview and the classroom observation. Flexibility will be maintained to accommodate the teachers' schedules and minimize disruption to their teaching duties. Each interview will be conducted at a time and location convenient for the teacher, preferably at their school in a private setting to ensure comfort and confidentiality. Interviews will be audio-recorded with the explicit permission of the participant. The researcher will use a pre-developed interview guide but will remain flexible to explore emerging themes and allow participants to elaborate on their experiences. Each interview is expected to last approximately 45 to 60 minutes.

Following the interview, the researcher will conduct one classroom observation for each participating teacher. The observation will focus on a regular mathematics lesson where the teacher is likely to use visual aids. During the observation, the researcher will take detailed, descriptive field notes, documenting the types of visual aids used, how they are integrated into the lesson, teacher-student interactions related to the media, and student engagement. The researcher will aim to be as unobtrusive as possible to minimize the observer effect. Each observation will correspond to the length of a typical mathematics lesson period, usually around 40 to 60 minutes.

3.10. Data Presentation

Data presentation refers to the manner in which the findings of the study are organized and displayed for the reader. In qualitative research, the goal is to present rich, descriptive accounts that convey the depth and complexity of the collected data.

The findings of this study will be presented primarily through thematic descriptions supported by direct quotes from the participating teachers. Thematic descriptions involve presenting the identified themes and sub-themes that emerged from the data analysis, offering a narrative explanation of each theme (Braun and Clarke, 2006). This approach allows the researcher to synthesize the common patterns and meanings found across the participants' experiences.

Direct quotes will be used extensively to illustrate and substantiate these themes. These verbatim excerpts from the interview transcripts will provide the reader with a direct voice

from the participants, enhancing the credibility and authenticity of the findings (Miles, Huberman, and Saldaña, 2019). Each quote will be clearly attributed using a pseudonym or an anonymous identifier (for example, "Teacher A," "Participant 1") to maintain participant confidentiality. The use of descriptive narratives combined with illustrative quotes ensures that the presentation is both analytical and grounded in the participants' own words, allowing the reader to understand the specific details of their experiences and perceptions regarding visual aids in mathematics teaching.

3.11. Data Analysis

Data analysis in qualitative research is the process of systematically organizing, interpreting, and making sense of the collected data to identify patterns, themes, and meanings. It involves moving from raw data to meaningful insights.

This study will employ thematic analysis to analyze the collected qualitative data. Thematic analysis is a flexible and widely used method for identifying, analyzing, and reporting patterns (themes) within qualitative data (Braun and Clarke, 2006). A theme captures something important about the data in relation to the research questions and represents some level of patterned response or meaning within the data set.

The justification for choosing thematic analysis is its suitability for exploring the rich, descriptive data generated from semi-structured interviews and classroom observations. It allows for a detailed examination of teachers' experiences, justifications, and perceptions, directly addressing the "how" and "what form" questions of the study. Thematic analysis is not tied to a specific theoretical framework, making it adaptable for various qualitative research designs, including phenomenology, where the goal is to describe shared experiences (Hsieh and Shannon, 2005).

The process of thematic analysis will follow the six phases outlined by Braun and Clarke (2006):

Familiarizing oneself with the data: This initial phase involves immersing in the data by repeatedly reading the interview transcripts and reviewing field notes. This helps the researcher to get a general sense of the depth and breadth of the information.

Generating initial codes: After familiarization, the researcher will systematically go through the entire data set, identifying interesting features and patterns. These features will be coded, which means assigning a brief phrase or word to segments of text that capture a basic unit of

meaning. This process is inductive, meaning codes are derived directly from the data (Miles, Huberman and Saldaña, 2019).

Searching for themes: Once coding is complete, the researcher will review the generated codes and begin to group them into potential themes. A theme represents a broader pattern of meaning that captures important aspects of the data related to the research questions. This involves looking for connections and relationships between different codes.

Reviewing themes: This phase involves refining the identified themes. The researcher will assess if the themes accurately represent the data and if they are distinct from each other. This involves two levels of review: first, checking if the themes work in relation to the coded extracts, and second, considering if the themes accurately reflect the entire data set. Themes may be merged, split, or discarded during this phase.

Defining and naming themes: Once the themes are refined, each theme will be clearly defined and given a concise, descriptive name. This involves articulating the essence of each theme and explaining what aspect of the data it captures. Sub-themes may also be identified to provide further detail within broader themes.

Producing the report: The final phase involves writing up the analytical narrative. This includes providing a detailed account of each theme, supported by illustrative direct quotes from the participants. The report will link the findings back to the research questions and the broader literature.

This systematic approach to thematic analysis ensures rigor and transparency in interpreting the qualitative data, leading to credible and trustworthy findings (Levitt et al., 2017).

3.12. Ethical Considerations

Ethical considerations are fundamental to conducting responsible and trustworthy research. They involve ensuring the well-being, rights, and dignity of all participants and maintaining the integrity of the research process. Adherence to ethical principles is crucial in qualitative research, where personal and sensitive information may be shared.

This study will strictly adhere to the following ethical considerations:

3.12.1. **Informed Consent**

Informed consent is the process by which a researcher ensures that participants are fully aware of the study's purpose, procedures, potential implications, and their rights before

agreeing to participate. In this study, all participants will be thoroughly informed about the research. This will involve providing a detailed written information sheet that outlines the study's objectives, the specific data collection methods (semi-structured interviews and classroom observations), the estimated time commitment required from them, and how their data will be used. The information will be presented in clear, simple language, avoiding jargon, to ensure full comprehension. Before any data collection begins, the researcher will verbally explain all aspects of the study and provide ample opportunity for participants to ask any questions they may have. Only after participants confirm their understanding and voluntarily agree to participate will they be asked to sign a written informed consent form. This signed form will serve as a record of their agreement to participate in the study, ensuring that their decision is autonomous and well-informed (Flick, 2018).

3.12.2. **Voluntary Participation**

Voluntary participation means that individuals choose to take part in a study freely and without any form of coercion, pressure, or undue influence. For this study, participation will be entirely voluntary. Teachers will be explicitly assured that their decision to participate or decline participation will have no negative impact on their employment status, professional evaluations, or any other aspect of their relationship with their school or the Ministry of Primary and Secondary Education. The researcher will emphasize that there are no incentives or penalties associated with participation or non-participation. This commitment to voluntary participation will be clearly communicated in both the initial invitation to participate and the informed consent form, reinforcing that their involvement is a free choice.

3.12.3. **Right to Withdraw**

The right to withdraw ensures that participants can discontinue their involvement in the study at any point without facing any repercussions. In this research, participants will be clearly informed of their absolute right to withdraw from the study at any stage, from the initial contact to the completion of data collection and even during the analysis phase up to a specified point before final reporting. They will not be required to provide a reason for their withdrawal. Furthermore, participants will be informed that if they choose to withdraw, any data already collected from them will be immediately destroyed and excluded from the study's analysis and final report. This ensures that participants maintain full control over their involvement and their personal data throughout the research process.

3.13. Chapter summary

This chapter has provided an account of the research methodology employed in this study. It established the use of a qualitative research approach, underpinned by an interpretivist philosophy and guided by a descriptive phenomenological research design. The target population of secondary school mathematics teachers in Zimbabwe was identified and a purposive sample of 9 teachers was justified based on an accessible cluster of three schools. The chapter outlined the data collection methods, specifically semi-structured interviews and classroom observations, detailing their advantages and disadvantages in relation to the study. A step-by-step data collection procedure was described in narrative form, followed by an explanation of how the data will be presented and analyzed using thematic analysis. Finally, the critical ethical considerations, focusing on informed consent, voluntary participation, and the right to withdraw, were discussed in detail, ensuring participant protection and research integrity. This comprehensive methodology provides a clear roadmap for conducting the study and ensuring the credibility and trustworthiness of its findings.

CHAPTER FOUR

4.0. RESULTS PRESENTATION, ANALYSIS AND DISCUSSION

4.1. Introduction

This chapter presents the findings of the study. The aim of this study was to explore how secondary school teachers in Zimbabwe employ visual aids and their pedagogical justification in the teaching and learning of mathematical concepts in Sanyati district in Mashonaland West, Zimbabwe. It also looked at why teachers choose to use or not use these aids. The study also examined how teachers view the effectiveness of these aids. Finally, it sought to identify ways to improve the use of visual aids in mathematics education. The findings are based on data collected from nine secondary school mathematics teachers. These teachers were from three different schools in Sanyati district in Zimbabwe. All these teachers were interviewed and the collected data was analyzed using thematic analysis. This method helped to identify patterns and themes within the teachers' responses.

4.2. Presentation and analysis of findings

This section presents and analyses findings from the study.

4.2.1. How do secondary school teachers in Zimbabwe employ visual aids in their mathematics teaching?

This section presents and analyses the data related to the first research question. The analysis of teacher interviews revealed several key themes regarding their use of visual aids. These themes include the types of visual aids commonly used, the frequency of their use, and the factors influencing their selection.

4.2.1.1. Commonly used Visual Aids

Teachers reported using a range of visual aids in their mathematics lessons. The chalkboard was the most frequently mentioned tool. Teachers used it for writing notes, drawing diagrams, and solving problems. Other traditional aids, such as charts and models, were also mentioned. Some teachers created their own materials.

Teacher 1 stated, *"I mostly use the chalkboard. It is always there and easy to write on."* Similarly, Teacher 3 noted, *"The chalkboard is my main tool. I draw shapes and graphs on it."*

Teacher 5 added, *"Sometimes I bring in charts. These charts show formulas or properties of shapes."* Teacher 7 shared, *"I have made some models for geometry. Students can touch them and see the shapes better."* Teacher 9 explained, *"For basic concepts, I draw pictures on the board. This helps students see what I am talking about."*

This section highlights that traditional tools like chalkboards, charts, and physical models are the primary visual aids employed by teachers. The analysis suggests that these readily available and low-cost options form the backbone of visual instruction in Zimbabwean secondary schools, indicating a reliance on familiar and accessible methods.

4.2.1.2. Infrequent use of digital visual aids (smartboards, digital flash cards, PowerPoint presentations).

The use of digital visual aids was limited among the teachers. Few teachers reported using smart boards, digital flash cards, PowerPoint presentations and videos. When digital visual aids were used, it was often for specific topics or when resources were available. This theme highlights a gap in the integration of modern technology.

Teacher 2 commented, *"We have a computer lab, but it is rarely used for maths. It is difficult to book it."* Teacher 4 said, *"I have tried showing videos on my phone sometimes. But the screen is too small for the whole class."*

Teacher 6 mentioned, *"We do not have projectors in our classrooms. So, using digital visual aids content is hard."* Teacher 8 explained, *"I would like to use more online resources. However, internet access is a big problem at school."* Teacher 1 also noted, *"Digital visual aids are not common here. We rely on what we have."*

This section reveals a significant gap in the integration of digital visual aids to teach mathematics. The analysis shows that digital visual aids, such as smart boards, digital flash cards, PowerPoint presentations and videos are rarely used due to challenges like booking computer labs, small screen sizes, lack of equipment, and poor internet access.

4.2.1.3. Resource constraints impacting use

Teachers frequently cited a lack of resources as a major barrier to using more diverse visual aids. This included a shortage of materials, equipment, and even basic supplies. These constraints often forced teachers to rely on readily available, low-cost options.

Teacher 3 stated, *"We do not have enough teaching aids. We have to make do with what is available."* Teacher 5 explained, *"Buying materials is expensive. So, I draw everything on the board."*

Teacher 7 shared, *"If we had more models, I would use them more often. But they are hard to get."* Teacher 9 commented, *"The school does not have a budget for new visual aids. We use old charts that are sometimes torn."* Teacher 2 added, *"Even basic things like coloured chalk are sometimes scarce."*

This section underscores the pervasive challenge of limited resources. The analysis indicates that teachers are severely constrained by a shortage of materials, equipment, and even basic supplies, forcing them to rely on improvisation and readily available, often less effective, alternatives. This directly impacts the diversity and quality of visual aids used.

4.2.1.4. Teacher-Made Materials

Many teachers reported creating their own visual aids. This was often a response to the lack of commercially available resources. These materials included hand-drawn charts, improvised models, and simplified diagrams. This showed teachers' efforts to overcome resource limitations.

Teacher 4 said, *"I draw my own charts. It takes time, but it helps explain things."* Teacher 6 explained, *"For fractions, I cut out paper shapes. This helps students see the parts."* Teacher 8 noted, *"I make simple models using cardboard. It is not perfect, but it works."* Teacher 1 shared, *"I often prepare my own diagrams before class. This saves time during the lesson."* Teacher 3 added, *"We share ideas among ourselves for making materials. It helps a lot."*

This section demonstrates teachers' proactive efforts to overcome resource limitations. The analysis shows that many teachers create their own visual aids, such as hand-drawn charts and improvised models. This highlights their dedication and adaptability in a resource-scarce environment, though it also implies an additional burden on their time and effort.

4.2.2. What form of pedagogical justifications do Zimbabwean secondary school teachers provide for their use or non-use of visual aids in mathematics teaching?

This section presents and analyses the data related to the second research question. The analysis of teacher responses revealed various reasons for their choices regarding visual aids.

These justifications related to student understanding, engagement, and practical considerations.

4.2.2.1. Justifications for using media

Teachers commonly justified the use of visual aids by highlighting its positive impact on student learning. They believed that visual aids made abstract concepts more concrete. They also felt these aids helped students understand difficult topics better. Another reason was to increase student interest and participation in lessons.

Teacher 1 stated, *"Visuals aids make abstract ideas clear. Students can see what I mean, especially in geometry."* Teacher 2 explained, *"When I use a chart, students grasp the concept faster. It is easier than just talking."* Teacher 4 commented, *"It helps students remember things. A picture stays in their mind longer than words."* Teacher 6 said, *"Students get more interested when I show them something. They pay more attention."* Teacher 8 noted, *"For algebra, drawing graphs helps them connect the numbers to a picture. They see the relationship."*

Teacher 3 added, *"It caters to different learning styles. Some students learn better by seeing."* Teacher 5 shared, *"It simplifies complex topics. Breaking it down visually makes it less scary for them."* Teacher 7 explained, *"When they see a model, they can manipulate it. This hands-on experience is good for understanding."* Teacher 9 said, *"It makes the lesson lively. It is not just me talking all the time."*

This section reveals that teachers primarily use visual aids to make abstract mathematical concepts more understandable and concrete for students. The analysis indicates a strong belief that visuals aids improve comprehension, aid memory, and increase student engagement and interest, catering to diverse learning styles.

4.2.2.2. Reasons for non-use of media

Teachers also provided reasons for not using visual aids more often. These reasons included time constraints, large class sizes, and a lack of specific training. Some teachers also felt that certain topics did not require visual aids. Practical challenges often outweighed the perceived benefits.

Teacher 1 stated, *"There is not enough time to prepare new visual aids for every lesson. The syllabus is too long."* Teacher 3 explained, *"With 60 students in a class, it is hard to use a*

small chart. Not everyone can see it." Teacher 5 commented, *"I haven't had training on how to use some of the newer technologies. So, I stick to what I know."*

Teacher 7 said, *"Some topics, like basic arithmetic, do not need many visuals aids. They are straightforward."* Teacher 9 noted, *"Setting up a projector takes time. Sometimes, it is just quicker to write on the board."* Teacher 2 added, *"The school timetable is tight. There is no extra time for elaborate preparations."* Teacher 4 shared, *"If a visual aid is not directly relevant to the specific concept, I do not use it. It can be a distraction."*

Teacher 6 explained, *"Managing materials in a crowded classroom is difficult. Things can get lost or broken."* Teacher 8 said, *"Sometimes, the effort to create a visual aid is too much for the benefit it provides for a single lesson."*

This section highlights the practical challenges teachers face that limit their use of visual aids. The analysis shows that time constraints, large class sizes, lack of training, and the perceived irrelevance of visuals for certain topics are significant barriers, often overriding the recognized benefits of these aids.

4.2.2.3. Beliefs about student learning styles

Teachers' justifications also reflected their beliefs about how students learn mathematics. Many teachers recognized that students have different ways of understanding information. They believed that visual aids helped address these diverse learning needs. This showed an awareness of pedagogical principles.

Teacher 1 said, *"Some students are visual learners. They need to see things to understand them fully."* Teacher 3 explained, *"I try to use visuals because not all students learn by listening. Some need to see the concept."* Teacher 5 commented, *"It helps bridge the gap for students who struggle with abstract thinking. They need a concrete starting point."*

Teacher 7 noted that, *"By using different methods, including visuals, I try to reach every student in the class."* Teacher 9 stated, *"It is about making the learning accessible to everyone. Visuals are a key part of that."* Teacher 2 added, *"If a student is stuck, a drawing can often unlock their understanding."*

When asked, Teacher 4 shared, *"I have seen students who were confused suddenly understand when I drew a diagram."* Teacher 6 explained, *"It is not just about teaching, but*

about ensuring students actually learn. Visuals help with that." Teacher 8 said, *"Some concepts are just too hard to explain with words alone. You need to show them."*

This section demonstrates teachers' awareness of varied student learning needs. The analysis indicates that teachers use visual aids to accommodate different learning styles, particularly for visual learners and those who struggle with abstract thinking, suggesting a pedagogical understanding of how visuals can bridge comprehension gaps.

4.3. Discussion of findings

This chapter discusses the findings presented in Chapter 4. It interprets these findings by comparing them with existing literature.

4.3.1. Dominance of traditional visual aids

This study's findings indicate that the chalkboard is the most commonly used visual aid. Teachers also frequently use charts and self-made models. This reliance on traditional media suggests that these are the most accessible and familiar tools for teachers. This finding is consistent with the general observation by Mangwende and Maharaj (2018) that many teachers do not use digital visual aids, implying a continued dependence on conventional methods. The use of traditional aids also reflects the resource constraints discussed later.

The study found that the use of digital visual aids, such as smart boards, digital flash cards, PowerPoint presentations and videos is infrequent. Teachers reported difficulties in booking computer labs, small screen sizes, lack of equipment, and poor internet access as barriers. This finding strongly supports the research by Mangwende and Maharaj (2018, 2020), who identified limited digital visual aids use and barriers like lack of resources and teacher preparedness in Zimbabwean mathematics classrooms. Oyedele, Rwambiwa, and Mamvuto (2018) also observed that trainee teachers rarely used educational media and technology due to insufficient or non-working facilities in schools.

While some recent studies, such as Mutambara and Tsakeni (2022) and Ganyani and Muchemwa (2024), highlight efforts to use social media pedagogies and smartphones, particularly during the COVID-19 pandemic where some digital visual aids are found, this study's findings suggest that these efforts remain isolated or limited in broader classroom practice. The general trend observed in this study is still one of infrequent digital visual aids use, indicating that despite some innovative attempts, widespread integration is yet to occur.

The study's findings consistently show that a lack of resources is a major barrier to using diverse visual aids. Teachers cited shortages of materials, equipment, and basic supplies. This forces them to rely on readily available, low-cost options. This finding directly corroborates the barriers identified by Mangwende and Maharaj (2020), which include a lack of resources. Oyedele, Rwambiwa, and Mamvuto (2018) also noted that inadequate and non-functioning facilities hindered the use of educational media. The findings underline that resource availability is a critical factor influencing the types and frequency of media employed by teachers.

A notable finding is that many teachers create their own visual aids. This is often a direct response to the lack of commercially available resources. This practice, involving hand-drawn charts and improvised models, demonstrates teachers' resourcefulness and dedication in overcoming limitations. While the provided literature does not directly address teacher-made materials as a specific theme, it indirectly relates to the broader context of resource scarcity and teachers adapting to their environment. This practice can also be seen as a form of "cultural resource" integration, as teachers adapt available materials to their specific teaching needs, similar to how cultural practices are integrated into mathematics (Chikodzi, 2022; Sunzuma and Maharaj, 2020).

4.3.2. Pedagogical justifications for visual aids use

This section discusses the pedagogical reasons teachers provide for using or not using visual aids. The findings align with existing literature on teachers' beliefs about student learning and the practicalities of classroom instruction.

Teachers in this study justified using visual aids primarily by its perceived positive impact on student learning and engagement. They believed visuals make abstract concepts concrete, improve understanding, and increase student interest. This aligns with Ocampo et al. (2023), who highlight that interactive media can enhance learning for students with different preferences. The finding that visual aids increases student engagement is supported by Koyuncu (2024), who found that creating digital visual aids deepened student engagement.

Furthermore, teachers' belief that visual aids simplifies complex topics and aids memory resonates with Sunzuma and Maharaj (2021), who found that integrating ethno mathematical approaches (a form of culturally relevant media) enriched mathematical understanding by connecting abstract geometry to students’ lived experiences. The desire to develop students'

technological skills, as mentioned by teachers, is also supported by Getenet (2017), who argues that integrating technology enhanced visual aids prepares students for a digital world. The use of visuals to cater to diverse learning styles, including multilingual learners, echoes Cavalcante et al. (2023), who showed how language-friendly digital visual aids empowered teachers to address student needs. The adaptive use of educational videos, pictures and worked examples during the pandemic, as noted by Mutambara and Tsakeni (2022), also reflects teachers' pedagogical justification driven by necessity and the goal of supporting learner autonomy.

The study's findings reveal several reasons why teachers do not use visual aids more often, including time constraints, large class sizes, and lack of training. These align with existing literature. The lack of confidence in visual pedagogical content knowledge (VPCK) is a significant barrier, as found by Sunzuma and Luneta (2022), where pre-service teachers reverted to traditional methods due to low confidence and lack of digital visual aids. Insufficient training, as reported by teachers in this study, is also a major barrier identified by Sunzuma and Maharaj (2021) regarding inconsistent use of ethnomathematics.

Concerns about the relevance of certain media for specific topics and institutional factors like curriculum demands also emerged in this study. This is consistent with the literature, which notes that if the curriculum is prescriptive, teachers may prioritize traditional methods. Resource availability, a key reason for non-use in this study, is a widely recognized challenge; Oyedele, Rwambiwa, and Mamvuto (2018) specifically highlighted inadequate and non-functioning facilities as a reason for rare use of teaching aids.

Teachers' justifications for using visual aids often stemmed from their beliefs about diverse student learning styles. They recognized that students learn in different ways and that visual aids can help bridge comprehension gaps for those who struggle with abstract thinking. This finding is consistent with the broader pedagogical principle that visual aids can cater to diverse learning preferences, as highlighted by Ocampo et al. (2023). It shows that teachers are aware of the need for varied approaches to reach all students.

4.4. Chapter Summary

Chapter 4 discussed the study's findings on the employment of visual aids by secondary school mathematics teachers from three selected secondary schools in Sanyati district in Mashonaland West, Zimbabwe. It highlighted a reliance on traditional visual aids due to resource constraints and limited digital tool integration, despite teachers' efforts to create their

own materials. The chapter also explored teachers' pedagogical justifications for using visual aids, primarily focusing on enhanced comprehension, increased engagement, and catering to diverse learning styles, while acknowledging barriers like time and lack of training.

CHAPTER FIVE

5.0.SUMMARY, DISCUSSIONS ,CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This chapter provides a concise summary of the study. It then presents the conclusions drawn from the findings. Finally, it offers recommendations based on the research and suggests areas for future investigation.

5.2. Summary of the study

This study explored how secondary school mathematics teachers in Zimbabwe employ visual aids. It also examined their reasons for using or not using these aids. Furthermore, it investigated teachers' views on the effectiveness of visual aids for student learning. The study aimed to identify ways to improve the integration of visual aids in mathematics teaching.

Chapter One established the research context and problem. It highlighted the global and local need to understand teacher practices. It also outlined the study's objectives and research questions. Chapter Two provided a comprehensive review of existing literature. It showed that while teachers recognize media's potential, actual use is often limited by infrastructure and training gaps. Chapter Three detailed the qualitative methodology. It described the interpretivist philosophy and descriptive phenomenological design. A purposive sample of nine mathematics teachers from three schools was selected. Data was collected through semi-structured interviews and classroom observations. Thematic analysis was used for data interpretation. Ethical considerations were also addressed.

The major findings indicated that teachers primarily use traditional visual aids like chalkboards and charts. Digital tool use remains infrequent due to resource limitations. Teachers often create their own materials to overcome these challenges. Justifications for media use included improved student comprehension, increased engagement, and catering to diverse learning styles. However, non-use was attributed to time constraints, large class sizes, and a lack of training. Teachers generally perceived visual aids as effective for learning and engagement. Yet, they faced challenges in formally measuring this effectiveness. Key recommendations emerged, focusing on training, resource provision, curriculum support, and sharing best practices.

5.3. Discussion

This chapter discusses the findings of the study on how Zimbabwean secondary school teachers employ visual aids and their pedagogical justification in the teaching and learning of mathematical concepts.

5.3.1. How do secondary school teachers in Zimbabwe employ visual aids in their mathematics teaching?

The findings of this study indicate that the use of visual aids varies significantly across secondary schools in Zimbabwe. Many teachers predominantly use traditional visual aids such as chalkboards, charts and printed diagrams. These aids are easy to get and teachers use them to represent abstract mathematical ideas more clearly. Some teachers also use modern digital visual aids such as educational videos and projectors especially in schools with better infrastructure. The use of these digital visual aids is linked to increased student engagement and improved conceptual understanding of mathematics. However, due to inadequate resources in schools, some teachers resort to improvisation that is creating visual aids from locally available resources. This reflects teacher creativity and adaptability in the face of limited support. On the other hand, some teachers reported not using visual aids at all because of lack of financial support to procure required materials, large class sizes, time pressure or limitations and limited professional development on how to effectively integrate visual aids in teaching and learning mathematics. This aligns with existing literature that emphasizes the importance of both access to resources and teacher preparedness in effective visual aids integration.

5.3.2. What form of pedagogical justifications do Zimbabwean secondary school teachers provide for their use or non-use of visual aids in mathematics teaching?

Teachers who actively use visual aids provided several pedagogical justifications. They argued that visual aids help to stimulate learners' interest to learn, motivation, active participation and improve understanding of abstract and complex mathematical concepts. These tools were praised for making abstract concepts more concrete. Teachers highlighted that visual aids enhance comprehension of mathematical concepts and accommodate all learners from different backgrounds. In contrast, teachers who reported limited or no use of visual aids justified this by pointing to barriers such as financial constraints, inadequate training, lack of time for preparation and pressure to cover the syllabus. Some teachers also mentioned large class sizes as a challenge to effectively employ visual aids in their

mathematics teaching. The discussion reveals that the decision to use or not use visual aids is rarely about rejecting their pedagogical value. Instead, it reflects a range of limitations that must be addressed to promote a broader and more effective integration of visual aids in mathematics education.

5.4. Conclusions

Based on the study's findings, several conclusions can be drawn regarding the employment of visual aids and their pedagogical justifications in the teaching and learning of mathematics in Zimbabwean secondary schools.

5.4.1. How do secondary school teachers in Zimbabwe employ visual aids in their mathematics?

This research study reveals that Zimbabwean secondary school teachers employ visual aids in different ways depending on accessibility of visual aids, training of teachers and the location or set up of the school. Most secondary school teachers rely on traditional visual aids such as chalkboard, hand drawn charts and some models particularly in schools with limited technological resources. This reliance is largely due to the limited availability of modern digital visual aids and the pervasive issue of resource scarcity in schools. Few secondary school teachers in well resourced schools use modern digital visual aids like educational videos, projectors or power point presentation to enhance teaching and learning of mathematical concepts. Additionally, where standard visual aids are not available, teachers improvise using low cost , locally available materials to help learners to visualise mathematical concepts. However, the use of visual aids remain inconsistent across Zimbabwean secondary schools due to factors like unequal access to visual aids or resources and varying teacher competencies.

5.4.2. What form of pedagogical justifications do Zimbabwean secondary school teachers provide for their use or non-use of visual aids ?

Teachers provide clear pedagogical justifications for their use of visual aids. They believe that visual aids enhance student understanding by making abstract concepts concrete. Teachers who use visual aids insist that visual aids improve student engagement, motivation and comprehension of mathematical concepts. Also, visual aids can stimulate learners' interest to learn and promote active participation .On the other hand, teachers who do not use visual aids identified several factors such as financial constraints that prevents schools from

procuring standard visual aids, lack of knowledge on how to use some modern digital visual aids, time limitations , large class sizes and the pressure to cover the syllabus within the required time frame. These challenges hinder the effective integration of visual aids in the teaching and learning of mathematics.

5.5. Recommendations

Based on the study's conclusions, the following recommendations are made for various stakeholders to enhance the effective use of visual aids in mathematics education in Zimbabwean secondary schools.

5.5.1. Investment in Infrastructure and Resources

The Ministry of Primary and Secondary Education, along with school authorities, should prioritize significant investment in essential infrastructure. This includes ensuring reliable electricity supply, providing functional computing devices, and establishing consistent internet access in all secondary schools. Adequate funding should also be allocated for procuring a diverse range of visual aids, such as charts, models, and basic supplies. This will reduce teachers' reliance on improvised materials and enable broader media use.

5.5.2. Development of localized educational applications

Educational technology developers, in collaboration with local universities and experienced mathematics teachers, should focus on creating localized educational applications. These digital tools should be specifically tailored to the Zimbabwean mathematics heritage based curriculum and cultural context. Such apps could incorporate local examples, relevant problem-solving scenarios, and, where appropriate, vernacular languages. This will ensure that digital media is both accessible and pedagogically relevant to students' lived experiences.

5.5.3. Comprehensive professional development

Teacher training institutions and the Ministry of Education should offer comprehensive and on going professional development programs. These programs must be practical and hands-on, focusing on how to pedagogically integrate various types of instructional media into specific mathematics topics. Training should cover both traditional and digital tools, addressing technological skills and effective teaching strategies. This will build teachers' confidence and competence in using media effectively.

5.5.4. Encouragement of diverse media use

Schools and teacher professional bodies should actively encourage teachers to explore and utilize a diverse range of instructional media. This includes traditional visual aids, manipulatives, digital simulations, educational videos, and interactive whiteboards. Professional development and school-level support should guide teachers in selecting the most appropriate media for different mathematical concepts and student learning styles.

5.5.5. Curriculum integration and support

The national mathematics curriculum should explicitly integrate and support the use of visual aids. Curriculum developers should provide clear guidelines and examples of how specific visual aids and digital tools can be used to achieve learning objectives. This integration will ensure that media is seen as a central component of mathematics instruction, rather than an optional addition, promoting consistent and purposeful use across all schools.

5.6. Suggestions for Future Research

This study provides valuable insights into the employment and justification of visual aids. However, it also highlights areas that warrant further investigation. Future research could conduct quantitative studies to measure the direct impact of specific types of visual aids on student performance and learning outcomes. This would provide empirical evidence to complement the qualitative perceptions gathered in this study. Additionally, research could explore the role of school leadership and administrative support in promoting or hindering the integration of visual aids. Intervention studies could also be designed to test the impact of specific training programs or resource provision initiatives on teacher practices and student learning.

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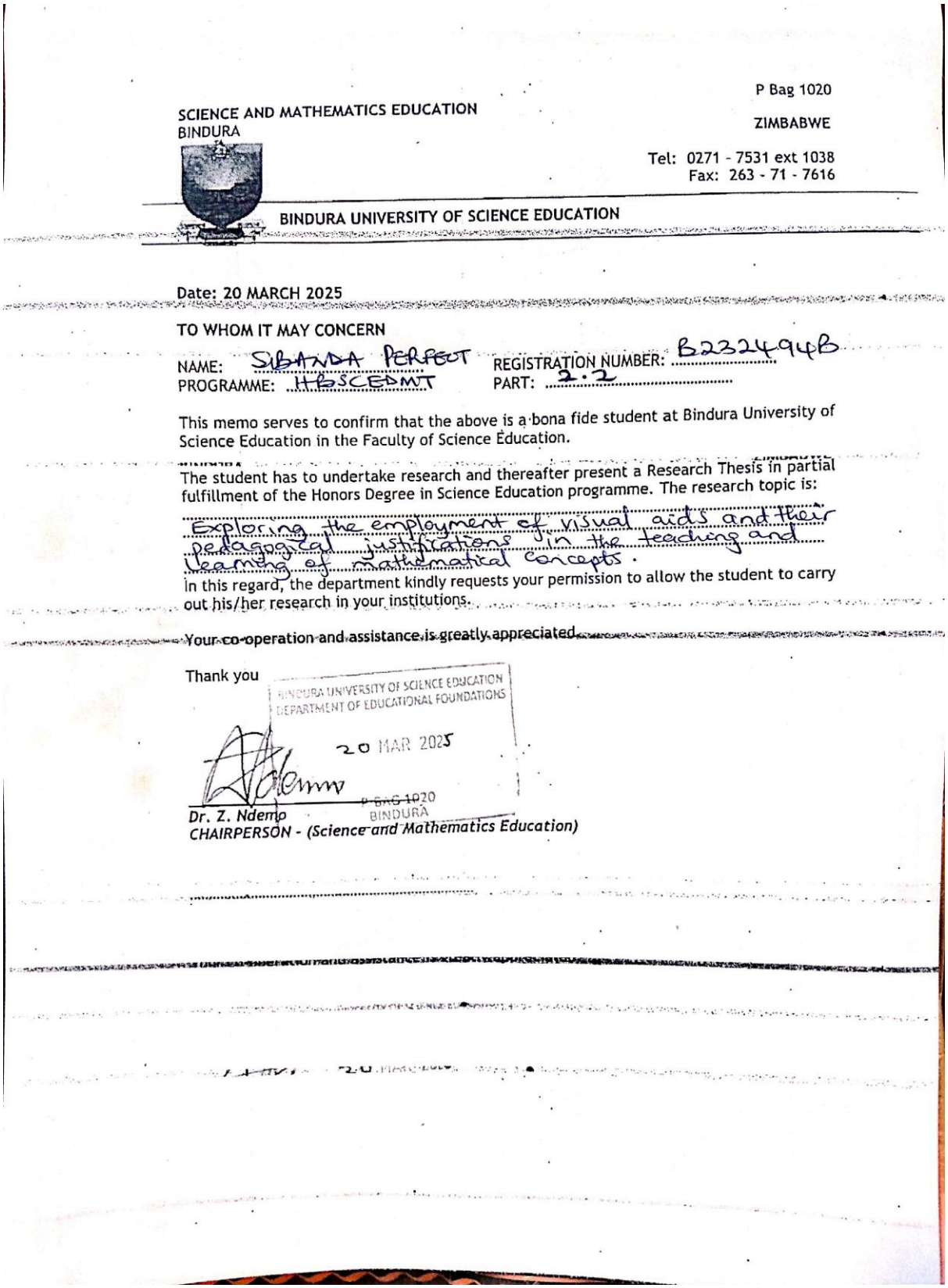
APPENDICES

APPENDIX A: INTRODUCTORY LETTER FROM BINDURA UNVIVERSITY OF SCIENCE EDUCATION.



SCIENCE AND MATHEMATICS EDUCATION
BINDURA

P Bag 1020
ZIMBABWE
Tel: 0271 - 7531 ext 1038
Fax: 263 - 71 - 7616

BINDURA UNIVERSITY OF SCIENCE EDUCATION

Date: 20 MARCH 2025

TO WHOM IT MAY CONCERN

NAME: SIBANDA PERFECT REGISTRATION NUMBER: B2324948
PROGRAMME: HBSCEDMT PART: 2.2

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

The student has to undertake research and thereafter present a Research Thesis in partial fulfillment of the Honors Degree in Science Education programme. The research topic is:

Exploring the employment of visual aids and their pedagogical justifications in the teaching and learning of mathematical concepts.

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

Your co-operation and assistance is greatly appreciated.

Thank you

BINDURA UNIVERSITY OF SCIENCE EDUCATION
DEPARTMENT OF EDUCATIONAL FOUNDATIONS
20 MAR 2025
P BAG 1020
BINDURA

Dr. Z. Ndemo
CHAIRPERSON - (Science and Mathematics Education)

APPENDIX B : LETTER REQUESTING FOR PERMISSION TO COLLECT DATA TO THE MINISTRY OF PRIMARY AND SECONDARY EDUCATION.

Bindura University of Science Education

P.O. Box 1020

Bindura

04 August 2025

The Secretary

Ministry of Primary and Secondary Education

P.O.Box CY 121

Causeway

HARARE

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CONDUCT A RESEARCH PROJECT IN SELECTED SECONDARY SCHOOLS IN SANYATI DISTRICT, MASHONALAND WEST PROVINCE.

The above subject refers:

I am a final year Bachelor of Science Education (Mathematics) student at Bindura University of Science Education, currently undertaking a research project as part of the requirements for my degree . The research topic reads, **"Exploring the employment of visual aids and their pedagogical justification in the teaching and learning of mathematical concepts."** I respectfully seek permission from your esteemed office to conduct this research in the following secondary schools : Kwayedza Secondary School, Rotterview Academy and Brightlight Secondary School.

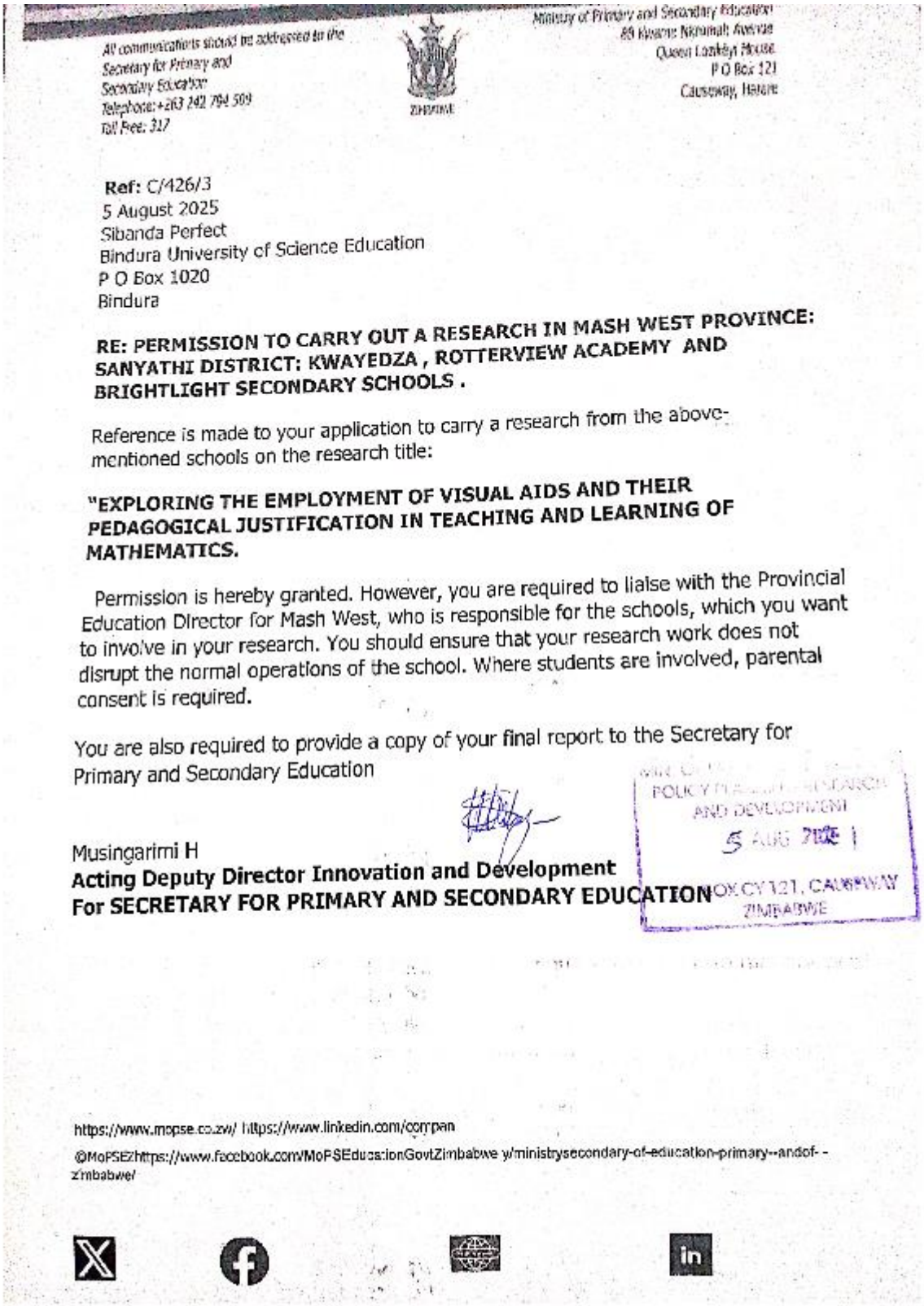
The study will involve selected mathematics teachers from the mentioned schools. Data will be collected using interviews and classroom observations. Attached to this letter is letter obtained from Bindura University of Science Education. The collected data will be treated with maximum confidentiality and the researcher will only collect data that answers to his research questions.

Your cooperation and assistance is greatly appreciated

Yours faithfully

Sibanda Perfect(B232494B)

APPENDIX C : LETTER FROM THE MINISTRY OF PRIMARY AND SECONDARY EDUCATION GRANTING PERMISSION TO COLLECT DATA



All communications should be addressed to the Secretary for Primary and Secondary Education
Telephone: +263 242 794 509
Toll Free: 317

ZIMBABWE

Ministry of Primary and Secondary Education
89 Kwame Nkrumah Avenue
Queen Lozikeyi House
P O Box 121
Causeway, Harare

Ref: C/426/3
5 August 2025
Sibanda Perfect
Bindura University of Science Education
P O Box 1020
Bindura

RE: PERMISSION TO CARRY OUT A RESEARCH IN MASH WEST PROVINCE: SANYATHI DISTRICT: KWAYEDZA , ROTTERVIEW ACADEMY AND BRIGHTLIGHT SECONDARY SCHOOLS .

Reference is made to your application to carry a research from the above-mentioned schools on the research title:

"EXPLORING THE EMPLOYMENT OF VISUAL AIDS AND THEIR PEDAGOGICAL JUSTIFICATION IN TEACHING AND LEARNING OF MATHEMATICS.

Permission is hereby granted. However, you are required to liaise with the Provincial Education Director for Mash West, who is responsible for the schools, which you want to involve in your research. You should ensure that your research work does not disrupt the normal operations of the school. Where students are involved, parental consent is required.

You are also required to provide a copy of your final report to the Secretary for Primary and Secondary Education

POLICY ... AND DEVELOPMENT
5 AUG 2025
BOX CY 121, CAUSEWAY
ZIMBABWE

Musingarimi H
Acting Deputy Director Innovation and Development
For SECRETARY FOR PRIMARY AND SECONDARY EDUCATION

https://www.mopse.co.zw/ https://www.linkedin.com/compan
@MoPSEzhttps://www.facebook.com/MoPSEducationGovtZimbabwe y/ministrysecondary-of-education-primary--andof- - zimbabwe/

CamScanner

APPENDIX D : LETTER TO THE PROVINCIAL EDUCATION DIRECTOR REQUESTING FOR PERMISSION TO COLLECT DATA

Bindura University of Science Education

P.O. Box 1020

Bindura

04 August 2025

The Provincial Education Director

Ministry of Primary and Secondary Education

Chinhoyi

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CONDUCT A RESEARCH PROJECT IN SELECTED SECONDARY SCHOOLS IN SANYATI DISTRICT, MASHONALAND WEST PROVINCE.

The above subject refers:

I am a final year Bachelor of Science Education (Mathematics) student at Bindura University of Science Education, currently undertaking a research project as part of the requirements for my degree . The research topic reads, **"Exploring the employment of visual aids and their pedagogical justification in the teaching and learning of mathematical concepts."** I respectfully seek permission from your esteemed office to conduct this research in the following secondary schools : Kwayedza Secondary School, Rotterview Academy and Brightlight Secondary School.

The study will involve selected mathematics teachers from the mentioned schools. Data will be collected using interviews and classroom observations. Attached to this letter is letter obtained from Bindura University of Science Education. The collected data will be treated with maximum confidentiality and the researcher will only collect data that answers to his research questions.

Your cooperation and assistance is greatly appreciated

Yours faithfully

Sibanda Perfect(B232494B)

APPENDIX E : LETTER FROM THE PROVINCIAL EDUCATION DIRECTOR GRANTING PERMISSION TO COLLECT DATA.

All communications should be addressed to
"The Provincial Education Director"
Telephone: 067-23043/25655
Tele Fax: 067-23320
Email edumashwest@gmail.com

ZIMBABWE

Ministry of Primary & Secondary Education
Mashonaland West Province
P.O Box 328
Chinhoyi
6/8/2025

The District Schools Inspector
SANYATI District

AUTHORITY TO CARRY OUT EDUCATIONAL RESEARCH: SCHOOLS IN
SANYATI **DISTRICT: MR/MRS/MS:** PERFECT SIBANDA
EC.NO/IDNO. 19750790P **STATION** PATCHWAY PRIMARY SCHOOL
DISTRICT SANYATI **INSTITUTION** BINDURA UNIVERSITY
REG.NO. B2324948B **PROGRAMME** B.Sc. MATHEMATICS

The above named student has been granted authority by the Provincial Education Director to carry out a research in SANYATI District. The student has been advised to visit your office before entering the schools.

Research Topic EXPLORING THE EMPLOYMENT OF VISUAL AIDS AND THEIR PEDAGOGICAL JUSTIFICATIONS IN THE TEACHING AND LEARNING OF MATHEMATICAL CONCEPTS

Period of research 4 AUGUST 2025 TO 31 AUGUST 2025

Targeted school/s. KWANEDZA, BRIGHTLIGHT SECONDARY SCHOOLS AND ROTTERVIEW ACADEMY.

Method of research. INTERVIEWS, QUESTIONNAIRES & OBSERVATIONS.

Please ensure that the learning and teaching programmes at the targeted schools are not interrupted in any way; the student strictly adheres to the activities and topics specified in his/her letter of request and that the research should be conducted according to the given time frame.

The District Schools Inspector is requested to liaise with the researcher on the specific schools where the research will be conducted and advise the Provincial Office of the chosen schools. Furthermore, the District Schools Inspector should ensure that a copy of the research findings is submitted to the Provincial Education Director once the research is completed.

Chemusandu. F.
FOR ACTING PROVINCIAL EDUCATION DIRECTOR
MASHONALAND WEST PROVINCE

APPENDIX F: DATA COLLECTION INSTRUMENTS

APPENDIX 1 :INTERVIEW GUIDE FOR MATHEMATICS TEACHERS

1.How do you teach new concepts to the learners in mathematics ?

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2.How do you engage your learners during your mathematics lesson ?

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3.What do you anticipate from the learners if visual aids are used to teach mathematics ?

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4.Which types of visual aids do you use when teaching mathematics ?

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5. How often do you use visual aids in your lesson ?

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6. Can you describe a recent lesson when you used visual aids ?

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7.What are the factors that influence your decision to use or not use visual aids in the teaching and learning of mathematics ?

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8 . Are visual aids important or not in the teaching and learning of mathematics ? Give a reason

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9. What do you think about the use of visual aids to illustrate abstract concepts ?

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10. What is your view about the use of visual aids for teaching mathematics ?

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11.What challenges do you face in using visual aids ?

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12.How do your students respond when you use visual aids ?

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13. Have you noticed any changes in your students' performance or engagement when you use visual aids ?

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14. Do you think visual aids help students to understand abstract concepts ?

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15.What support or training do you think is needed to improve the integration of visual aids in your teaching ?

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16.What do you think can be done to make the use of visual aids effective in the teaching and learning of mathematics ?

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17.What recommendations would you like to give to the Ministry of Primary and Secondary Education to improve on the use of visual aids in the teaching and learning of mathematical concepts ?

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APPENDIX 2 : CLASSROOM OBSERVATION

Focus area Indicators to observe	**YES/NO**	**NOTES**
Are visual aids used during the lesson ?		
Type of visual aids e.g. chart, digital tools, models		
Are visual aids appropriate for the topic ?		
Are learners actively engaged when visual aids are used ?		
Are visual aids clear and understandable?		
Does the teacher use visual aids during explanations ?		
Does the use of visual aids help the learners to comprehend the concept ?		
Challenges noticed in using visual aids		