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INTEGRATING AFRICAN INDIGENOUS KNOWLEDGE SYSTEMS INTO PRIMARY SCHOOL MATHEMATICS

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ABSTRACT

This study explores the integration of African Indigenous Knowledge Systems (AIKS) into the teaching and learning of primary school mathematics. The research is premised on the understanding that indigenous knowledge embodies mathematical ideas such as measurement, classification, patterning, estimation, and problem-solving, which can be harnessed to enrich classroom instruction. Guided by the interpretivist paradigm, the study employed a qualitative research design to investigate how African cultural practices and everyday experiences can be used to contextualize mathematical concepts for learners. Data was collected through semi-structured interviews with teachers in selected primary schools. Purposive sampling was used to select 15 participants. The research revealed that integrating Indigenous Knowledge Systems (IKS) into primary school mathematics enriches the curriculum by making it more culturally relevant, inclusive, and contextually meaningful for learners. The findings demonstrated that Indigenous knowledge contains deeply embedded mathematical ideas that, when thoughtfully incorporated into teaching, enhance learners' conceptual understanding and engagement. The study concluded that integrating AIKS into primary mathematics instruction holds significant pedagogical value and recommends curriculum development, teacher professional development, and policy support to ensure successful adoption.

Key words: African Indigenous Knowledge Systems; Primary mathematics; Ethno mathematics; culturally responsive pedagogy; Zimbabwe.

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CHAPTER 1

1.0 Introduction

Mathematics education plays a crucial role in shaping the cognitive and problem-solving abilities of learners, particularly at the primary school level. However, the teaching of mathematics in many countries, including Zimbabwe, has often been dominated by Western frameworks that overlook the rich mathematical knowledge embedded in Indigenous cultures. According to Chikunda (2017), Indigenous Knowledge Systems (IKS), which encompass the practical, cultural, and spiritual l knowledge passed down through generations, offer valuable mathematical insights that are relevant, context-specific, and aligned with local ways of life. These systems of knowledge, which include traditional practices such as counting, measuring, and geometric design, have been largely side lined in the formal curriculum.

This research seeks to explore the integration of Indigenous Knowledge Systems into the primary school mathematics curriculum in Zimbabwe. By examining how local mathematical practices can be effectively incorporated into teaching strategies, this study aims to bridge the gap between formal education and the everyday mathematical knowledge of learners. Integrating IKS into mathematics education not only makes learning more relevant and engaging for students but also affirms their cultural identities and promotes a more inclusive and decolonized educational system.

1.1 Background of the study

Current educational practices frequently marginalize non-Western knowledge systems, resulting in disengagement among Indigenous learners and a narrow perspective of mathematical knowledge (Mavhunga , 2018). Numerous studies highlight the benefits of culturally responsive teaching in improving student engagement and academic performance. However, limited empirical research exists on the systematic integration of IKS into mathematics curricula, particularly at the foundational level of primary education. This research seeks to bridge that gap by exploring effective ways to incorporate Indigenous mathematical knowledge into classroom practice.

Mpofu and Mawere (2020) argues Zimbabwe's educational system, like many post-colonial systems, has been heavily influenced by Western models of knowledge and teaching. While the Zimbabwean primary school mathematics curriculum aims to provide students with the skills necessary to succeed in a globalized world, it often neglects the rich cultural and

mathematical practices inherent in the country's Indigenous communities (Mutekwe, 2020). These practices, which include traditional knowledge about geometry, counting, measurement, and agriculture, are integral to daily life in many rural areas but are rarely acknowledged in the formal curriculum.

The Zimbabwean curriculum, like many other education systems in sub-Saharan Africa, has long prioritized Western mathematical concepts, which may not always resonate with the lived experiences of students from rural or Indigenous backgrounds. Muchenje (2016) posits that many learners, particularly those from Indigenous communities, may struggle to relate to the abstract and theoretical nature of traditional mathematics instruction. This disconnect can lead to a lack of engagement, low academic performance, and a diminished sense of self-worth among learners who feel that their cultural backgrounds are not valued in the educational process.

According to Chikunda (2017), Indigenous Knowledge Systems, on the other are deeply embedded in the daily lives of learners, especially those from rural and Indigenous communities. Local communities possess sophisticated methods of measuring land, counting livestock, designing structures, and calculating quantities, all of which can provide authentic contexts for learning mathematical concepts (Mutekwe, 2020). These traditional mathematical practices have been developed over centuries, offering an alternative approach to problem-solving and critical thinking that could enhance students' understanding of mathematics in school (Mutekwe, 2020).

Research across the globe has shown that Indigenous cultures contain rich mathematical practices. For instance, studies by Barton (2016) and Gerdes (2018) illustrate how Indigenous communities use spatial reasoning, measurement, and pattern recognition in daily life. Examples include the symmetrical designs in African basket weaving, complex counting systems among Aboriginal Australians, and architectural precision in traditional African huts.

These practices provide authentic, real-world contexts for mathematical concepts such as geometry, arithmetic, and algebra. Incorporating them into formal education can foster a deeper conceptual understanding by linking school mathematics with learners' lived experiences. Furthermore, it counters the misconception that mathematics is a culturally neutral or exclusively Western discipline.

Zimbabwe's primary school curriculum acknowledges the importance of local knowledge in subjects such as agriculture and heritage studies. However, mathematics remains heavily influenced by Eurocentric content and teaching methods. The Curriculum Framework for Primary and Secondary Education (2015–2022) encourages contextual and heritage-based learning but lacks specific guidelines for incorporating IKS into mathematics.

Studies by Chikunda (2017) and Mavhunga (2018) highlight that while teachers express interest in integrating local knowledge; they often lack the pedagogical training, curriculum support, and teaching materials to do so effectively. There is a gap between policy aspirations and classroom practice. Furthermore, the exclusion of elders and community knowledge holders from formal education limits access to rich Indigenous mathematical content.

Zimbabwe has a wealth of Indigenous mathematical knowledge embedded in everyday cultural practices. Chikunda (2017) argues that cultural practices not only demonstrate logical reasoning and numerical understanding but also provide authentic contexts for teaching key mathematics concepts in primary education. According to Chikunda (2017), Shona and Ndebele communities traditionally used body-part counting systems and group-based counting for trade and household activities. For example, counting cattle, grain, or harvested crops involved bundling units into fives or tens, which mirrors base-10 and grouping concepts in formal mathematics (Chikunda, 2017). As noted by Mavhunga (2018), certain Indigenous languages also have distinct number words that reflect cultural ways of quantifying and categorizing objects. Traditional methods of measuring land, volume, and distance such as using strides (nhanho), arm lengths (ruoko), or containers like gango and hwiza demonstrate knowledge of non-standard units of measurement (Mavhunga, 2018). These methods can be linked to formal units and provide an accessible entry point to measurement topics in school

Mavhunga (2018) argues that by incorporating cultural practices into primary mathematics education, teachers can create lessons that are not only pedagogically sound but also culturally affirming and engaging. These practices demonstrate that mathematics is a universal language expressed differently across cultures and can enhance learners' appreciation of their heritage while improving mathematical understanding.

According to Chikunda (2017), the Zimbabwean primary school syllabus encourages a shift towards more inclusive teaching practices, but the integration of IKS into the mathematics curriculum remains underexplored. There is limited empirical research on how IKS can be

incorporated into formal mathematics education, and teachers often lack the training or resources to do so effectively. Moreover, there is insufficient clarity in the curriculum on how IKS can be meaningfully incorporated into mathematics lessons. As such, there is a need for a systematic exploration of how Indigenous mathematical knowledge can be integrated into the existing curriculum in ways that are pedagogically sound and culturally relevant.

Chikunda (2017) posits that one of the primary benefits of integrating IKS into mathematics instruction is that it makes learning contextual and meaningful. Concepts such as counting, estimation, geometry, and measurement are already embedded in traditional practices like farming, architecture, crafts, and games (Zaslavsky, 2015; Gerdes, 2018). When learners are taught mathematics using examples and practices familiar from their cultural environment, they are more likely to grasp abstract ideas and retain knowledge (Mosimege, 2016). For instance, symmetry in basket weaving or patterns in beadwork can help learners understand geometric concepts better than abstract textbook examples.

Studies show that culturally relevant pedagogy, which includes IKS, increases learners' motivation, confidence, and participation in mathematics (Gay, 2019; Mawere, 2015). When students see their culture reflected in classroom content, they feel a greater sense of belonging and are more likely to engage with the material. This is particularly important in Zimbabwe, where students from rural and indigenous backgrounds may feel alienated by Western-oriented content (Shizha, 2018).

Integrating IKS helps bridge the cultural gap between school and home, thereby fostering inclusive learning environments. It validates the knowledge systems of marginalized communities and challenges the dominance of Eurocentric worldviews in education (Semali & Kincheloe, 2017; Mapara, 2016). In Zimbabwe, this promotes a sense of pride and identity among learners from indigenous communities and supports national goals of cultural preservation and decolonization of education (MoPSE, 2015).

IKS promotes experiential and reflective learning, which aligns well with modern pedagogical goals of inquiry-based and learner-centred teaching. Indigenous knowledge is not simply memorized; it is acquired through observation, participation, and problem solving in real-life contexts (Odora Hoppers, 2016). For example, traditional games like *tsoro* require strategic thinking and arithmetic, while agricultural planning involves logic, measurement, and prediction.

By embedding IKS in mathematics teaching, education becomes relevant to local needs and developmental goals. Learners are better equipped to apply mathematical reasoning to solve practical problems in their communities such as designing structures, managing resources, or improving agricultural yields (Mawere, 2015). This local relevance aligns with Zimbabwe's Curriculum Framework, which emphasizes a heritage-based and competence-oriented education (MoPSE, 2015).

When IKS is included in the mathematics curriculum, teachers are encouraged to diversify their teaching strategies and develop or use more interactive, place-based resources. This leads to improved pedagogical practices and deeper engagement with learners (Mtetwa & Garofalo, 2016). It also stimulates professional reflection and a re-evaluation of what constitutes valid mathematical knowledge.

This research, therefore, aims to investigate how Indigenous Knowledge Systems can be effectively integrated into primary school mathematics teaching in Zimbabwe. The study will explore the challenges, opportunities, and practical strategies for implementing IKS in the classroom, with a focus on enhancing student engagement, improving learning outcomes, and contributing to a more inclusive and decolonized curriculum. By addressing these gaps, this study seeks to contribute to the broader conversation on decolonizing education in Zimbabwe and other African countries, where the value of local knowledge is increasingly recognized as crucial for educational reform.

1.2 Statement of the problem

In Zimbabwe, the teaching and learning of mathematics at the primary school level remains largely influenced by Eurocentric models that prioritize abstract, decontextualized concepts and ignore learners' cultural backgrounds. This has contributed to a persistent disconnect between classroom mathematics and learners' everyday experiences, resulting in low engagement, limited conceptual understanding, and poor academic performance (Mtetwa & Garofalo, 2016). Despite the richness and relevance of African Indigenous Knowledge Systems (AIKS) such as traditional measurements, patterns in crafts and architecture, and problem-solving strategies in agriculture and trade, these culturally embedded knowledge forms are rarely acknowledged or integrated into the formal curriculum (Mawere, 2015).

This marginalization not only perpetuates the colonial legacy within the education system but also undermines the cultural identity and cognitive development of learners, particularly in

rural and peri-urban settings where indigenous knowledge is still widely practiced (Mapara, 2016). Moreover, the lack of teacher training and appropriate pedagogical frameworks for integrating indigenous knowledge into mathematics teaching further exacerbates the problem (Nherera, 2018). As a result, there is a critical need to explore how Indigenous Knowledge Systems (IKS) can be meaningfully integrated into primary school mathematics in Zimbabwe to promote culturally responsive teaching, foster deeper understanding of mathematical concepts, and enhance learner outcomes. Thus, this research aims to address this gap by investigating the integration of African Indigenous Knowledge into mathematics instruction at the primary level within the Zimbabwean education context.

1.3 Research questions

This research aims to answer the following questions:

1.3.1 What is the current state of Indigenous Knowledge Systems in the Zimbabwean primary school mathematics curriculum?

1.3.2 What Indigenous mathematical concepts and practices can be effectively integrated into primary school mathematics instruction?

1.3.3 What strategies and pedagogical approaches can be developed to integrate IKS into primary school mathematics teaching?

1.4 Research objectives

The primary aim of this research is to explore how Indigenous Knowledge Systems (IKS) can be effectively integrated into primary school mathematics education in Zimbabwe. The specific objectives of the study are:

1.4.1 To investigate the current state of Indigenous Knowledge Systems in the Zimbabwean primary school mathematics curriculum:

1.4.2 To identify Indigenous Knowledge practices and mathematical concepts that can be integrated into primary school mathematics teaching:

1.4.3 To propose strategies and pedagogical approaches for integrating IKS into primary school mathematics instruction.

1.5 Significance of the study

This research will contribute to decolonizing the curriculum, validating Indigenous knowledge, and promoting equity in education. It will also provide practical tools for teachers and inform policy development toward inclusive educational practices.

The Zimbabwean primary school mathematics syllabus emphasizes the integration of Indigenous Knowledge Systems (IKS) to create a more inclusive and culturally responsive educational experience. This approach aligns with national efforts to decolonize the curriculum and recognize the value of local knowledge in education. Curriculum. It contributes to ongoing efforts to decolonize the Zimbabwean education system by validating and incorporating Indigenous Knowledge Systems (IKS) into mainstream mathematics education. This helps create a curriculum that reflects the cultural heritage and lived experiences of learners.

By contextualizing mathematical concepts through familiar Indigenous practices, the research aims to increase learners' interest, participation, and motivation in mathematics, particularly among those from Indigenous and rural communities. Integrating culturally relevant examples and teaching methods can improve conceptual understanding and retention, leading to better academic performance in mathematics. The research will support teachers by providing strategies, training resources, and practical examples for integrating IKS into their teaching, enhancing their confidence and effectiveness in delivering culturally responsive education.

The findings can inform education policymakers and curriculum developers in Zimbabwe on how to systematically incorporate IKS into the national mathematics curriculum, promoting equity and inclusivity. By documenting and using Indigenous mathematical knowledge in formal education, the research also contributes to preserving and valuing cultural heritage that is at risk of being lost.

1.6 Limitations

Much of the Indigenous mathematical knowledge exists in oral form and is not formally documented, making it difficult to systematically collect and validate information for integration into the curriculum. Indigenous Knowledge Systems vary significantly between

ethnic groups and regions in Zimbabwe. This diversity may limit the generalizability of the research findings and require localized adaptation of any proposed teaching models. Some teachers may lack training, confidence, or willingness to integrate IKS into their teaching due to unfamiliarity with the content or a preference for conventional Western teaching methods. The rigid structure and time-bound nature of the existing national curriculum may restrict the extent to which teachers can incorporate IKS without compromising syllabus coverage. Schools, especially in rural areas, may lack the instructional materials and support needed to effectively integrate Indigenous knowledge into mathematics lessons. There may be resistance from parents, teachers, or policymakers who question the academic value or relevance of Indigenous knowledge in formal education, affecting the acceptance and implementation of the research outcomes. The translation of Indigenous concepts into classroom language (often English) may result in the loss of meaning or misinterpretation, affecting the accuracy and effectiveness of the integration. Despite these limitations, the research remains a critical step toward building a more inclusive and culturally relevant education system in Zimbabwe.

1.7 Delimitations

This research was limited to the integration of Indigenous Knowledge Systems into the mathematics curriculum at the primary school level (Grades 1–7) and does not extend to secondary or tertiary education. The study was conducted in selected schools within specific regions of Zimbabwe where Indigenous communities are actively engaged. It did not attempt to represent all regions or cultural groups in the country. The research focused solely on mathematics education and did not explore the integration of Indigenous Knowledge in other subject areas such as science, social studies, or language.

The study was conducted within a limited school term, which may not fully capture long-term effects or sustainability of integrating IKS in mathematics teaching. The study involved selected primary school teachers. Broader stakeholder groups such as policymakers or curriculum developers were not directly involved in data collection. The research prioritized mathematical concepts found in Indigenous practices such as games, crafts, agriculture, architecture, and trade, and did not cover spiritual or ceremonial aspects of Indigenous knowledge that may also involve mathematics. These delimitations helped narrow the research focus and ensured that it remains manageable, while still providing valuable insights into the integration of Indigenous Knowledge Systems into primary school mathematics.

1.8 Definitions of terms

Indigenous Knowledge Systems

Indigenous Knowledge Systems refer to the local, traditional knowledge that has been developed and passed down through generations within Indigenous communities (Chikunda,2017). It includes cultural practices, beliefs, languages, and problem-solving methods used to navigate the world. In the context of mathematics, it refers to the mathematical knowledge embedded in daily practices such as farming, architecture, trade, and crafts.

1.9 Organisation of the study

This research was organized into five comprehensive chapters, each addressing key components of the study in a systematic and logical manner:

Chapter One: Introduction

This chapter lays the foundation for the study by presenting the background and context of the research. It includes:

- Background of the Study
- Statement of the Problem
- Purpose of the Study
- Research Objectives and Questions
- Significance of the Study
- Limitations and Delimitations
- Definition of Key Terms
- Organization of the Study

Chapter Two: Literature Review

This chapter explores existing literature related to Indigenous Knowledge Systems (IKS) and mathematics education. It reviews global and Zimbabwean perspectives and highlights gaps in the current body of knowledge. Subsections include:

- The Concept of Indigenous Knowledge Systems
- The Role of Culture in Mathematics Education
- Theoretical Frameworks (e.g., Culturally Responsive Pedagogy, Sociocultural Theory)
- Global and Regional Case Studies on IKS Integration
- Review of the Zimbabwean Primary Mathematics Syllabus

- Summary and Research Gap

Chapter Three: Research Methodology

This chapter outlines the methods used to collect and analyse data. It includes:

- Research Design
- Population and Sampling Techniques
- Data Collection Methods (e.g., interviews, observations, document analysis)
- Data Analysis Procedures
- Ethical Considerations
- Validity and Reliability Measures

Chapter Four: Presentation and Analysis of Findings

This chapter presents the data collected from the field and analyses it in relation to the research questions and theoretical frameworks. It includes:

- Description of Participants
- Thematic Presentation of Results
- Interpretation of Findings
- Comparison with Literature

Chapter Five: Summary, Conclusions, and Recommendations

The final chapter provides a summary of the research, draws conclusions based on the findings, and offers recommendations. It includes:

- Summary of Key Findings
- Conclusions in Relation to Research Objectives
- Recommendations for Policy, Practice, and Further Research
- Limitations and Reflections

This structure ensures a clear, coherent, and comprehensive presentation of the research process and outcomes.

CHAPTER 2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1Introduction

This chapter presents theoretical frameworks and critical review of existing literature related to the integration of Indigenous Knowledge Systems (IKS) into primary school mathematics education. The literature review explores the current state of Indigenous Knowledge Systems in the Zimbabwean primary school mathematics curriculum, Indigenous Knowledge practices and mathematical concepts that can be integrated into primary school mathematics teaching, and strategies and pedagogical approaches for integrating IKS into primary school mathematics instruction.

2.1 Theoretical Foundations for Integration

This study is grounded on Culturally Responsive Pedagogy (CRP) and Sociocultural Theory to guide the integration of Indigenous Knowledge Systems (IKS) into primary school mathematics.

2.1.1 *Culturally Responsive Pedagogy (CRP):*

As advanced by Gay (2019), CRP emphasizes the use of students' cultural backgrounds to inform and enrich teaching practices. It argues that cultural relevance enhances engagement, comprehension, and student identity in learning. In mathematics, this involves designing lessons that reflect learners' Indigenous experiences. According to Gay (2019), Culturally Responsive Pedagogy (CRP) emphasizes the importance of using learners' cultural backgrounds, knowledge, and experiences as a foundation for effective teaching. It supports the idea that integrating Indigenous knowledge into mathematics helps bridge the gap between home and school, making learning more meaningful and accessible for students from diverse cultural backgrounds.

Culturally Responsive Pedagogy (CRP), as articulated by Gay (2019), is a teaching approach that recognizes the importance of including students' cultural references in all aspects of learning. It is rooted in the understanding that culture deeply influences the way students learn,

process information, communicate, and behave in the classroom. Mtetwa and Garofalo (2016) posits that CRP is more than just acknowledging cultural diversity, it is about using cultural knowledge, prior experiences, and performance styles of diverse students to make learning more relevant and effective.

CRP advocates for teaching that is relevant to students' lived experiences (Nherera, 2018). In the context of this research, this means integrating Indigenous Knowledge Systems (IKS) into mathematics to reflect the real-world practices and traditions of learners. For example, using Indigenous games, patterns, or farming practices to teach mathematical concepts like counting, measurement, or geometry. CRP maintains that all students are capable of high academic achievement. According to Mapera (2016), connecting mathematics to familiar cultural contexts, CRP helps eliminate barriers created by culturally distant curricula and builds confidence and competence among learners. This pedagogy shifts the focus from teacher-driven delivery to student-centred learning, where students' cultural identities and community knowledge are respected and used as a foundation for new learning.

Teachers practicing CRP seek to understand and affirm the cultural backgrounds of their students. In this case, that includes learning about local Indigenous mathematical concepts and finding ways to integrate them into formal instruction meaningfully and respectfully. CRP also encourages both teachers and students to recognize and challenge the power imbalances and historical injustices embedded in education systems (Mawere, 2015). Thus, Integrating IKS is a way of reclaiming space for marginalized knowledge systems and promoting educational equity.

In Zimbabwe's primary schools, CRP would involve:

- Using local measurement units and techniques from traditional agriculture or crafts to explain formal metric systems.
- Incorporating traditional storytelling or oral counting systems to teach sequences and patterns.
- Encouraging learners to share mathematical ideas and practices from their home or community contexts.

The benefits of CRP include the following:

- Increased Engagement: Students are more motivated and invested when they see their culture reflected in the curriculum.
- Improved Understanding: Teaching that connects to prior knowledge leads to deeper conceptual learning.
- Enhanced Identity and Inclusion: Students feel valued and respected, which contributes to a positive learning environment.

Culturally Responsive Pedagogy provides a powerful theoretical and practical foundation for integrating Indigenous Knowledge Systems into primary school mathematics. It ensures that mathematics education is inclusive, equitable, and empowering for all learners, especially those whose cultural knowledge has historically been excluded from formal education.

2.1.2 *Sociocultural Theory:*

Vygotsky's (1978) theory posits that learning is a socially mediated process shaped by cultural tools and interactions. Mathematical learning, therefore, must be situated within the cultural contexts of learners, using familiar artefacts, practices, and language to scaffold new knowledge. This theory highlights the social and cultural influences on learning and cognitive development. It supports the integration of Indigenous practices into teaching by recognizing that learning occurs in cultural contexts and through interaction with knowledgeable community members.

According to Mtetwa and Garofalo (2016), Sociocultural Theory support a holistic and inclusive approach to mathematics education, positioning Indigenous Knowledge not as supplementary, but as an integral and equal component of the learning process. Sociocultural Theory emphasizes that learning and cognitive development are deeply embedded in social and cultural context (Mapera, 2016). The theory asserts that knowledge is constructed through interaction with others and is influenced by the cultural tools, language, and practices of the society in which an individual is raised. It moves beyond the idea of learning as an isolated, individual activity to recognize the crucial role of community, culture, and social interaction in shaping understanding.

Vygotsky's (1978) theory emphasizes on the zone of proximal development (ZPD). This is the difference between what a learner can do independently and what they can achieve with guidance or collaboration. Within the ZPD, learners can grasp new concepts when teachers, peers, or community members scaffold them. Integrating Indigenous Knowledge Systems

(IKS) into the classroom can expand students' ZPD by connecting new mathematical concepts with familiar cultural practices.

Vygotsky (1978) assets that tools such as language, symbols, and cultural artefacts mediate learning. In mathematics, this includes counting systems, measuring instruments, or even indigenous games that embody mathematical reasoning. These tools are passed down through generations and serve as a bridge between individual cognition and collective cultural knowledge (Vygotsky, 1978).

According to Vygotsky (1978), social interaction is not just helpful for learning but it is essential. Students learn best through dialogue, collaboration, and interaction with more knowledgeable others, such as teachers, peers, elders, and community members (Vygotsky, 1978). Thus, learning is most effective when it takes place in authentic, real-life contexts. When mathematics is taught through local examples like farming, trading, or traditional architecture it becomes more meaningful and relatable to learners.

When applied to the integration of IKS into primary school mathematics, Sociocultural Theory encourages:

- Collaborative learning environments where students engage in discussions that draw on their home and community experiences.
- Community involvement in education, where elders and cultural knowledge holders contribute to classroom activities.
- Use of indigenous artefacts and tools (e.g., baskets, beadwork, clay pots) to teach mathematical ideas such as measurement, patterning, and geometry.
- Contextual learning, where mathematical concepts are taught through real world, culturally relevant problems.

Sociocultural Theory supports this research by:

- Emphasizing the importance of cultural context in learning mathematics.
- Providing a rationale for including local community knowledge in curriculum design.
- Justifying the need for interactive and participatory teaching methods that reflect learners' social and cultural backgrounds.

Sociocultural Theory provides a strong foundation for integrating Indigenous Knowledge Systems into mathematics education. It highlights that learning is a socially mediated process, enriched by the cultural practices, tools, and interactions within a learner's environment. By recognizing and incorporating Indigenous ways of knowing, teachers can create more inclusive, relevant, and effective mathematics learning experiences.

2.2 Indigenous Knowledge systems and Mathematics Education in Zimbabwe.

Indigenous Knowledge Systems (IKS) refer to the body of knowledge, skills, practices, and beliefs developed by Indigenous communities over centuries, often passed through generations by oral tradition and cultural practices. IKS is holistic, context-specific, and embedded in the social, spiritual, and ecological fabric of local communities. It encompasses areas such as agriculture, health, astronomy, navigation, and notably, mathematics—often manifesting in practical applications like architecture, trade, and crafting.

Scholars such as Semali and Kincheloe (2017) argue that IKS represents a valid and rich epistemology that challenges the dominance of Western knowledge systems. In the context of education, integrating IKS can promote inclusivity, cultural relevance, and a decolonized curriculum.

Despite the limited volume of local empirical studies specifically linking IKS and mathematics education, a growing body of Zimbabwean research supports the integration of Indigenous knowledge into teaching and learning processes. These works provide critical insights into the contextual realities, opportunities, and challenges of implementing culturally responsive pedagogy in Zimbabwean schools.

The study by Chikunda (2017) on integrating Indigenous Knowledge in the Zimbabwean science curriculum provides a foundation for similar efforts in mathematics. The study found that Indigenous practices were often marginalized in classroom practice due to a lack of policy clarity and teacher preparedness. Chikunda (2017) emphasizes that for IKS to be meaningfully incorporated, teacher training programs must include local knowledge content and methodologies. Though focused on science, the implications for mathematics are clear curriculum reform must go hand in hand with capacity building and resource development.

In the analysis of Zimbabwean curriculum reforms, Mavhunga (2018) notes that while the 2015–2022 Curriculum Framework encourages heritage-based education, it provides insufficient guidance on operationalizing Indigenous content in mathematics. She highlights that the curriculum's focus on 21st-century skills and global competitiveness often overshadows local relevance. Mavhunga (2018) argues for a more balanced approach that acknowledges and utilizes Indigenous knowledge, particularly in foundational subjects like mathematics, to enhance learning outcomes and student identity.

The study by Mpofu and Mawere (2020) on traditional games in Zimbabwe, highlighted how games like tsoro and nhodo embody complex mathematical reasoning, including counting, planning, and sequencing. They argue that these games should be integrated into the mathematics curriculum as tools for teaching number concepts, strategy, and logical thinking, especially in early grades. The authors show how traditional recreation can be used to contextualize learning in a culturally meaningful way.

Chikodzi and Nyota (2020) explored the use of local artefacts and practices in education in rural Zimbabwe. It found that learners responded positively when lessons included familiar cultural elements, such as using clay pots to teach volume or local currency histories to explain financial mathematics. Teachers reported higher engagement when using culturally grounded resources, despite facing challenges in accessing formal teaching materials that support IKS integration.

Zimbabwe School Examinations Council (ZIMSEC) national examiner reports have periodically pointed out that learners often struggle with applying mathematical concepts in real-life contexts. This has been interpreted by Muchenje, (2016) as a result of a disconnect between abstract content and learners' cultural environments. The reports indirectly support the case for contextualized teaching methods that could be informed by Indigenous practices.

Mutekwe (2020) 's analysis of postcolonial curriculum transformation in Zimbabwe contends that without fully embracing local epistemologies including mathematics embedded in daily life, the education system remains colonial in structure and outlook. He calls for curriculum re-

engineering to integrate Indigenous learning processes across all subjects, including mathematics, to build learner agency and national identity.

2.3 The current state of Indigenous Knowledge system in the Zimbabwean primary school Mathematics.

The integration of Indigenous Knowledge Systems (IKS) into formal education has gained growing attention across Africa, particularly in post-colonial contexts where Western educational models have historically marginalized local epistemologies. In Zimbabwe, the education system remains largely influenced by colonial legacies, especially in subjects like mathematics, where abstract approaches dominate, leaving little room for cultural contextualization (Matose, 2018).

In Zimbabwe, IKS manifests in a variety of forms, including traditional measurements, games like nhodo and tsoro, geometric patterns in basket weaving and hut decorations, and problem-solving in agriculture and construction (Mapara, 2016). These practices often involve mathematical concepts such as counting, estimation, symmetry, proportional reasoning, and spatial awareness (Mawere, 2015).

Research indicates that while Zimbabwe's curriculum framework acknowledges the importance of local knowledge, there is minimal practical integration of IKS into mathematics education. According to Shizha (2018), the dominance of Western paradigms has led to the devaluation of indigenous practices as "unscientific," resulting in their exclusion from formal syllabi. This disconnect affects learners' ability to relate mathematical concepts to their real-life experiences and contributes to poor performance and disengagement in mathematics, especially among rural learners (Mtetwa & Garofalo, 2016).

The 2015 Zimbabwe Curriculum Framework for Primary and Secondary Education recognizes the importance of heritage-based education, but it lacks concrete strategies for embedding IKS into specific subjects such as mathematics. As noted by Chikomba and Mhishi (2019), although the curriculum advocates for a competence-based and learner-centred approach, it falls short of operationalizing indigenous knowledge in classroom practice. Teachers often rely on textbooks that mirror Western content and pedagogies, leaving them with little guidance or resources to include IKS in their teaching (Nherera, 2018).

Studies show that many teachers in Zimbabwe are either unaware of the potential value of IKS in mathematics or feel ill equipped to incorporate it due to inadequate training during pre-service education (Mawere, 2015). Furthermore, cultural and institutional biases often lead to the undervaluing of indigenous knowledge, even among local educators (Shizha, 2018). Teachers tend to view mathematics as objective and universal, and thus resistant to local adaptation.

Despite these challenges, some scholars and education practitioners have begun exploring ways to localize mathematics teaching through culturally relevant examples and indigenous contexts. For instance, research by Nyoni (2020) advocates for the integration of traditional games and crafts as tools to teach mathematical reasoning in early grades. Pilot studies have shown that when learners encounter mathematics in familiar cultural contexts, they demonstrate improved understanding and increased motivation (Chikomba & Mhishi, 2019).

The current state of IKS in Zimbabwean primary school mathematics remains limited, with indigenous knowledge being largely absent from formal instruction and curriculum resources. While policy frameworks offer rhetorical support for cultural relevance and heritage-based learning, practical implementation lags behind. Addressing this gap requires targeted teacher training, curriculum reform, and further research into culturally grounded pedagogical approaches that can bridge the divide between school mathematics and learners' indigenous knowledge environments.

2.4 Indigenous mathematical concepts and practices effectively integrated into primary school mathematics instructions.

The integration of Indigenous Knowledge Systems (IKS) into school curricula is increasingly viewed as a way to make education more relevant, contextual, and culturally responsive. In mathematics education, indigenous mathematical concepts and practices offer rich opportunities for linking abstract theories with learners' lived experiences (Nyoni, 2020). In the Zimbabwean context, there is a growing body of literature that identifies specific indigenous mathematical practices that can be meaningfully included in primary school mathematics instruction to enhance comprehension, engagement, and cultural identity. Mathematics education in Zimbabwe, like in many other post-colonial African countries, has long been shaped by Western curricula and pedagogies. However, indigenous knowledge systems deeply rooted in the culture, language, and daily practices of Zimbabwean communities offer rich,

contextualized mathematical concepts that can enhance the relevance and effectiveness of primary school instruction.

Integrating these indigenous mathematical practices into the formal curriculum not only supports mathematical understanding but also fosters cultural identity and inclusivity in the classroom (Gerdes, 2018). Indigenous mathematical knowledge in Zimbabwe is embedded in various cultural and practical domains such as farming, architecture, craftwork, trade, and games. These domains provide numerous opportunities to teach mathematical concepts in ways that are meaningful to learners' lived experiences (Zaslavsky, 2015).

Traditional African societies, including those in Zimbabwe, have long used indigenous counting systems that differ from the base-10 numeral system but demonstrate a strong grasp of quantity, place value, and arithmetic operations. For example, the Shona and Ndebele languages have number words and structures that reflect grouping and partitioning (Mawere, 2015). Studies show that these systems can serve as foundational tools to teach modern number concepts by connecting learners' linguistic and cultural backgrounds to arithmetic (Zaslavsky, 2015). Using these native counting systems can be instrumental in teaching number sense and place value. Encouraging learners to count in their mother tongue before transitioning to English numerals can strengthen foundational skills (Nyoni, 2019).

Measurement is a key area where indigenous practices can be integrated. Traditional Zimbabwean communities used body parts such as arms, feet, and fingers for estimating length and distance practices still observable in rural markets and daily activities. Moreover, indigenous systems used containers like gourds and calabashes for measuring volume, and stones or bags for mass (Mapara, 2016). Integrating these practices into lessons on non-standard and standard measurement units can help learners grasp the concept of measurement more concretely (Mosimege, 2016).

Indigenous crafts and architecture offer abundant examples of geometric reasoning. Zimbabwean traditional basket weaving, pottery, beadwork, and hut construction all involve shapes, symmetry, angles, tessellation, and spatial reasoning (Gerdes, 2018). The geometric patterns found in floor decorations (murals), mats, and fences provide authentic learning resources for teaching concepts such as area, perimeter, congruence, and patterns (Mtetwa & Garofalo, 2016). Such culturally grounded artefacts not only teach geometry but also preserve cultural heritage. These traditions can be incorporated into lessons on shapes, symmetry, and

measurement. For instance, analysing the symmetrical designs on a nhembe (cloak) or a woven basket introduces learners to concepts of reflection, rotation, and spatial reasoning in a culturally meaningful way (Gerdes, 2018).

According to Mapara (2016), traditional games like nhodo (played with stones), tsoro, and dara (strategy board games) involve counting, probability, and strategic thinking skills central to mathematics learning. These games offer informal yet effective ways to reinforce concepts such as counting, addition, subtraction, and logical reasoning (Nyoni, 2020). Incorporating such games into classroom activities fosters learning through play and supports development of problem-solving skills in familiar and engaging contexts. These games support the development of logical thinking and computational fluency (Gerdes, 2018).Thus, incorporating traditional games into mathematics lessons makes learning engaging and accessible.

Music and dance are also embedded with mathematical elements such as rhythm (patterns and repetition), sequencing, and time intervals. Ascher, (2019) posits that indigenous songs and oral storytelling often follow structured patterns that can be analysed for mathematical properties. These culturally relevant forms can support instruction in pattern recognition, sequences, and early algebraic thinking.

Chikomba and Mhishi (2019) argues that agricultural practices such as planting by lunar cycles, spacing crops evenly, and predicting rainfall patterns reflect logical and mathematical thinking. Zimbabwean subsistence farming involves the use of estimation, counting, and data interpretation, which can be linked to statistics and measurement concepts in school mathematics (Mawere, 2015). Communities traditionally tracked time through moon phases, seasonal changes, and agricultural events. For example, the Shona month "Nyamavhuvhu" (August), named after strong winds, connects natural observation with the passage of time (Mudzingwa & Ndlovu, 2021). These concepts provide a basis for teaching time, sequencing, and calendar use.

Agricultural practices offer numerous mathematical applications. Ascher, (2019) argues that indigenous methods of measuring land using body parts (e.g., mubato for a hand span) or tools like the guyo (grinding stone) for measuring grain volumes can be used to teach non-standard and standard measurement systems.. These practices help learners understand measurement in tangible, real-world contexts.

Zaslavsky, (2015) asserts that traditional systems of trade, such as bartering in rural markets, involve arithmetic, estimation, and equivalence reasoning. These real-life economic transactions can be modelled in classroom activities to teach basic operations and financial literacy (Zaslavsky, 2015). Role-playing such exchanges enhances learners' problem-solving and reasoning abilities.

According to Nherera (2018), integrating Indigenous mathematical concepts into primary school instruction presents a valuable opportunity to enrich learning experiences and foster inclusivity. One of the most significant advantages of this approach is its cultural relevance; students are more likely to engage with mathematical ideas when they are presented in familiar and meaningful contexts (Mapara, 2016). This relevance not only enhances student motivation but also deepens their understanding, as abstract concepts are grounded in real-life applications that reflect their lived experiences (Mapara, 2016).

Shizha (2018) argues that integration promotes inclusion by ensuring that learners from diverse backgrounds see their cultures and ways of knowing represented in the classroom. This validation of Indigenous knowledge systems contributes to a more equitable educational environment (Shizha, 2018). Additionally, by incorporating Indigenous mathematics into the curriculum, schools play a role in preserving and transmitting cultural heritage, turning the classroom into a space where traditional knowledge is both valued and sustained (UNESCO, 2017).

Despite these benefits, there are notable challenges. A study done by Mtetwa and Garofalo (2016) reported that many teachers lack the training required to effectively incorporate ethno mathematical approaches into their teaching. The scarcity of curriculum resources tailored to this purpose further compounds the issue, as does the broader tendency within educational systems to undervalue Indigenous knowledge (Nherera, 2018).

To address these obstacles, several strategic recommendations have been proposed. First, professional development programs should be designed to equip teachers with the tools and knowledge needed to teach ethno mathematics effectively (Mtetwa, 2017). Nyoni (2020) posits that curriculum reform is essential to ensure that Indigenous examples are meaningfully integrated into textbooks and learning materials. Chikunda (2017) argues that community involvement is crucial; inviting local experts and elders into the educational process can foster authentic knowledge exchange and enhance cultural continuity. Furthermore, ongoing research

and documentation are necessary to support curriculum development and to build a robust foundation for the inclusion of Indigenous mathematical knowledge (UNESCO, 2017).

Numerous indigenous mathematical practices ranging from measurement techniques and geometric designs to traditional games and environmental reasoning can be effectively integrated into primary school mathematics instruction. These practices not only provide culturally relevant entry points for mathematical concepts but also validate learners' backgrounds and promote inclusive education. For successful integration, however, curriculum developers, teacher training institutions, and policymakers must develop structured approaches to identify, validate, and incorporate these practices into teaching materials and pedagogy.

2.5 Strategies and Pedagogical approaches developed to integrate Indigenous knowledge systems into primary school mathematics.

The push for integrating Indigenous Knowledge Systems (IKS) into formal education stems from the need to decolonize curricula and make learning more culturally responsive and relevant. In mathematics education, especially at the primary school level, this integration calls for the development of pedagogical strategies that both respect indigenous worldviews and align with curricular standards. In the Zimbabwean context, several scholars and education practitioners have identified promising approaches and challenges in operationalizing this integration.

According to Gay (2019), one of the foundational approaches to integrating IKS into mathematics teaching is the application of culturally responsive pedagogy (CRP). CRP encourages teachers to draw on learners' cultural backgrounds, local knowledge, and experiences to inform instruction (Gay, 2019). In Zimbabwe, culturally responsive mathematics teaching would involve using familiar contexts such as traditional games, farming practices, crafts, and architecture to teach abstract mathematical concepts (Mawere, 2015; Chikomba & Mhishi, 2019). This strategy not only bridges the gap between home and school learning environments but also enhances learner motivation and engagement.

Semali and Kincheloe, (2017) posits that effective integration of IKS often requires moving beyond the classroom to involve community elders, artisans, and cultural practitioners as co-educators. Place-based learning connects mathematical content to the learners' immediate environment such as local markets, farming methods, or building designs to ground abstract

concepts in real-life situations (Semali & Kincheloe, 2017). In Zimbabwe, incorporating activities like visiting traditional homesteads to explore geometry in hut designs or studying measurement through local trade practices can enrich the learning experience (Mapara, 2016).

Mtetwa and Garofalo, (2016) posits that another key strategy involves localizing and adapting the curriculum to reflect indigenous perspectives and examples. While Zimbabwe's 2015 Curriculum Framework emphasizes heritage-based education, actual textbooks and teaching resources often lack indigenous content (MoPSE, 2015). Scholars advocate for curriculum developers to incorporate indigenous mathematical content explicitly into learning objectives, activities, and assessments (Mtetwa & Garofalo, 2016). Localized curriculum materials may include indigenous counting systems, traditional units of measurement, or geometric patterns from local crafts.

According to Mosimege (2016), inquiry-based learning that encourages exploration, discovery, and critical thinking aligns well with the oral and experiential nature of IKS. Activities like problem solving using indigenous tools or designing projects around traditional structures and games allow learners to construct mathematical understanding collaboratively (Mosimege, 2016). This participatory approach helps shift learners from passive recipients of abstract knowledge to active constructors of meaning, rooted in their cultural context.

Nherera (2018) asserts that the successful integration of IKS into mathematics teaching depends heavily on teachers' knowledge, attitudes, and skills. Teacher education programs need to include modules on ethno mathematics, cultural relevance, and IKS to prepare educators to implement context-based teaching (Mawere, 2015; Nherera, 2018). Ongoing professional development workshops and collaborations with local communities can support teachers in developing appropriate strategies and building confidence in using culturally grounded approaches (Chikodzi & Nyoni, 2019).

As indicated by Nyoni (2020), the creation of learning resources and teaching aids that reflect indigenous knowledge is crucial. Visual aids, games, stories, puzzles, and manipulatives based on local practices can support mathematics learning in ways that are meaningful to learners (Nyoni, 2020). For instance, using a model of a traditional grain storage bin to teach volume, or a beadwork pattern to illustrate symmetry and repetition, can make lessons more relatable.

Effective integration of IKS into primary school mathematics in Zimbabwe requires a multifaceted pedagogical approach, grounded in cultural relevance, local participation, and systemic support. Strategies such as culturally responsive teaching, place-based learning, curriculum localization, and teacher capacity building can significantly enhance the relevance and impact of mathematics education. However, successful implementation demands collaboration among educators, curriculum developers, communities, and policymakers to institutionalize these practices within the formal education system.

2.6 Summary and Research Gap

The literature strongly supports the integration of IKS into mathematics education as a means to promote contextualized, relevant, and inclusive learning. However, there is a notable gap in Zimbabwe regarding empirical research on how such integration can be implemented effectively in primary schools. Few studies have documented the specific Indigenous mathematical practices that can enrich the curriculum or explored teachers' perspectives and readiness to adopt culturally responsive approaches.

This study seeks to fill this gap by investigating the current state of IKS in primary schools, indigenous mathematical concepts that can be integrated into primary school mathematics and strategies for integrating IKS into primary school mathematics in Zimbabwe, guided by the principles of Culturally Responsive Pedagogy and Sociocultural Theory.

Summary of Key Insights from Zimbabwean Literature:

- Indigenous mathematical knowledge is present but underutilized in schools.
- Teachers often lack training and resources to teach using IKS.
- The curriculum supports heritage-based learning in principle but lacks clear guidelines.
- Traditional games, tools, and cultural practices offer effective entry points for math instruction.
- Students perform better and are more engaged when content is culturally relevant.
- Broader decolonization of the curriculum is essential for meaningful integration.

In summary, the Zimbabwean primary school mathematics syllabus advocates for the integration of Indigenous Knowledge Systems to make mathematics education more relevant

and engaging for learners. However, successful implementation requires addressing challenges related to curriculum design, teacher training, and resource availability.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter outlines the research design, population, sampling procedures, data collection methods, instruments, data analysis techniques, and ethical considerations used in this study. The methodology is designed to explore how Indigenous Knowledge Systems (IKS) can be integrated into the teaching of primary school mathematics in Zimbabwe, focusing on teacher practices, curriculum alignment, and learner engagement.

3.2 Research Paradigm

The study is anchored in the interpretivist paradigm, which emphasizes understanding human experiences from the perspectives of those involved. The interpretivist paradigm emphasizes understanding the socially constructed meanings and lived experiences of individuals (Creswell, 2019; Schwandt, 2018). Interpretivism is suitable for exploring how indigenous knowledge systems are perceived, valued, and integrated within formal education, especially in culturally diverse contexts.

Interpretivism holds that reality is subjective and context-dependent, and therefore, researchers must immerse themselves in participants' worlds to uncover the meanings they assign to phenomena (Lincoln & Guba, 1985). The choice of this paradigm aligns with the study's goal of capturing the nuanced cultural meanings and practices embedded in African Indigenous Knowledge (AIK) and how these can inform the teaching of mathematics in primary schools.

This paradigm supports the exploration of how teachers and learners interpret and apply Indigenous knowledge within mathematics education. According to Creswell (2019, the interpretivist paradigm is a philosophical framework used in qualitative research that focuses on understanding human experiences, social contexts, and meanings from the perspective of those involved. It is rooted in the belief that reality is socially constructed, subjective, and context-dependent (Creswell, 2019). As indicated by Schwandt (2018), Interpretivism holds that individuals interpret their world based on their experiences and interactions. In the context of this study, both teachers and learners understand and apply mathematics differently depending on their cultural background and lived experiences.

Knowledge is seen as being bound to a specific time, place, and cultural context. Therefore, the integration of Indigenous Knowledge Systems (IKS) into mathematics cannot be fully understood without appreciating the sociocultural realities of Zimbabwean communities. Schwandt (2018) posits that rather than seeking a single "truth," the interpretivist approach values multiple perspectives. This is especially important in a study involving teachers, each of whom brings a different understanding of IKS and mathematics. Thus, applying the interpretivist paradigm in this research allows for:

- Capturing how teachers interpret and apply Indigenous knowledge in teaching mathematics.
- Understanding learners' cultural experiences and how these shape their mathematical thinking.
- Highlighting the perspectives of elders and community members on the value of IKS in education.
- Interpreting curriculum documents not just for content, but for the cultural assumptions and ideologies they reflect.

In summary, the interpretivist paradigm provides the appropriate lens for exploring the cultural, contextual, and experiential dimensions of integrating Indigenous Knowledge Systems into Zimbabwean primary mathematics education.

3.3 Research methodology

This study adopts a qualitative case study design. A qualitative approach is most suitable as it allows for an in-depth exploration of participants' perceptions, experiences, and practices related to IKS and mathematics education. This approach enables the researcher to generate rich, in-depth insights into the perceptions of teachers regarding the integration of indigenous knowledge into mathematics education (Denzin & Lincoln, 2018). African Indigenous Knowledge (AIK) is deeply rooted in oral traditions, communal practices, and lived experiences. A qualitative approach allows researchers to explore these rich, complex cultural narratives in a way that quantitative methods cannot (Smith, 2020; Chilisa, 2019). This research seeks to understand the integration of AIK into mathematics education. Qualitative research is best suited for uncovering such subjective interpretations and meaning-making processes (Creswell, 2019).

The integration of AIK in education is context dependent practices and understandings vary across regions and communities. A qualitative approach provides the depth needed to explore these local contexts and educational realities (Denzin & Lincoln, 2018). Since the research is based on an interpretivist paradigm, a qualitative approach complements the philosophical stance by focusing on co-constructed meaning, rather than universal truths or generalizations (Schwandt, 2018).

The qualitative approach is both methodologically appropriate and strategically advantageous for a study investigating the integration of African Indigenous Knowledge into primary mathematics. It enables deep engagement with cultural contexts, empowers local knowledge systems, and supports the development of contextually relevant educational practices.

3.4 Research Design

Cohen, Manion and Morrison (2018) define a research design as a strategy that is drawn up by the researcher to organise the research to make it practicable so that research questions can be answered based on evidence and warrants. The need to have research questions answered as one of the key purposes of research design is also highlighted by Choongwa (2018) who defines a research design as a specific guide about how the research will be conducted in answering the research questions. This implies that the research design should show the details of the nature of data to be collected and how it is going to be analysed to provide evidence to answer research questions. This study uses a case study design that enables a detailed investigation of the integration process within a real-life educational context. This allows for an in-depth exploration of how AIK is integrated (or could be integrated) into primary mathematics in several selected schools or communities across a specific region or country.

A case study is appropriate for examining complex phenomena within their real-life contexts (Yin, 2014). Case study research aligns with the interpretivist paradigm by emphasizing the subjective experiences and socially constructed meanings of participants within a bounded context (Creswell, 2019; Schwandt, 2018). The integration of AIK in primary mathematics involves complex cultural, pedagogical, and curricular factors that vary by location. A case study provides a method for exploring these complexities in their natural context (Yin, 2014). AIK is localized and context-specific. A case study allows the researcher to focus on specific communities or schools, capturing the cultural nuances and educational dynamics involved in integrating indigenous knowledge into mathematics (Merriam, 2015).

Thus, the case study design is an appropriate and advantageous choice for a study focused on integrating African Indigenous Knowledge into primary mathematics. It allows the researcher to explore real-world practices, understand local contexts, and generate actionable insights while respecting the complexity and richness of indigenous cultural knowledge.

3.5 Population

The target population consists of 143 primary school teachers who have both pedagogical and mathematics content knowledge in schools in particular District in Zimbabwe. Due to the nature of the phenomenon that was being studied, it could not be possible to investigate all the entire teacher population of 143 qualified teachers; hence, the sample was required from the population.

3.6 Sample and Sampling procedure

Purposive sampling was used to select 15 primary school teachers with relevant knowledge and experience. Purposive sampling was used to select participants who have direct experiences with or insights into indigenous knowledge systems (Patton, 2022). Purposive sampling (also known as judgmental or selective sampling) is a non-probability sampling method where the researcher deliberately selects participants who are most likely to provide relevant, rich, and insightful data for the study (Patton, 2022). The research focuses on the integration of African Indigenous Knowledge (AIK) into mathematics education. Purposive sampling allows the researcher to intentionally select individuals who possess specific knowledge or experience related to this topic. These participants are in the best position to provide insightful and culturally embedded perspectives.

In interpretivist research, the aim is not generalization, but understanding meaning and experience in specific contexts. Purposive sampling supports this by enabling the selection of information-rich cases that are aligned with the interpretivist goal of deep, contextual understanding (Schwandt, 2018; Lincoln & Guba, 1985). Purposive sampling is especially compatible with case study and qualitative designs, where the emphasis is on depth rather than breadth (Creswell, 2019). It ensures that participants selected are directly involved in or affected by the phenomenon being studied.

By selecting participants who are directly relevant to the research question, purposive sampling saves time and resources while maximizing the quality and relevance of data collected (Palinkas et al., 2015). Information-rich participants can provide detailed narratives,

explanations, and contextual knowledge that are essential for understanding how indigenous knowledge can be applied to mathematics education (Patton, 2022). Purposive sampling ensures the inclusion of diverse voices with specific insights, allowing for a more comprehensive exploration of cultural, educational, and community-based perspectives (Cohen, Manion, & Morrison, 2018). By selecting teachers, the researcher honours and centres indigenous voices and knowledge, which is both ethically and methodologically appropriate for this type of study (Smith, 2016). Purposive sampling allows researchers to adapt their sampling criteria during data collection if new, relevant participant categories emerge offering flexibility without compromising the study's depth.

Purposive sampling is a relevant and advantageous choice for a study on integrating African Indigenous Knowledge into primary mathematics. It ensures the inclusion of key knowledge holders, respects cultural and contextual specificity, and supports the interpretive and qualitative nature of the research.

3.7 Data Collection Instruments

Guided by the insight developed from literature review the researcher used the Semi-structured interviews to solicit information from participating teachers on the following research questions:

3.7.1 What is the current state of Indigenous Knowledge Systems in the Zimbabwean primary school mathematics curriculum?

3.7.2 What Indigenous mathematical concepts and practices can be effectively integrated into primary school mathematics instruction?

3.7.3 What strategies and pedagogical approaches can be developed to integrate IKS into primary school mathematics teaching?

Through semi-structured interviews, the researcher engages directly with participants to co-construct meaning. This interaction is central to the interpretivist paradigm, which values depth of understanding over generalization. It also acknowledges the cultural contexts in which mathematical knowledge and Indigenous practices coexist, allowing for a more holistic interpretation of how learning occurs in Zimbabwean primary schools. Interviews provide thick descriptions of people’s experiences, beliefs, and practices essential for understanding the

integration of indigenous knowledge in a meaningful way (Patton, 2022). Engaging participants in conversations ensures that local voices and indigenous perspectives are respected and not merely observed from an outsider's viewpoint (Smith, 2016). Through interviews participants (teachers) can express their views and experiences directly. This approach empowers participants by recognizing them as knowledge holders rather than research subjects (Chilisa, 2019).

3.7 **Data Analysis**

Data was analysed using thematic analysis, involving transcription of interviews and discussions, coding of responses to identify patterns, Categorization into major themes and interpretation of themes in relation to the research questions and theoretical framework. Thematic analysis is a widely used method in qualitative research for identifying, analysing, and interpreting patterns (themes) within textual data. It is especially relevant for this study due to its flexibility, depth, and alignment with interpretivist paradigms.

The study aims to explore the integration of African Indigenous Knowledge (AIK) in mathematics. Thematic analysis helps identify recurring ideas, beliefs, and practices from interview transcripts (Braun & Clarke, 2016). The interpretivist paradigm focuses on constructing meaning from human experience. Thematic analysis aligns with this by systematically organizing participants' perspectives into coherent themes that reflect socially constructed realities (Clarke & Braun, 2016). The integration of AIK into primary mathematics involves complex cultural nuances and diverse contexts. Thematic analysis allows the researcher to identify both commonalities and differences across various settings and participant groups.

Codes enable the researcher to handle data more easily. This is in line with Mile and Hurberman (2015) who affirmed that codes promote data handling efficiency, data labelling and data retrieval also empower and speed up data analysis. The codes were created with the aspect to be analysed in mind and guided by the research questions. Thus, thematic analysis is an appropriate and effective method for analysing data in the study of integrating African Indigenous Knowledge into primary mathematics. It allows for in-depth exploration of culturally situated meanings, and ensures that participant voices are central to interpretation and reporting.

3.8 Trustworthiness

In this study, the researcher adopted Guba and lincoln (1985) who presented criteria for evaluation of trustworthiness as credibility, transferability, dependability and conformability. Credibility as the extent to which the results of the study approximate reality. In order to enhance credibility, the researcher audio-recorded the interviews and transcribed the verbatim to ensure accurate recording of all words uttered by the participants on the views on integration of ethno mathematics in the teaching of mathematics.

Transferability means that specific knowledge gained from the study conducted with small numbers of participants is transferable by the reader to other similar settings (Ncube, 2014). In this study, the sample was carefully selected to typically represent primary school teachers in Zimbabwe. This can enable other researchers to relate the findings of this study to their own settings. In this study, the researcher clearly outlined the aims and the objectives of the study at the beginning of the study. The research question to be answered were clearly articulated as a way of assisting conformability of the study.

Dependability involves participants' involvement in evaluation of the finding, interpretation and recommendation of the study. In this study, dependability was enhanced through verification of all data elements with the participants to ensure that data was captured accurately.

3.9 Ethical Considerations

Informed consent was obtained from all participants. Confidentiality and anonymity was maintained through coding. Permission was sought from relevant authorities including school heads and the Ministry. Participation was voluntary, with the right to withdraw at any time.

CHAPTER 4
FINDINGS, INTERPRETATION AND DISCUSSION OF DATA

4.1. INTRODUCTION

Chapter 3 described the research design and methodology used in the study. A qualitative research approach, in the form of a case study, was employed towards the exploring how

Indigenous Knowledge Systems (IKS) can be integrated into the teaching of primary school mathematics in Zimbabwe. The present Chapter presents the data and findings of the study. The study was guided by the following research questions which sought to explore how Indigenous Knowledge Systems (IKS) can be integrated into the teaching of primary school mathematics in Zimbabwe:

1. What is the current state of Indigenous Knowledge Systems in the Zimbabwean primary school mathematics curriculum?

2. What Indigenous mathematical concepts and practices can be effectively integrated into primary school mathematics instruction?

3. What strategies and pedagogical approaches can be developed to integrate IKS into primary school mathematics teaching?

The 15 teachers from primary schools participated in the study. The 15 teachers were subjected to interviews. For ethical reasons, research participants were identified by pseudonyms (Creswell & Plano Clark, 2011).
Table 4.1: below shows the demographic data for the participating teachers.

Table 4.1: Demographic data for participating teachers.

Participant	Sex	Qualifications	Experience (years)
T1	F	DIPED	13
T2	M	DIPED	24
T3	M	DIPED	17
T4	F	DIPED, BED	24
T5	F	CE	32
T6	F	DIPED	18
T7	F	DIPED	15
T8	M	CE	36
T9	F	DIPED	20
T10	M	CE, BED	37
T11	F	DIPED	12
T12	F	DIPED	17

T13	F	DIPED	13
T14	M	DIPED	21
T15	M	DIPED, BED	16

Key: BED: Bachelor of Education. DipEd: Diploma in Education. CE: Certificate in Education.

Table 4.1 above shows that all the participating teachers had a minimum qualification of at least a certificate in education, and at least ten years teaching experience. This shows that participating teachers sampled had experience with how Indigenous Knowledge Systems (IKS) can be integrated into the teaching of primary school mathematics in Zimbabwe. The table also shows the pseudonym of the participating teachers who were sampled from schools in the district council schools. A qualitative sample should be diverse within the confines of the defined population (Sutton & Austin, 2015).

4.2 The current state of Indigenous Knowledge Systems in the Zimbabwean primary school mathematics curriculum.

This research question was guided by theme and sub themes to facilitate the interview of participating teachers.

Theme: The Current State of Indigenous Knowledge Systems (IKS) in the Zimbabwean Primary School Mathematics Curriculum.

Introduction to the theme

The findings from the teachers' interviews reveal that while Indigenous Knowledge Systems (IKS) are recognized as valuable in enriching mathematics education, their integration in the Zimbabwean primary school curriculum remains limited, fragmented, and largely dependent on individual teacher initiative. Teachers expressed varying levels of understanding of IKS, highlighted both opportunities and challenges in its application, and noted gaps in policy guidance, training, and curriculum design. The analysis of responses led to the emergence of several sub-themes that reflect the current state of IKS in mathematics teaching.

Sub-themes

Teachers' Understanding and Conceptualisation of IKS in Mathematics

When participating teachers were asked how they understand and define indigenous knowledge systems in the context of mathematics education, some of the verbatim responses from the participating teachers of the sub questions asked are given below.

T1 said: "I think of indigenous knowledge as the traditional ways people in our communities solve problems, like using patterns in crafts or farming techniques."

T13 responded: "It's knowledge passed down from elders that can be linked to measurements, counting, and problem-solving methods."

T9 stated: "Honestly, I'm not very sure how it connects with mathematics exactly, but I believe it's about using local examples."

Current Practices of Incorporating IKS in Mathematics Lessons

When participating teachers where asked about ways indigenous knowledge concepts are currently included in primary school mathematics lessons and materials, some of the verbatim responses are as follows:

T4 remarked : *"We sometimes use traditional games like nhodo or tsoro to teach counting and strategy."*

T7 noted: *"Textbooks don't have much, but I try to bring in local examples when teaching measurement or shapes."*

T9 professed: *"There's very limited inclusion; it's mostly up to the individual teacher to add those elements."*

Challenges in Integrating IKS into Mathematics Education

Teachers were also asked challenges faced when integrating indigenous knowledge into mathematics teaching. There following are some of the verbatim responses:

T10 replied: *"The curriculum is very exam-focused, so there's little time to include traditional knowledge."*

T15 adduced: *"Lack of resources or clear guidelines makes it hard to know what's appropriate to include."*

T12 replied: *"Some parents or administrators may see it as irrelevant or unscientific."*

Indigenous Mathematical Practices in Use

Another sub question was on the existence of specific indigenous mathematical practices or examples that are commonly used in classrooms. Some verbatim responses were as follows:

T3 remarked: *"Yes, we use basket weaving patterns to teach geometry and symmetry."*

T6 replied: *"Sometimes we talk about traditional ways of measuring land or using counting sticks."*

T5 noted: *"Not often – most lessons rely on formal textbook examples."*

Curriculum Design and Representation of IKS

When asked on how the Zimbabwean primary mathematics curriculum designed to accommodate indigenous knowledge systems, the following were some of the verbatim responses:

T9 professed: *"The curriculum mentions it vaguely, but without specific guidelines."*

T4 remarked: *"It encourages real-life examples, but doesn't clearly link them to indigenous knowledge."*

T8 came out with this response: *"As far as I've seen, indigenous knowledge is not a main focus in the curriculum documents."*

Teacher Training and Professional Support

The participating teachers were also asked about the support or training provided to teachers for incorporating indigenous knowledge into mathematics education. The following are some of the verbatim responses:

T10 opined: *"We haven't received any formal training on this topic."*

T14 stated: *"Workshops sometimes touch on it, but not in much detail."*

T7 declared: *"Mostly, we rely on our own experiences or local elders if we want to include it."*

Learners' responses to IKS-based Teaching

When the participating teachers were asked how learners respond to the use of indigenous knowledge in mathematics lessons, some of the verbatim responses are below:

T4 said: *"They get excited when they see something familiar from their environment."*

T7 declared: *"Some learners find it easier to understand concepts through traditional examples."*

T11 verbalised: *"There's mixed interest—some enjoy it, while others don't see the connection to formal math."*

Policy and Administrative Influence on IKS integration.

When participating teachers were asked on what policy or administrative measures influence the inclusion or exclusion of indigenous knowledge in the curriculum, the following are some of the verbatim responses:

T15 said: *"Education policy talks about cultural relevance, but it's not emphasized in assessments."*

T9 professed: *"Administrators rarely bring it up unless there's a specific initiative."*

T2 remarked: *"Inclusion depends more on individual schools and teacher initiative than national policy."*

4.3 Indigenous mathematical concepts and practices effectively integrated into primary school mathematics instruction.

This research question was guided by the theme and sub theme, reflecting a range of practical and realistic perspectives of participating teachers.

Theme: Indigenous Mathematical Practices and Their Application in the Primary School Mathematics Curriculum

Introduction to the theme

Teachers' responses revealed that indigenous mathematical practices are still embedded in Zimbabwean communities and can provide meaningful opportunities for mathematics teaching in primary schools. These practices are reflected in everyday activities such as measurement, games, designs, trade, farming, and timekeeping. The interviews highlighted not only how these practices embody mathematical concepts, but also the potential benefits and challenges of bringing them into the classroom. Several sub-themes emerged, each pointing to practical examples of how Indigenous Knowledge Systems (IKS) connect to mathematical learning.

Sub-Themes

Indigenous practices of measurement and estimation

The participating teachers were asked about indigenous practices related to measurement or estimation familiar within their communities and the following are some of the verbatim responses:

T14 said: *"People often estimate distances using body parts, like hands or feet, especially when measuring land."*

T8 declared: *"In rural areas, they use arm lengths or sticks to measure out fields—very practical."*

T5 noted: *"Even for food or grain, elders estimate quantities using traditional containers, not scales."*

Traditional games as tools for mathematical thinking.

When participating teachers were asked on which traditional games or activities demonstrate mathematical thinking or problem solving, the following are some of the verbatim responses:

T1 responded: *"Games like tsoro involve counting and strategic thinking—it's great for logical reasoning."*

T6 replied: *"Children still play nhodo, which helps with sequencing and number patterns."*

T13 said: *"Even traditional riddles involve problem-solving skills that are mathematical in nature."*

Indigenous patterns and designs for geometry and symmetry

When participating teachers were asked on how indigenous patterns or designs (e.g., weaving, beadwork) were used to teach concepts like geometry or symmetry, the following were some of the verbatim responses.

T7 declared: *"Basket weaving shows perfect symmetry and repeating patterns excellent for teaching shapes and angles."*

T4 remarked: *"Mat designs often use tessellations, which we can connect to geometry topics."*

T12 adduced: *"These patterns naturally show reflection and rotation, which are part of our curriculum."*

Indigenous methods of counting, grouping and trading.

Asked about if indigenous methods of counting, grouping, or trading be connected to topics like number sense or place value, the following are some of the verbatim responses from the participating teachers.

T14 said *"In markets, people use groupings of 5s or 10s when trading—it mirrors the base-10 system."*

T3 stated: *"Traditional counting sometimes uses stones or seeds, which helps with understanding quantity."*

T7 declared: *"There's a strong concept of sharing equally, which links to division and fractions."*

Traditional timekeeping and calendar systems.

Asked about traditional time keeping or calendar systems could help teach concepts of time and sequence, the following are among some of the verbatim responses.

T11 verbalised: *"Some communities still use moon phases or seasons to track time, these relate to calendar topics."*

T13 said; *"Farmers use rainfall patterns to predict planting times, which teaches sequencing and estimation."*

T4 noted: *"Telling time by the sun's position is something elders still do, it introduces concepts of time naturally."*

Farming and construction practices as mathematical applications.

When asked about local farming or construction techniques that involve mathematical reasoning or spatial awareness, the following were among the verbatim responses from participating teachers.

T5 said: *"Farmers use rows and spacing for planting, good for teaching area and perimeter."*

T15 alluded: *"Traditional huts are circular, so we discuss radius and circumference using those."*

T7 declared: *"Building structures often involves measurement, angle judgment, and symmetry."*

The role of elders and community members in mathematics.

Asked about how elders or community members use mathematics in daily life, and could these practices be adapted for classroom use, the following are some of the verbatim responses:

T1 said: *"Elders estimate prices, measure land, and plan events, real-life applications of math."*

T14 responded: *"We could invite them to class to explain how they use counting and budgeting in traditional ceremonies."*

T11 remarked: *"Their knowledge could make math more relatable for learners."*

Opportunities and challenges in using indigenous mathematical practices.

Further, when asked about challenges or opportunities in using indigenous mathematical examples in formal instruction, the following are some of the verbatim responses:

T8 argued: *"The opportunity is making math more meaningful, but the challenge is lack of resources."*

T6 asserted: *"Some topics fit well, but assessments are too standardized to allow much flexibility."*

T10 opined: *"There's a lot of potential, especially for learner engagement, if supported by curriculum materials."*

4.4 **Strategies and pedagogical approaches can be developed to integrate Indigenous Knowledge Systems (IKS) into primary school mathematics teaching.**

Verbatim responses from participating teachers for the theme and sub themes, offered a range of perspectives based on real-world teaching contexts.

Theme: Strategies and Pedagogical Approaches for Integrating Indigenous Knowledge Systems (IKS) into Mathematics Teaching

Introduction to the theme

Teachers highlighted a variety of strategies and pedagogical approaches for embedding Indigenous Knowledge Systems (IKS) into primary school mathematics lessons. Their responses revealed that integration is most effective when it draws from learners' lived experiences, community practices, and cultural resources. The insights point to the use of contextualized teaching strategies, incorporation of cultural activities such as games and storytelling, engagement of elders, culturally relevant teaching resources, flexible assessment practices, teacher professional development, and collaborative networks. These approaches underline the practical potential of IKS to make mathematics more meaningful and accessible while remaining aligned with curriculum objectives.

Sub-Themes

Contextualised teaching strategies.

Asked on what teaching strategies participating teachers used or observed that successfully incorporate indigenous knowledge into math lessons, the following are some of the verbatim responses:

T3 stated: *"I've used local farming examples to teach measurement, students really connect with that."*

T15 said: *"Incorporating traditional counting systems helps build number sense for younger learners."*

T6 replied: *"Sometimes I let learners share how math is used in their families, it brings in indigenous perspectives naturally."*

Storytelling, games, and community-based activities.

Asked on how storytelling, local games, or community-based activities can be used to teach mathematical concepts, the following are some of the verbatim responses.

T3 stated: *"Traditional stories often include patterns, sequences, or numbers that we can link to math topics."*

T10 remarked: *"Games like tsoro or nhodo involve strategy and counting, they're great for logical reasoning."*

T7 responded: *"Organizing community role-plays or market simulations helps teach money and problem-solving."*

Involvement of elders and community members.

Asked what role elders or community members play in helping to integrate IKS into mathematics teaching, the following are some of the verbatim responses from the participating teachers:

T8 came out with this response: *"They can visit schools and explain how they use math in crafts, farming, or trading."*

T13 responded: *"Elders have real-life experience with traditional ways of calculating or estimating, they're a valuable resource."*

T1 said: *"Community members can contribute stories or demonstrate skills that show the practical side of math."*

Development of lesson materials and resources

Asked on what kinds of lesson materials or resources would support the integration of indigenous knowledge in math instruction, the following are some of the responses from the participating teachers.

T5 said: *"We need textbooks or guides that include local examples and traditional practices."*

T12 replied: *"Visual aids showing traditional patterns or tools would help explain concepts like symmetry or measurement."*

T7 alluded: *"Videos or recordings of elders demonstrating math in everyday life would make lessons more authentic."*

Adapting assessment practices.

When asked on how assessment practices be adapted to reflect learners' understanding of both formal and indigenous mathematics, the following are some of the verbatim responses:

T2 said: *"We could include project-based tasks where learners solve real-world problems using local methods."*

T11 remarked: *"Assessments should allow for explanations based on indigenous reasoning, not just textbook methods."*

T15 opined: *"Portfolios or reflective journals could help document how learners connect math to their culture."*

Teacher training and professional development.

Asked on what training or professional development do teachers need to effectively use IKS in mathematics classrooms?

T12 adduced: *"Workshops that show how to link curriculum topics with indigenous practices would be helpful."*

T7 remarked: *"We need exposure to traditional knowledge ourselves before we can teach it."*

T14 said: *"Collaborative training with local cultural experts could build both knowledge and confidence."*

Curriculum alignment with IKS .

Asked on which aspects of the current curriculum be aligned with indigenous knowledge without compromising learning objectives, the following are some of the verbatim responses from the participating teachers.

T2 asserted: *"Topics like measurement, geometry, and number operations can easily include indigenous examples."*

T13 said: *"We can integrate IKS into problem-solving, estimation, and patterns without changing the core objectives."*

T8 alluded. *"The curriculum allows room for local context, so it's about using that space wisely."*

Collaborative strategies and partnerships.

Finally, when asked on what collaborative strategies (e.g., teacher networks, school-community partnerships) could promote IKS-based teaching in mathematics, the following are some of the verbatim responses:

T10 said: *"We could form local teacher groups to share ideas and create lesson plans using indigenous knowledge."*

T7 remarked: *"Partnering with cultural organizations or traditional leaders can help bridge the gap."*

T2 replied: *"Organizing community days where students learn from elders would strengthen the school-community bond."*

4.5 Summary

This study explored how primary school teachers perceive, interpret, and implement Indigenous Knowledge Systems (IKS) in mathematics education, highlighting both

opportunities and challenges. Teachers generally understood IKS as traditional, culturally rooted ways of solving problems, such as using patterns in crafts, local farming techniques, traditional games, and indigenous counting methods. Examples included land measurement with body parts, market-based grouping, weaving to illustrate symmetry, and timekeeping through natural cycles. These practices were recognized as rich in mathematical content, with games like *tsoro* and *nhodo* fostering counting, sequencing, and problem solving, while crafts and construction introduced concepts of geometry, patterns, and measurement.

Despite this awareness, integration of IKS in mathematics teaching was found to be limited and inconsistent. Teachers reported that curriculum guidelines and textbooks provide little direction, leaving the use of indigenous practices to personal initiative. Challenges included an exam-driven curriculum, lack of structured resources, minimal training on IKS, and occasional resistance from parents or administrators who view traditional practices as irrelevant or unscientific. As a result, indigenous examples in lessons though engaging and relatable for learners remain sporadic and unevenly applied.

Teachers identified strategies that enhance the integration of IKS, such as contextualizing lessons with local examples, storytelling, traditional games, and community-based activities. Involving elders and cultural experts was seen as especially valuable for making mathematical concepts tangible and culturally authentic. Teachers also recommended collaborative networks, culturally relevant teaching materials, and alternative assessment methods such as projects and portfolios to capture both formal and indigenous mathematical understanding.

Professional development emerged as a critical need, with many teachers expressing uncertainty about how to effectively connect curriculum content with indigenous practices. Training workshops, co-learning with community elders, and the provision of culturally aligned resources were viewed as essential to empowering teachers.

Overall, while teachers recognized the strong potential of Indigenous Knowledge Systems to enrich mathematics education by making it more engaging, relevant, and culturally grounded, systemic support is lacking. The study highlights the need for clearer curriculum frameworks, resource development, flexible assessments, professional training, and stronger policy support to sustain meaningful integration of IKS in primary school mathematics.

4.6 Discussions

4.6.1 The current state of Indigenous Knowledge Systems in the Zimbabwean primary school mathematics curriculum.

The results from the interview of participating teachers shows that teachers understand and define indigenous knowledge systems in the context of mathematics education. This is in agreement with the previous literature. The study by Mpofu and Mawere (2020) on traditional games in Zimbabwe, highlighted how traditional games embody complex mathematical reasoning, including counting, planning, and sequencing. The authors show how traditional recreation can be used to contextualize learning in a culturally meaningful way.

The results from the interview of participating teachers also showed that teachers use traditional games like nhodo or tsoro to teach counting and strategy. This is in line with the study by Mapara (2016) which highlighted that in Zimbabwe, IKS manifests in a variety of forms, including traditional measurements, games like nhodo and tsoro, geometric patterns in basket weaving and hut decorations, and problem-solving in agriculture and construction.

The findings from the teachers' interview revealed that the curriculum is very exam-focused and there is little time to include traditional knowledge. The results also showed that lack of resources or clear guidelines makes it hard to know what is appropriate to include. This is consistent with the results from the past studies. As noted by Chikomba and Mhishi (2019), although the curriculum advocates for a competence-based and learner-centred approach, it falls short of operationalizing indigenous knowledge in classroom practice. Teachers often rely on textbooks that mirror Western content and pedagogies, leaving them with little guidance or resources to include IKS in their teaching (Nherera, 2018).

The findings from the teachers' interview revealed that teachers use basket weaving patterns to teach geometry and symmetry and measure land or using counting sticks.

This is consistency with the previous studies. Chikodzi and Nyota (2020) explored the use of local artefacts and practices such as using clay pots to teach volume or local currency histories to explain financial mathematics.

The results from the teachers' interview on how the Zimbabwean primary mathematics curriculum designed to accommodate indigenous knowledge systems revealed that the

curriculum mentions it vaguely, but without specific guidelines and does not clearly link mathematics to indigenous knowledge. This is in line with the results of the past studies. Research indicates that while Zimbabwe's curriculum framework acknowledges the importance of local knowledge, there is minimal practical integration of IKS into mathematics education. According to Shizha (2018), the dominance of Western paradigms has led to the devaluation of indigenous practices as "unscientific," resulting in their exclusion from formal syllabi.

The results from the interview showed that teachers never receive any formal training on how to incorporate indigenous knowledge into mathematics education. This is consistent with results of the past studies. Studies show that many teachers in Zimbabwe are either unaware of the potential value of IKS in mathematics or feel ill equipped to incorporate it due to inadequate training during pre-service education (Mawere, 2015).

The findings from the teachers' interview on how learners respond to the use of indigenous knowledge in mathematics lessons showed that learners get excited when they see something familiar from their environment and some learners find it easier to understand concepts through traditional examples. This is in line with the results from the past studies. Chikodzi and Nyota (2020) found that learners responded positively when lessons included familiar cultural elements.

The findings on interview on what policy or administrative measures influence the inclusion or exclusion of indigenous knowledge in the curriculum revealed that education policy talks about cultural relevance, but it's not emphasized in assessments and administrators rarely bring it up unless there's a specific initiative. The results confirm the results of the previous studies. In the analysis of Zimbabwean curriculum reforms, Mavhunga (2018) notes that while the 2015–2022 Curriculum Framework encourages heritage-based education, it provides insufficient guidance on operationalizing Indigenous content in mathematics.

4.6.2 Indigenous mathematical concepts and practices effectively integrated into primary school mathematics instruction.

The results from the interviews about indigenous practices related to measurement or estimation familiar within their communities revealed that people often estimate distances using body parts, like hands or feet, especially when measuring land and use arm lengths or

sticks to measure out fields. This confirm the results from the past studies. A study by Mapara (2016) revealed that traditional Zimbabwean communities used body parts such as arms, feet, and fingers for estimating length and distance in rural markets and daily activities.

The findings from the interview also showed that games like tsoro involve counting and strategic thinking; nhodo helps learners to understand sequencing, and number patterns. This is in line with the results of the past studies. Mapara (2016) argues that incorporating games such as Tsoro,or Nhodo into classroom activities fosters learning through play and supports development of problem-solving skills in familiar and engaging contexts. These games support the development of logical thinking and computational fluency (Gerdes, 2018).Thus, incorporating traditional games into mathematics lessons makes learning engaging and accessible.

The findings from the interview showed that basket weaving reveal symmetry and repeating patterns excellent for teaching shapes and angles. The results also showed that Mat designs often use tessellations can connect to geometry topics and these patterns naturally show reflection and rotation, which are part of our curriculum. This confirms the results of the past studies. Zimbabwean traditional basket weaving, pottery, beadwork, and hut construction all involve shapes, symmetry, angles, tessellation, and spatial reasoning (Gerdes, 2018). The geometric patterns found in floor decorations (murals), mats, and fences provide authentic learning resources for teaching concepts such as area, perimeter, congruence, and patterns (Mtetwa & Garofalo, 2016).

The findings from the teachers' interview about if indigenous methods of counting, grouping, or trading be connected to topics like number sense or place value revealed that traditional counting sometimes uses stones or seeds, which helps with understanding quantity and there's a strong concept of sharing equally, which links to division and fractions. This is consistent with results from the past studies. The Shona and Ndebele languages have number words and structures that reflect grouping and partitioning (Mawere, 2015). Studies show that these systems can serve as foundational tools to teach modern number concepts by connecting learners' linguistic and cultural backgrounds to arithmetic (Zaslavsky, 2015).

The findings from the interview about traditional time keeping or calendar systems could help teach concepts of time and sequence showed that Some communities still use moon phases or seasons to track time, these relate to calendar topics and farmers use rainfall patterns to predict

planting times, which teaches sequencing and estimation. Further, the results showed that telling time by the sun's position is something elders still do and this introduces concepts of time naturally. This is consistent with the previous studies. Communities traditionally tracked time through moon phases, seasonal changes, and agricultural events (Mudzingwa & Ndlovu, 2021). For example, the Shona month "Nyamavhuvhu" (August), named after strong winds, connects natural observation with the passage of time (Mudzingwa & Ndlovu, 2021). These concepts provide a basis for teaching time, sequencing, and calendar use.

The findings from the teachers' interview revealed that farmers use rows and spacing for planting, good for teaching area and perimeter. The results also show that building structures often involves measurement, angle judgment, and symmetry. This is in agreement with the results from the past. The geometric patterns found in floor decorations (murals), mats, and fences provide authentic learning resources for teaching concepts such as area, perimeter, congruence, and patterns (Mtetwa & Garofalo, 2016). Such culturally grounded artefacts not only teach geometry but also preserve cultural heritage.

The results of the study also revealed that elders estimate prices, measure land, and plan events, real-life applications of mathematics. This confirm the results from the past. Community members used containers like gourds and calabashes for measuring volume, and stones or bags for mass (Mapara, 2016). Integrating these practices into lessons on non-standard and standard measurement units can help learners grasp the concept of measurement more concretely (Mosimege, 2016).

Further, the findings from the teachers' interview revealed that challenges or opportunities in using indigenous mathematical examples in formal instruction make mathematics more meaningful, but the challenge is lack of resources and also some topics fit well, but assessments are too standardized to allow much flexibility.

This is in agreement with the past studies. Integrating these indigenous mathematical practices into the formal curriculum not only supports mathematical understanding but also fosters cultural identity and inclusivity in the classroom (Gerdes, 2018). Indigenous mathematical knowledge in Zimbabwe is embedded in various cultural and practical domains such as farming, architecture, craftwork, trade, and games. These domains provide numerous opportunities to teach mathematical concepts in ways that are meaningful to learners' lived experiences (Zaslavsky, 2015).

4.6.3 Strategies and pedagogical approaches can be developed to integrate Indigenous Knowledge Systems (IKS) into primary school mathematics teaching.

The findings from the teachers' interview on what teaching strategies used or observed that successfully incorporate indigenous knowledge into mathematics lessons, revealed that teachers used local farming examples to teach measurement, students really connect with that incorporating traditional counting systems helps build number sense for younger learners. This is consistent with results from the past studies. In Zimbabwe, culturally responsive mathematics teaching would involve using familiar contexts such as traditional games, farming practices, crafts, and architecture to teach abstract mathematical concepts (Mawere, 2015; Chikomba & Mhishi, 2019). This strategy not only bridges the gap between home and school learning environments but also enhances learner motivation and engagement.

The findings from the interview showed that traditional stories often include patterns, sequences, or numbers that we can link to math topics and games like tsoro or nhodo involve strategy and counting. This is in agreement with the results of the past studies. Visual aids, games, stories, puzzles, and manipulatives based on local practices can support mathematics learning in ways that are meaningful to learners (Nyoni, 2020).

On the role elders or community members play in helping to integrate IKS into mathematics teaching, the results from the teachers interview showed that community members can contribute stories or demonstrate skills that show the practical side of mathematics. This is consistent with the findings of the previous studies. Semali and Kincheloe, (2017) posits that effective integration of IKS often requires moving beyond the classroom to involve community elders, artisans, and cultural practitioners as co-educators. Place-based learning connects mathematical content to the learners' immediate environment such as local markets, farming methods, or building designs to ground abstract concepts in real-life situations (Semali & Kincheloe, 2017).

The results of the interview on what kinds of lesson materials or resources would support the integration of indigenous knowledge in mathematics instruction revealed that there is need of textbooks or guides, visual aids and videos that include local examples and traditional practices. This is in line with the results from the previous studies. As indicated by Nyoni (2020), the creation of learning resources and teaching aids that reflect indigenous knowledge is crucial.

Visual aids, games, stories, puzzles, and manipulatives based on local practices can support mathematics learning in ways that are meaningful to learners (Nyoni, 2020).

The findings of the interviews on how assessment practices be adapted to reflect learners' understanding of both formal and indigenous mathematics showed that teachers used project-based tasks where learners solve real-world problems using local methods and assessments should allow for explanations based on indigenous reasoning, not just textbook methods. This is consistent with results from the past studies. Scholars advocate for curriculum developers to incorporate indigenous mathematical content explicitly into learning objectives, activities, and assessments (Mtetwa & Garofalo, 2016). Localized curriculum materials may include indigenous counting systems, traditional units of measurement, or geometric patterns from local crafts.

Further, the results of the study on what training or professional development do teachers need to effectively use IKS in mathematics classrooms revealed that workshops that show how to link curriculum topics with indigenous practices would be helpful and collaborative training with local cultural experts could build both knowledge and confidence. This is in line with the results from the past studies. Ongoing professional development workshops and collaborations with local communities can support teachers in developing appropriate strategies and building confidence in using culturally grounded approaches (Chikodzi & Nyoni, 2019).

The results of the interviews on which aspects of the current curriculum be aligned with indigenous knowledge without compromising learning objectives showed that topics like measurement, geometry, and number operations can easily include indigenous examples. This is in agreement with the results from the past studies. Teacher education programs need to include modules on ethno mathematics, cultural relevance, and IKS to prepare educators to implement context-based teaching (Mawere, 2015; Nherera, 2018).

Finally, the findings on what collaborative strategies (e.g., teacher networks, school-community partnerships) could promote IKS-based teaching in mathematics revealed that formation of local teacher groups help teachers to share ideas and create lesson plans using indigenous knowledge. The results also suggests that collaborating with cultural organizations or traditional leaders can help bridge the gap. This conform to the results of the previous studies. Activities like problem solving using indigenous tools or designing projects around traditional structures and games allow learners to construct mathematical understanding

collaboratively (Mosimege, 2016). This participatory approach helps shift learners from passive recipients of abstract knowledge to active constructors of meaning, rooted in their cultural context.

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. INTRODUCTION

Chapter four analysed and discussed the data from a study on. This chapter summarises the key findings of the study, draws conclusions and proffers recommendations to enhance the integrating of African indigenous knowledge systems into primary school mathematics.

5.2 SUMMARY

This research project explores how Indigenous Knowledge Systems (IKS) can be meaningfully integrated into the teaching and learning of mathematics at the primary school level. The study was guided by the following research questions which sought to explore how Indigenous Knowledge Systems (IKS) can be integrated into the teaching of primary school mathematics in Zimbabwe:

1. What is the current state of Indigenous Knowledge Systems in the Zimbabwean primary school mathematics curriculum?

2. What Indigenous mathematical concepts and practices can be effectively integrated into primary school mathematics instruction?

3. What strategies and pedagogical approaches can be developed to integrate IKS into primary school mathematics teaching?

5.2.1 Summary of Interview Findings on the current state of Indigenous Knowledge Systems in the Zimbabwean primary school mathematics curriculum.

The study revealed that teachers generally understand and define indigenous knowledge systems (IKS) in the context of mathematics education, a finding consistent with earlier literature. Teachers highlighted the use of traditional games such as *nhodo* and *tsoro* to teach counting, strategy, and logical reasoning, echoing research by Mpofu and Mawere (2020) and Mapara (2016), who emphasized the mathematical value of traditional recreation and practices. Teachers also reported using indigenous artefacts and designs, such as basket weaving patterns for geometry and counting sticks for measurement, in line with previous studies (Chikodzi & Nyota, 2020).

Despite this recognition, several challenges were noted. The Zimbabwean mathematics curriculum was found to be exam-focused, with limited space for IKS integration. Teachers lamented the lack of resources and clear guidelines, a concern also raised in past studies (Chikomba & Mhishi, 2019; Nherera, 2018). Furthermore, while the curriculum framework acknowledges cultural relevance, it only makes vague references to IKS without practical guidance, reflecting concerns raised by Shizha (2018) about the dominance of Western paradigms.

Teacher training emerged as another major gap, as participants revealed that they have not received formal preparation on how to incorporate IKS into mathematics education. This aligns with Mawere (2015), who observed that many teachers feel unprepared or lack awareness of the value of IKS due to inadequate pre-service training.

In terms of learner responses, teachers reported that learners were enthusiastic and more engaged when familiar cultural elements were included in lessons, consistent with findings by Chikodzi and Nyota (2020).

Finally, policy and administrative issues were noted. While education policy emphasizes cultural relevance in principle, it does not prioritize IKS in assessments, and administrators rarely promote its inclusion except under specific initiatives. This reflects Mavhunga's (2018) observation that although Zimbabwe's curriculum reforms encourage heritage-based education, they fall short in providing clear strategies for embedding indigenous knowledge into mathematics teaching.

5.2.2 Summary of interview results on what Indigenous mathematical concepts and practices can be effectively integrated into primary school mathematics instruction.

The study revealed that indigenous practices of measurement and estimation remain central in Zimbabwean communities, where people use body parts such as hands, feet, arms, and sticks to measure distances or fields, confirming earlier findings by Mapara (2016). Teachers also identified traditional games like *tsoro* and *nhodo* as useful tools for developing counting, sequencing, logical reasoning, and problem-solving skills, aligning with prior studies (Mapara, 2016; Gerdes, 2018).

Indigenous designs and crafts such as basket weaving, mats, and beadwork were shown to illustrate symmetry, tessellation, reflection, and rotation, offering authentic resources for teaching geometry and spatial reasoning. These findings echo earlier research (Gerdes, 2018; Mtetwa & Garofalo, 2016). Similarly, traditional counting and grouping methods, such as using stones or seeds and sharing equally, were linked to number sense, division, and fractions, in agreement with studies showing how Shona and Ndebele number systems reflect grouping and partitioning (Mawere, 2015; Zaslavsky, 2015).

Teachers also highlighted indigenous timekeeping practices, including the use of moon phases, seasonal cycles, rainfall patterns, and the sun's position to track time and sequence. These methods align with findings by Mudzingwa and Ndlovu (2021), who emphasized the cultural basis of time concepts in Shona traditions. Farming and construction practices, such as spacing rows of crops or using circular hut structures, were identified as rich contexts for teaching area, perimeter, angles, and symmetry, supporting earlier work by Mtetwa and Garofalo (2016).

The role of elders and community members was also emphasized, as they apply mathematics in daily life through land measurement, pricing, event planning, and traditional measurement tools like gourds and stones. Such practices provide meaningful entry points for introducing both non-standard and standard measurement units, consistent with Mapara (2016) and Mosimege (2016).

Finally, while teachers recognized the opportunities of integrating indigenous practices to make mathematics more relevant and meaningful, they noted challenges such as lack of resources and rigid, exam-oriented assessments. This reflects earlier findings (Gerdes, 2018; Zaslavsky, 2015), which highlight both the pedagogical value of IKS and the systemic barriers to its full inclusion.

5.2.3 Summary of interview results on what strategies and pedagogical approaches can be developed to integrate IKS into primary school mathematics teaching.

The study revealed that teachers successfully incorporated indigenous knowledge into mathematics lessons through strategies such as using local farming examples to teach measurement and traditional counting systems to build number sense. These culturally responsive approaches align with prior studies (Mawere, 2015; Chikomba & Mhishi, 2019) showing that traditional practices, games, crafts, and architecture bridge home and school learning, making mathematics more engaging. Teachers also highlighted the role of traditional stories, games like *tsoro* and *nhodo*, and community activities in developing logical reasoning and problem-solving, consistent with Nyoni (2020).

Community elders and members were found to play a vital role by contributing stories, skills, and demonstrations that show the practical side of mathematics, supporting Semali and Kincheloe's (2017) emphasis on place-based learning and the involvement of cultural practitioners as co-educators. Teachers stressed the need for culturally relevant resources,

including textbooks, guides, visual aids, and videos that reflect local practices, echoing Nyoni's (2020) call for indigenous teaching aids.

On assessment, teachers suggested project-based tasks, localized problem-solving, and explanations grounded in indigenous reasoning. This is consistent with Mtetwa and Garofalo (2016), who advocate for curriculum developers to embed indigenous mathematical content into learning objectives, activities, and assessment. Professional development was also identified as crucial, with teachers recommending workshops and collaboration with cultural experts, in line with Chikodzi and Nyoni (2019).

The study further showed that aspects of the curriculum such as measurement, geometry, and number operations can be aligned with indigenous practices without compromising learning objectives, reflecting arguments by Mawere (2015) and Nherera (2018) for ethnomathematics and context-based teaching in teacher education programs. Finally, teachers emphasized collaborative strategies such as forming teacher networks, partnering with cultural organizations, and school-community projects to promote IKS-based mathematics teaching. This supports Mosimege's (2016) findings that participatory approaches rooted in cultural practices encourage learners to actively construct mathematical understanding rather than passively receiving abstract knowledge.

5.3 CONCLUSION

The research concluded that integrating Indigenous Knowledge Systems (IKS) into primary school mathematics enriches the curriculum by making it more culturally relevant, inclusive, and contextually meaningful for learners. The findings demonstrated that Indigenous knowledge contains deeply embedded mathematical ideas that, when thoughtfully incorporated into teaching, enhance learners' conceptual understanding and engagement.

Furthermore, the study revealed that such integration fosters respect for diverse worldviews, supports identity formation among Indigenous learners, and promotes equity in education. Effective integration requires sustained collaboration between teachers, Indigenous communities, and policymakers, as well as targeted teacher training to equip teachers with the necessary cultural and pedagogical competencies.

Ultimately, this research affirms that mathematics education benefits from embracing multiple knowledge systems, and it advocates for systemic efforts to reframe curricula to be reflective of the cultural realities of all learners.

5.4 RECOMMENDATIONS

The following are the recommendations made from the findings of this research:

(i) Integrate Indigenous mathematical concepts into national and regional curricula by identifying culturally embedded patterns, measurement systems, and problem-solving techniques relevant to local contexts.

(ii) Provide professional development programs for teachers that focus on Indigenous pedagogy, cultural sensitivity, and methods for connecting IKS with formal mathematics content.

(iii) Actively involve Indigenous elders, knowledge holders, and community members in curriculum design, classroom instruction, and the validation of learning materials.

(iv) Develop culturally appropriate teaching aids, textbooks, and digital content that reflect Indigenous worldviews and mathematical practices.

(v) Encourage education policymakers to support and mandate the inclusion of Indigenous knowledge in formal education through clear guidelines, funding, and monitoring frameworks.

(vi) Promote ongoing research to evaluate the impact of IKS integration on learner outcomes and adapt approaches based on empirical evidence and community feedback.

(vii) Encourage inquiry-based and experiential learning methods that allow students to explore mathematics through real-life Indigenous practices, such as crafts, storytelling, agriculture, and architecture.

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Appendices

INTERVIEW SCHEDULE FOR TEACHERS

RESEARCH QUESTION 1

What is the current state of indigenous knowledge systems in the Zimbabwe primary school mathematics curriculum?

Sub- questions

1. How do teachers understand and define indigenous knowledge systems in the context of mathematics education?

2. In what ways are indigenous knowledge concepts currently included in primary school mathematics lessons and materials?
3. What challenges do teachers face when integrating indigenous knowledge into mathematics teaching?
4. Are there specific indigenous mathematical practices or examples that are commonly used in classrooms?
5. How is the Zimbabwean primary mathematics curriculum designed to accommodate indigenous knowledge systems?
6. What support or training is provided to teachers for incorporating indigenous knowledge into mathematics education?
7. How do learners respond to the use of indigenous knowledge in mathematics lessons?
8. What policy or administrative measures influence the inclusion or exclusion of indigenous knowledge in the curriculum?

RESEARCH QUESTION 2

What are the Indigenous mathematical concepts and practices that can be effectively integrated into primary school mathematics instruction?

Sub questions

1.What indigenous practices related to measurement or estimation are familiar within your community?

2.Which traditional games or activities demonstrate mathematical thinking or problem-solving?

3.How are indigenous patterns or designs (e.g., weaving, beadwork) used to teach concepts like geometry or symmetry?

4.Can indigenous methods of counting, grouping, or trading be connected to topics like number sense or place value?

5.What traditional time-keeping or calendar systems could help teach concepts of time and sequence?

6. Are there local farming or construction techniques that involve mathematical reasoning or spatial awareness?

7. How do elders or community members use mathematics in daily life, and could these practices be adapted for classroom use?

8.What challenges or opportunities do you see in using indigenous mathematical examples in formal instruction?

RESEARCH QUESTION 3

What are Strategies and pedagogical approaches can be developed to integrate Indigenous Knowledge Systems (IKS) into primary school mathematics teaching?

Sub questions

1. What teaching strategies have you used or observed that successfully incorporate indigenous knowledge into math lessons?
2. How can storytelling, local games, or community-based activities be used to teach mathematical concepts?
3. What role can elders or community members play in helping to integrate IKS into mathematics teaching?
4. What kinds of lesson materials or resources would support the integration of indigenous knowledge in math instruction?
5. How can assessment practices be adapted to reflect learners' understanding of both formal and indigenous mathematics?
6. What training or professional development do teachers need to effectively use IKS in mathematics classrooms?
7. Which aspects of the current curriculum can be aligned with indigenous knowledge without compromising learning objectives?
8. What collaborative strategies (e.g. teacher networks, school-community partnerships) could promote IKS-based teaching in mathematics?

SAMED

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BINDURA UNIVERSITY OF SCIENCE EDUCATION

Date: ----------

TO WHOM IT MAY CONCERN

NAME: MUDAMBURI CHIPO REGISTRATION NUMBER: B225958A

PROGRAMME: HBSc Ed Mathematics PART: 2:1

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

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

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

Z Ndemo (Dr.)
CHAIRPERSON - SAMED

Reference: MUDAMBURI·C

E. C. No.: 1977041 G

All communications should be addressed to
"The Provincial Education Director Mashonaland East Province"
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ZIMBABWE

Ministry of Primary & Secondary Education
Mashonaland East Province
P.O. Box 752
Marondera
Zimbabwe

30/06/2025.

~~Mr~~./Mrs./Miss MUDAMBURI CHIDO

BEATRICE GOVERNMENT PRIMARY SCHOOL

P·BAG 49 BEATRICE

PERMISSION TO CARRY OUT RESEARCH IN SCHOOL FOR EDUCATIONAL PURPOSES: ~~MR~~/MRS/MISS MUDAMBURI·C **E. C. NO.** 1977041 G
STUDENT I. D. B225958A **TEACHER AT** BEATRICE PRY **SCHOOL**

Reference is made to your minute dated 30 JUNE 2025.
Please be advised that permission has been granted that you carry out research work in our schools. You are accordingly being asked to furnish the Ministry with information about your findings so that we share the knowledge for the benefit of the system as well as our nation at large.

We wish you all the best and hope to hear from you after completing your project work.

HUMAN RESOURCES OFFICER – DISCIPLINE
FOR PROVINCIAL EDUCATION DIRECTOR
MASHONALAND EAST PROVINCE
/mm

MIN. OF PRY & SEC. EDUCATION
HUMAN RESOURCES – DISCIPLINE
MASHONALAND EAST PROVINCE
30 JUN 2025
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