

BINDURA UNIVERSITY OF SCIENCE EDUCATION



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**RESEARCH TOPIC: THE INTEGRATION OF INDIGENOUS KNOWLEDGE SYSTEMS IN
THE TEACHING OF MATHEMATICS AT PRIMARY LEVEL.**

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REQUIREMENTS OF BACHELOR OF SCIENCE HONOURS DEGREE IN MATHEMATICS
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DEDICATION

To my beloved wife, Marenga Emily.

This dissertation is dedicated to you, the unwavering source of strength and inspiration in my life. Your love and support have been my guiding light throughout this journey, providing me with the motivation to pursue my dreams and the courage to face challenges head-on.

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With all my love

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ABSTRACT

This study investigated the integration of Indigenous Knowledge Systems in the teaching of mathematics at primary school level. The main objectives of the study were to determine the challenges in IKS integration in teaching of mathematics at primary level, establish the importance of using Indigenous Knowledge Systems in teaching of mathematics and to come up with approaches that can be used in minimizing the challenges on IKS integration in teaching of mathematics. The study employed a qualitative research within the interpretive research paradigm. The sample consisted of 3 teachers and 3 administrators selected from 1 primary School in Mudzi District using purposive and cluster sampling technique. The major findings of the study revealed that student's engagement and comprehension of mathematical ideas improved when Indigenous Knowledge Systems (IKS) are incorporated into elementary mathematical instruction. The study found out that there are several obstacles to overcome while incorporating IKS into mathematical curriculum, chief among them being curriculum restrictions, resource shortage and community opposition. The study also noted that multifaceted strategy including curriculum flexibility, professional development, community participation and resource development is needed to integrate IKS at primary level. Lastly a wide range of instructional strategies and resources catered to the different learning levels of the students were necessary for IKS into basic mathematics education. Based on the findings, the study recommends that the Ministry of Education provide focused professional development programs to emphasize IKS, establish cooperative learning opportunities and produce culturally appropriate material that represent indigenous viewpoints in the mathematics curriculum. The Ministry of Education should develop awareness programs aimed at communities and parents that highlight the advantages of integrating IKS into classrooms.

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1.0 Chapter 1

1.1 Introduction

Mathematics is an important subject in school curriculum. The subject is crucial in laying a fundamental base which uphold mental discipline and promotes logical reasoning and mental rigor. Above all mathematical knowledge plays an important role in understanding the concepts of other school subjects such as science, music and art. The subject has a direct link to everyday human life activities be it in social, cultural and economic environment. Hence learning mathematics introduces learners to concepts, skills and thinking strategies that are essential in daily life and support learning across the curriculum. It enables learners get sense of the numbers, shapes and patterns they observe in the world around them, offers ways of handling data in an increasingly digital world and makes a crucial contribution to their development as a successful learner.

However the researcher has observed that learning of mathematics has become a challenge in the educational system in Zimbabwe. Learners are struggling with mathematical concepts and processes which lead to low performance on the particular subject at primary level. This phenomenon has resulted in mathematics being perceived as an abstract and difficulty subject by learners and sometimes, by teachers too. Machinga, (2000) asserts that some obstacles that promote low performance in mathematics in many African schools are cultural. There is culture dissonance between what is taught in mathematics education in schools and the cultural understanding of how mathematics is applied in everyday lives of African students

(Brandbury2018). This phenomenon has called for the integration of Indigenous Knowledge Systems (IKS) in the teaching and learning of mathematics particularly at primary school level to curb poor performance on the subject in schools.

This chapter focuses on the background of the study, statement of the problem, research questions, objectives, significance of the study. Key terms are also defined and a summary of the chapter is also given. The study is going to investigate on the integration of Indigenous Knowledge Systems (IKS) in the teaching and learning of mathematics at primary school level.

1.2 Background of the study

Basing on the findings of the presidential commission of inquiry into education and training (Nziramasanga 1999). The findings of the commission were that the National curriculum did not aggressively promote the teaching of mathematics among other science subjects. This view by the commission came into existence after noted that most learners in schools are under performing in science subjects particularly mathematics. The recommendations of the commission lead to restructure of successive comprehensive national education curriculums of Zimbabwe of (2017-2022) and the New Heritage based curriculum. One of the main goals of the curriculums is to implement effective ways that can improve the teaching and learning of mathematics and increase the nation's pass rate at grade 7 primary level. The Zimbabwe National Curriculum Framework (2017-2017) emphasized the integration of Indigenous Knowledge Systems to make learning relevant, inclusive and responsive to local contexts. Mopse Mash West, (2019) acknowledge the use of Indigenous knowledge Systems in the teaching and learning through integrating Ubuntu/ hunhu in the teaching and learning process. Chombo,

(2000) also argues that education in Zimbabwe should shift from the prevalent and pervasive influence of foreign cultures and need measures to strengthen the base of local knowledge.

Difficulties in the learning of mathematics subject has greatly affected pass rate of grade seven learners at school, cluster, District, provincial and National level. According to Zimsec (2021) national pass rate for the past three consecutive years was as follows 37, 11% in 2021, 40, 09% in 2022 and 45, 5% in 2023.. This low pass rate is also experienced at school level where the researcher is currently stationed at. Result analysis indicates that an average pass rate in mathematics ranges from 15% to 30% for the past three consecutive years. It is under this background of low performance in grade seven examination that calls for new ways of enhancing the teaching and learning of mathematics at primary level. Former Education Minister Cain Mathema quoted in Herald, (2021) indicated that mathematics is one of the most failed subject at grade seven examination, which impacted on the general grade seven pass rate at all levels. This continuous low performance in mathematics subject at primary level together with view by the new curriculum of using Indigenous Knowledge System in the teaching and learning have prompted the researcher to engage in the investigation on the integration of the Indigenous Knowledge Systems in the teaching and learning of mathematics at Primary level. The sources of the learners' challenges in understanding mathematical concepts may be caused by non-alternative western teaching methodologies which are totally divorced from learner's lived cultural experiences. The difficulties in understanding of mathematical concepts ultimately leads to poor performance of the subject in all levels of learning. Higgs, (2008) recommends that curriculum planners and developers should consider infusing the curriculum content with knowledge from the local communities. The Indigenous Knowledge Systems are manifested in different cultural artifacts and objects that people use in their daily lives. Some of the

mathematics concepts embodied by artifacts and cultural objects include universal behaviors such as counting, symmetry, similarities, number patterns and geometry. Shizha, (2015) explains that mathematics is regarded as a social construct that explains the reality of people to construct and use knowledge to explain their reality. In all this Indigenous Knowledge System proved to be a relevant and effective tool to positively enhance the performance of learners in the area of mathematics.

Hence all these call for a change of focus in the teaching methodologies and incorporate Indigenous Knowledge Systems in the teaching and learning of mathematics at primary level. This takes into consideration, the use of indigenous games, feeble, riddles among in the teaching and learning of mathematics. Masiwa, (2001) conducted a study on traditional games in Zimbabwe and found that traditional games are rich in many concepts of mathematics such as counting, estimation, probability, arithmetic modulo among others which reflects the importance of Indigenous Knowledge Systems in the teaching and learning of mathematics. This is also supported by the study conducted by Mpofu and Mpofu ,(2019) which also pointed that indigenous games such as nhodo, tsoro, pada and hwishu are rich in mathematical concepts such as arithmetic progression, number patterns ,and types of numbers.

In order to come up with answers to the question raised and contribute to imperial evidence of the integration of the Indigenous Knowledge Systems in the teaching and learning of mathematics at primary school level, the researcher conducted a research on the integration of IKS at primary level.

1.3 Statement of the problem

The primary aim of the study is to investigate on the integration of Indigenous Knowledge Systems in the teaching and learning of mathematics at primary level. Many primary schools have experienced poor performance in mathematics at grade 7 which resulted in low pass rate on this particular subject at grade 7 examination. This low performance in mathematics has since impacted on the general performance of grade seven learners on their public examination at national level. This phenomenon has led to a wider consultation by the Nziramasanga Commission of inquiry into education which consider the inclusion of Indigenous Knowledge Systems in the teaching and learning through Ubuntu/hunhu philosophy. According to Makuvaza, (2010) the findings and recommendations of the commission Ubuntu/ hunhu should be the aim of education for Zimbabwe. These recommendations were also supported by Chombo, (2000) who also argues that education in Zimbabwe should shift from the prevalent and pervasive influence of foreign cultures and need measures to strengthen the base of local knowledge. It is the use of this local knowledge that can increase the understanding of mathematical concepts in the teaching and learning at primary school level and increase the pass rate as indicated by the New curriculum frame work of (2017-2022). Hence the researcher noted that integrating indigenous knowledge systems in the teaching and learning of mathematics at primary level has of greater significance in addressing consistence lower pass rates experienced in primary schools. Sunzuma and Maharaj, (2020) explains that the incorporation of indigenous materials into school mathematics contribute positively to understanding of mathematic concepts as well as improving performance. Integrating IKS in the teaching of mathematics contextualize the concept which simplifies the mathematical concepts from being abstract to a real experienced life situations which foster a good retention of concept. Nyathi, (2013) also supported that

integrating cultural aspects in mathematics instructions has long term benefits for mathematics learners, one of the benefits is that it improves retention of mathematical concepts. Social constructivist theorists have it that for meaningful learning to take place the social background need to be acknowledged. When it comes to mathematics knowledge it is a social construct that explains the reality of people who construct and use the knowledge to explain their reality and the knowledge has, therefore a cultural aspect to it. One of the reasons for poor performance in mathematics problem solving is the exclusion and marginalization of the wealth of knowledge learners bring to the classroom. This implies that learners come to school already possessing important ideas they extracted from their cultural environment which if harnessed in the teaching and learning of mathematics can contribute much in the understanding of mathematical concepts by learners.

It is the use of Indigenous Knowledge Systems that incorporates the existing knowledge learners have from their cultural background in the teaching and learning to maximize understanding of concepts. Learners at primary level learn mathematics word problems more easily and with better understanding when teaching draws from lived experiences and cultural practice Mawere, (2018). Mathematical problems at primary level is one of the learning area which presents a major challenges to learners hence contribute to low pass rate at grade 7 general examinations. This calls for the Integration of IKS in the teaching and learning of mathematics as it simplifies mathematical word problems to learners by bring them into realities they experience in their cultural environment. This can be done through the use of indigenous games, storytelling, riddles in the teaching and learning of mathematics.

Mpofu and Mpofu, (2019) in their study on indigenous games of Karanga people show that the use of indigenous knowledge like games to teach mathematics is original and unique, and if

utilized within a particular culture and society would yield great results. Mathematical curriculum that is divorced from learner's lived experience and badly written textbooks are some of the causes of learner's inability to understand and solve mathematical problems. This has impact on the poor performance of learners at grade seven as reflected by the low pass rates in mathematics experienced in primary schools. Thus the use of learner's lived experience in the teaching and learning of mathematics is significance as it makes the subject relevant and interesting. It is the integration of Indigenous Knowledge Systems in the teaching and learning of mathematics which can bring mathematical concepts into reality experienced by learners in their cultural environment. Mosimege, (2013), explains that the integration of Indigenous Knowledge Systems in the teaching of mathematics is likely to make the subject more accessible to most learners as they can relate it to many of the activities and experiences outside the classrooms. This situation could transform the way grade seven learners in primary schools learn mathematical concepts and improve their performance at grade seven examinations. Indigenous Knowledge Systems reduces mathematics from being an abstract subject that has no connection to what the learner's experience in their everyday life. This will motivate, build confidence and increase learner's ability to tackle mathematical challenges in their learning. Chitate, (2015) mentioned that they are student related factors that contributed to higher fail rate in the teaching and learning of mathematics at primary school that includes mathematics anxiety and prior knowledge these factors can only dealt with through the use of Indigenous Knowledge Systems.

Use of IKS has of a greater significance in increasing the understanding of mathematical concepts at primary level. The major thrust of the study is to develop an effective instrument that can be used by teachers to familiarize with possible challenges that can minimize understanding of mathematics concepts by learners and formulate a problem solving tool to these challenges

through the use of Indigenous Knowledge Systems. Use of usual teaching methodologies acquired by teachers in their Pedagogy education have put into practice in schools, but however understanding of mathematical concepts remain a thorn in the flesh in most learners at all levels in primary schools.

Most of the methods used by teachers in teaching and learning of mathematical fall short in bridging the gap between concepts taught and real experiences existing in learner's cultural context. This phenomenon has effectively suppressed the pass rate of many primary Schools. Despite all the efforts being made that involves workshops to assist teachers with technical and conceptual information to enhance understanding of mathematical concepts, mobilization of adequate resources (textbooks) among others, but learners continuously struggle with mathematics concepts and processes. This persisting challenges has resulted in mathematics being perceived as an abstract and difficulty subject by both learners and teachers. The ways in which the concepts are taught, explained and presented to learners are subject to scrutiny. All these drew the attention of the researcher to conduct a research on the integration of Indigenous Knowledge Systems in the teaching of mathematics concepts at primary school in which a primary School is selected for sampling purpose.

1.4 Research questions

- What Indigenous Knowledge Systems that can be integrated in the teaching of mathematics at primary level?
- What are challenges that can be faced when integrating Indigenous Knowledge Systems in teaching of mathematics?

- What are the approaches that can be employed to minimize challenges that encountered when integrating Indigenous Knowledge Systems at primary level?

1.5 Objectives of the study

- To identify specific Indigenous Knowledge Systems that can be integrated into the teaching and learning of mathematics at primary level.
- To determine the challenges that are faced when integrating Indigenous Knowledge Systems in the teaching and learning of mathematics and possible solutions.
- To determine approaches that can be used in minimizing the challenges encountered when integrating Indigenous Knowledge Systems at primary level.

1.6 Significance of the study

The findings of the study will be a beneficial to a number of stakeholders that includes teachers, learners, parents and responsible authorities.

1.6.1 Teachers

The results from the study will benefit teachers with appropriate teaching skills as well as broaden their thinking on how they can motivate learners, simplify concepts and increase better understanding of mathematics through integrating Indigenous Knowledge Systems in the teaching and learning of mathematics. The research findings can also expose teachers to simple and effective teaching methodologies that are experienced by learners in their real life other than sticking to abstract methods of teaching mathematics.

1.6.2 Learners

Once learners increased their understanding of mathematic concepts through the use of Indigenous Knowledge Systems they will be motivated and endeavor to change of their attitude towards the mathematics. The findings will also play a role in eradicating math phobia within learners and extinguish the notion that mathematics is a difficulty subject obsessed with abstract concepts only.

1.6.3 Parents

There is hope that the research findings will be useful to the parents. The findings will help parents change their attitudes towards the subject and became more supportive to learners, teachers and the school as a whole.

1.6.4 Responsible authorities.

The findings of the study will expose administrators to the use of Indigenous Knowledge Systems which plays a significant role in the teaching of mathematics. It will extend their field of knowledge, increase their skills and assist in the Integration of Indigenous Knowledge Systems in the teaching and learning of mathematics in schools. The findings of the study will go a long way in compelling the school administrators and relevant stakeholders to provide material support, conducting staff development activities and workshops towards the Integration of Indigenous Knowledge Systems in the teaching and learning of mathematics which contribute to

increased pass rates, cultivate positive attitudes and motivation towards the mathematics in primary schools. The usefulness of the research findings can also extend to the curriculum planners who can be compelled to find the best way of integrating indigenous Knowledge Systems in the teaching and learning of mathematical subject in primary schools.

1.7 Assumptions

The school's responsible authority will grant the needed permission for the researcher to conduct his research at the school.

The respondents shall response to interviews as required and to the best of their knowledge.

Interview and observation guide used to gather data for the research shall provide quality and the required data.

1.8 Limitations.

Brown, etal, (1999) define limitations as an “imposed” restriction which is therefore essentially out of the researcher's control. In this research study time is going to be a limiting factor. The researcher is a classroom practitioner, hence is expected to be at work till 4pm. This present a challenge to the researcher who is expected to create a balance on the time of doing school business and time to do his research. The research shall also be dealing with learner as a sample of the study who may be committed to school business during the time when the research activities are to be carried out. Financial resources are also a limiting factor in the carrying out of the study. Response may give false results due to negative publicity, failure to understand requirements of questions and other external influences.

1.9 Delimitation

The research is carried out at Kondo Primary school in Mudzi District of Mashonaland East Province.

1.10 Definition of terms

Teaching. - is the facilitation of learning, it is the process of imparting knowledge, skills, and attitudes and values (Nziramanga, 2004).

Poor performance. - refers to inadequate level of achievement on educational endeavors. (Islahul, 2020).

Learner. - A learner is someone who is engaged in the process of acquiring knowledge or a new skill. (www.quora.com/what-is-the-meaning-of-learner

Learning - is the modification of behavior once one has acquired knowledge or skills through instruction (Farrant, 1982).

Mathematics. - is the science that deals with logic of shapes, quantity and arrangement (www.livescience.com).

1.11 Summary

This chapter provide a summary of the study by providing and discuss issues relating to the background and overview of the study, the objectives of the study, the research questions,

significance of the study and limitations and delimitations of the study. The next chapter will focus on literature review.

2.0 CHAPTER TWO LITERATURE REVIEW

2.1 Introduction

The previous chapter contextualized the research by clearly articulating the statement of the problem , presentation of the background of the study , highlighting the research objectives , familiarize with the significance of the study , making the assumptions , outlining the scope of the study and finally draw attention to possible limitations of the study.

This particular chapter of the study is there to provide a review of a related literature that is key to the investigation into the integration of Indigenous Knowledge Systems in the teaching of mathematics at primary level at Kondo Primary School in Mudzi District. According to Monash University, (2024) a literature review is a type of academic writing that provides an overview of existing knowledge in a particular field of research. Given the above definition, literature review is a detailed examination of previous researches that are directly or indirectly linked to a current study and draw application from various research to study of the integration Indigenous Knowledge Systems in the teaching of mathematics at primary level at Kondo primary in Mudzi District.

2.2 Indigenous Knowledge Systems (IKS).

Indigenous Knowledge Systems (IKS) has been considered as one of effective and helpful tool in the teaching and learning in schools. Since formal learning was introduced it brought with it imported teaching methodologies which even now are considered as relevant channels of imparting knowledge in each and every subject area including mathematics. Among these

western methodologies. Indigenous Knowledge Systems (IKS) was an outcast, poor and unacceptable in the formal learning though the learning was meant for indigenous people who have their own cultural environment which they understand better than western culture and methodologies. However as time progresses there was a continuous improvement of the education systems and teaching methodologies particularly in Africa. Zimbabwe as one of the African countries involved in the enormous search for better education through improved educational systems and effective methodologies, managed to identify Indigenous Knowledge Systems as important aspect to consider in teaching and learning in its new curriculums.

The Herald, (2024) refers (IKS) to the understandings, skills and philosophies developed by societies with long histories of interactions with their natural surroundings. It further explains that it is this local knowledge that informs decision- making about fundamental aspect of day- to- day life. This implies that Indigenous Knowledge Systems is a systematic pattern of acquiring vast knowledge through interaction with the immediate cultural environment and this knowledge is applied in solving problems that emanates among individuals or in a society as a whole. In supporting of this view Nyathi , (2013) explains IKS as the unique knowledge systems, practices, and innovations developed by local communities on Zimbabwe to manage their own lives . This knowledge system is unique and largely depend with the communities and is passed from generation to generation within the geographical area. It is more centered on community based learning, learners can share knowledge and experiences which clearly exhibits the existence of collaboration in IKS.

IKS is defined in the Zimbabwean New curriculum of (2017-2022) and the New heritage based curriculum as the observation of Ubuntu/hunhu and indigenous language systems and culture in the teaching and learning within the school environment. IKS came as a body of knowledge or

bodies of knowledge , of indigenous people of particular geographical areas that they have survived on for a long time, these bodies are developed through the process of acculturation and through kinship relationship that societal group form and are handed down to the posturing through oral tradition and cultural practices Mapara , (2009) . Senanayake (2006) perceives Indigenous Knowledge Systems as the unique knowledge restricted to a particular group of people in a society. It varies from culture to culture and is dynamic. This knowledge system form an essential base for an individual to acquire problem solving skills. Mascarenhas, (2004). Explains Indigenous Knowledge Systems as the sum of experience and knowledge of a given ethnic group that forms the basis for decision making in the face of familiar and unfamiliar problems and challenges. In formal learning process IKS can fit well in bridging the gap from the known to unknown in teaching of the concepts. It brings the use of real experiences rather than learning from abstract things. These IKS were taken for granted yet they possess the dominant powers to enhance problem solving skills, assimilation and mathematical analysis in a classroom situation. Mascarenhas, (2004) further explains IKS as the overall sum of knowledge, language and skills that individuals in a specific geographical area possess, enable them to get the most out of their environment. There is a constant application of mathematical concepts in day to day human life activities. Mathematics as a subject cannot be divorced from real life experiences of a human being. Thus in teaching and learning of mathematics, there is a need to integrate Indigenous Knowledge Systems a knowledge acquired by an individual from the natural environment. This knowledge system is vital in laying a strong foundation for conceptualization.

2.3. IKS Integration in Mathematics

Mathematics subject is perceived as one of the major subject which is so difficulty and composed of abstract concepts. Since the colonial era African nations adopted western methodologies in the teaching and learning of mathematics in their schools. In one way or another, it is these methodologies that limited exposure of learners to real life experiences of mathematics concepts. This scenario has brought a persisting problem of lower mathematical pass rate in primary school across nations. The researcher has found it that the integration of Indigenous Knowledge Systems (IKS) in mathematics learning has of greater value towards minimizing the challenges in the learning of the particular subject and increase the pass rate of the mathematics subject. Nyathi, (2013) explains that integrating IKS enhances primary mathematics education by providing contextual and culturally relevant examples, making mathematics more accessible and enjoyable for learners. This assertion by Nyathi, (2013) give clear evidence that IKS plays a crucial role in the learning of the mathematics subject as it present the concept to learners in their real and practical life situation than the presentation of the concepts in abstract form through un simplified methodologies. Chitate, (2015) also supported that traditional games and puzzles such as "Mancala and Tsoro" can be effectively used to teach mathematical concepts like numeracy, geometry and problem solving. These games in teaching mathematics are readily available and are within the learner's cultural context hence the concept taught is easily understandable to learners. Mpofu and Mpofu, (2019) conduct a study in Zimbabwe on indigenous games of Karanga people and found out that the use of Indigenous Knowledge like games in the learning of mathematics is original and unique, and if utilized within a particular culture or society yields great results. Learning of mathematics subject require critical thinking and problem solving skills which present a challenge to many learners at primary or secondary level. Lack of these abilities has lead learners to develop negative attitude

to the mathematic subject as well as exhibiting low performance. Therefore use of IKS help to secure the needed skills in solving mathematics problems. Mawere, (2018) states that IKS can help learners develop critical thinking and problem solving skills , essential for mathematics education activities such as storytelling among others.

Nhlanhla etal, (2022) argued that many of the concepts taught in schools are beyond the living experiences of the African students. This lack of correlation of concepts taught and cultural experiences of learners has negatively impact in the learning of mathematics hence provoked the need to integrate Indigenous Knowledge Systems in the teaching of mathematics. The integration of Indigenous Knowledge Systems in the teaching and learning of mathematics is essential as it closes the knowledge and communication gap between the teacher and the learner and rewarding undertaking for both teachers and learners if they can use collective language to share learning experiences that employ forms of communication that creates situation whereby meaning can be derived and learning becomes a living experiences. This brings tangible solution to poor performances in mathematics by our learners at primary level. Indigenous "culture" has become associated with ethno mathematics movement, because "ethno of ethno mathematics is identifiable cultural groups" (Larvor and Francois, 2018). In support to this notion Shizha, (2020) explains that mathematics as with any science and technology is about symbols and use of symbols , these symbols are cultural which are interpreted by cultural groups , people and communities that use them. Mathematical knowledge can not only acquired through formal learning or formal education, but learners can also acquire mathematical concepts through interacting with their environment. Integration of indigenous knowledge systems in teaching and learning of mathematics can involve the use of indigenous games, storytelling, and riddles among other.

2.4. IKS integration in Primary school

The integration of Indigenous Knowledge systems in teaching and learning at primary school level is considered by many as an important gesture. The Zimbabwe New curriculum model of (2017) has advocate the consideration of IKS in teaching and learning at primary school. This is reflected by inclusion of cultural based subjects that reflects IKS and considering Ubuntu/ Hunhu in the teaching and learning. Use of Artifacts in teaching and learning of Visual Performing Arts subject in Zimbabwe Primary education curriculum is a noticeable move towards integration of IKS in Primary school. Thaman, (2009) sees artifacts as an important IKS aspect that is an important teaching that can be used by teachers to bridge the gap between in and out of school concepts. Set up of assumed knowledge in planned schemes of work and lesson plans at primary school class has indeed put an effort to link the child to the concept taught by providing a clue from what the knows from his or her cultural background which is the so purpose of the Indigenous Knowledge System. The Zimbabwe IKS - based curriculum framework for Primary schools (2017-2022) has been set in motion to support the integration of Indigenous Knowledge Systems in the teaching and learning in primary school. It is the nation's curriculum that can foster the integration of IKS in primary schools. Shava, (2016) noted that knowledge, attitude or skill learned within IKS is essential and therefore its integration in the formal curriculum is paramount.

2.5. Teacher's perspectives of IKS

Indigenous Knowledge Systems has been proven by many researches to be effective in the teaching and learning in primary schools and secondary schools as well, but however various perspectives have been noticed from the teachers who are responsible in the integration of the IKS in teaching and learning. Nyathi, (2013) indicated that teachers have regarded IKS as an essential tool for promoting cultural identity and relevance in education. This positive perspective by teachers towards IKS has cemented the idea that the indigenous knowledge systems brings concept taught to reality and make the concept more relevant in their learning process. Teachers have also viewed Indigenous Knowledge Systems as better methodology to use to increase learner's understanding of the concepts taught. This was explained by Chitate, (2015) who said teachers appreciate Indigenous Knowledge Systems based learning because of its ability to connect theoretical concepts to real life situations. A case study by Chitate ,(2015) in his research titled "Integrating Indigenous Knowledge to mathematics education in Zimbabwe " carried out a survey of 100 primary school teachers and +75% of the teachers believed IKS enhanced mathematical learning . Some of the teachers also viewed the integration of indigenous Knowledge Systems in the teaching and learning as a noble idea as it motivate learners and increase their participation as compared to Euro-centric methods of teaching. Mawere, (2018) explains that teacher's value integrating Indigenous Knowledge Systems as it increased learner interest and participation when IKS is incorporated into lessons. In support of the perspective by many teachers on IKS as a motivator Magambiwa, (2017) did conduct a survey of 5 primary school in the research titled " IKS and Education in Zimbabwe: challenges and opportunities" 80% reported increased learner motivation with IKS based learning. Several other teachers, attributed IKS with the potential to enhance reflective reasoning in order to solve complex

sustainability problems. However other teachers view Indigenous Knowledge as being illogical, unscientific, ungodly and anti-development (Shizha and Makuvaza 2017).

2.6. Challenges of IKS

The integration of Indigenous Knowledge Systems in the teaching and learning of mathematics in primary schools proved to be effective and simplify concepts that are presented to learners in their more understandable cultural environment. However notable challenges have existed that can limit the integration of Indigenous Knowledge System in the teaching and learning. Sunzuma and Maharaj, (2019) carried out a study that exposed several challenges in integrating IKS methodologies in teaching and learning of mathematics. The challenges include lack of indigenous mathematical teaching approaches and how to integrate them in teaching of mathematics. Mugambiwa, (2017) stipulated that there is lack of policy and curriculum support for incorporating IKS into mathematics education. However this can also have negative impact on integrating the Indigenous Knowledge in all other learning areas. This limited documentation of concepts and practices of mathematics and other subject area was also acknowledged by Nyathi, (2013). A planned and systematic approach is crucial in developing a concept to maximize understanding of the concepts especially in mathematics which should be shown in the national curriculum and its school syllabi which is lacking on integrating indigenous Knowledge Systems especially in Zimbabwean school syllabi. Policies are there to foster and guide on how the IKS can be integrated. Nawesab, (2012) states that the teachers argue that the integration of Indigenous Knowledge System in teaching and learning is time consuming in content coverage.

Some of the activities in integrating IKS in teaching and learning of mathematics in our Zimbabwe context involves the use of traditional games, storytelling and riddles among others which may be perceived as time consuming and affect content coverage. In Zimbabwe schools more emphasis is placed on completing the subject syllabus which give pressures to teachers to resist the attempt to integrate IKS in their teaching. Lack of resources and materials for teaching IKS-based subjects brought a challenge in the integration of indigenous Knowledge Systems in teaching and learning (Matere ,2020) IKS are often taught by teachers who went through a Eurocentric education system that marginalized IKS and ethno mathematics(Shizha,2015) these teachers value more teaching using Eurocentric methods than integrating IKS in their teaching. Hence this require teacher training on incorporating IKS in the teaching and learning which is dragging behind in the Zimbabwe education system. This lack of teacher training was also noticed by Chitate, (2015) who indicate that lack of teacher training in incorporating IKS into mathematics education have drawbacks in the implementation of IKS in teaching.

Another challenge is the way people value the (IKS), the knowledge system is viewed as primitive and poor knowledge which cannot withstand the Eurocentric knowledge. Shizha, (2013) explains that IKS is portrayed as an old, primitive knowledge, irrational, illogical, and unscientific and common sense. These views has cause the rejection of Indigenous Knowledge Systems and taken as unacceptable in the teaching and learning especially by the teachers. Therefore there is need to change the perception and conception of the indigenous knowledge systems at the policy making and curriculum planning level as well as in teaching and learning. Another challenge is the failure go have appropriate IKS approach methodologies and integrate them in teaching and learning of mathematics. Hence teachers lack confidence using IKS which caused them to be unwilling to change from their traditional Eurocentric methods of teaching.

Nawesab , (2012) explains that the teachers argue that the integration of IKS methodologies are time consuming interns of content coverage . This view can force teachers to favor western - based methodologies of teaching mathematics and sideline the use of IKS.

2.7. Summary

The thrust of the chapter was to draw attention on relevant ideas that have been contributed by various educationist that have direct or indirect link regarding to the Integration of Indigenous Knowledge Systems in the teaching of mathematics at primary level. The covered topics in this particular topic includes Indigenous Knowledge System(IKS), Indigenous Knowledge System(IKS) integration in mathematics, Indigenous Knowledge System(IKS) integration at primary school, challenges of IKS and teacher's perspectives of IKS. The following section, chapter 3 will examine the methodologies used by the researcher to collect data for the study.

3.0 CHAPTER THREE Research Methodology

3.1 Introduction

The previous chapter focused on identifying gaps in the consulted literature that the current study intends to fill. This chapter deals with the research design and methodology which are explained therein. The researcher clearly examine research design, research method and data collection techniques. The researcher also outlines benefits and draw backs of using the research methods and instrument used in this study. Lastly the researcher gives attention to plans for data collection, processing and interpretation and ethical considerations are looked upon as well.

3.2. The Research Paradigm and design

3.2.1 The Research Paradigm

Research paradigm is a method, model or pattern for conducting a research. It is a frame work built upon philosophical ideas, assumptions, methodologies and values that provide guidance to a researcher on how to conduct the research (Creswell 2014). Denzin and Lincoln, (2000). Describe research paradigm as the underlining philosophical assumptions that guide research and influence the choice of methods. Creswell also supported that Research Paradigm is a set of beliefs and assumptions that guide research and provide a framework for understanding the research process. Morgan, (2007) defines research paradigm as a system of beliefs and practices that influence the researcher's selection of methods and techniques employed to study the case. It is a framework that provides a guidance to the researcher's decisions made during the inquiry process of the study. It is important for the researchers to consider research paradigms in their

case study as they have influence on the researcher's behavior when interacting with participants. Research paradigm also has an impact in shaping researcher's professional practice and the influence they have in the study.

3.2.2. Interpretive research paradigm.

This particular study followed interpretivist model of paradigm centered on qualitative research approach to explore on the Integration of Indigenous Knowledge Systems in the teaching of mathematics at primary level mainly focusing at Kondo Primary school in Mudzi District. Interpretivist is a qualitative research approach which seeks to understand the meaning and interpretation of data within the context in which the data is collected (Denzin and Lincoln, 2011). Interpretivist believe that truth is constructed through social interactions. In this study the researcher uses qualitative methods of collecting data which are interviews and observations which provide the social platform for participants to expose their views, experiences and behaviors on integrating IKS in the teaching of mathematics at primary level. In this study, views, opinions and experiences of participants are essential in understanding the social, educational and cultural context around the integrating of IKS in the teaching of mathematics. The interpretivist paradigm suit well particularly with the research under study as it seeks to get deeper understanding, collect and analyses data from participant's views and understandings (Patton, 2002). Interpretivist emphasize the importance of understanding the participant's perspectives and experiences. It seeks to uncover the meanings and interpretations that individuals assign to their experiences (Merriam, 2009). This aligns well with the research whose main thrust is to acquire data from teachers and learner's experiences and understandings. The

study employs qualitative research methods that includes observations, interviews and document analysis to gather data.

The qualitative research is particularly more ideal for the particular study which explore the integration of Indigenous Knowledge Systems in the teaching of mathematics at primary level at Kondo primary school. Creswell, (2014) explains that qualitative research allows for in-depth exploration of the research topic, enabling the researcher to gain a deeper understanding of the complexities involved in integrating IKS in mathematical education. Qualitative research also allows the researcher to have physical interactions with the participants and have in-depth understanding of experiences, beliefs and practices of the educators, students and all other concerned participants in the study. The physical interaction is vital in the provision of rich, detailed insights into how the IKS can be integrated in the teaching of mathematics at primary level.

Merriam ,(2009) stipulated that qualitative research provide a rich and nuanced understanding of the context in which the research is being conducted an important gesture in this study since the integration of IKS is embedded in the social and cultural context of the community. This allows the researcher to get into familiarization and increased understanding of social, cultural and environmental factors that influence teaching practices when integrating IKS in the teaching and learning. Increased understanding of social, cultural and environmental factors through qualitative research exposes the researcher to possible challenges and solutions on integrating IKS in the teaching of mathematics at primary level. Qualitative research is well known of its flexibility and adaptability. Patton, (2014) propounded that qualitative research is flexible and adaptive approach that allows researchers to adjust their methods and procedures as they collect and analyze data. It allow the researcher to be creative and adapt to unique situation of the study.

For instance the use of observation method in a classroom situation may capture classroom interactions and teaching strategies that cannot be captured using quantitative research. This flexibility is more vital in schools like Kondo primary under the study where there exist a diverse educational environment at the institution.

3.3. The research design

3.3.1 Qualitative case study research design

The research design adopted in this study is a qualitative research design which uses qualitative methods. Kumar (2011) defines research design as a comprehensive plan, structure and strategy that frameworks the procedures the research will adopt to obtain answers from the research questions. It is an overall plan or structure of a research study, including the methods and procedures used to collect and analyze data (Merriam, 2009) while McMillan and Schumacher (2010) add that a research design is an exploration which involves a portrayal of strategies directing when, from whom and under what condition will the information be acquired. The researcher adopted a qualitative research case study in this particular study in order to investigate the integration of IKS in the teaching of mathematics at primary level at Kondo primary. Data collected were analyzed and interpreted systematically. The case study research design is guided by the philosophical views in the interpretivist paradigm. The sole purpose is to have an in-depth understanding of how people make sense of their lives and experiences.

Qualitative research case study is an effective method of exploration to gain deeper understanding of factors that have impact in educational systems together with societal and cultural factors that have effect around education. Patton (2002) explains that qualitative research gives a platform to understand the world that emphasizes context, complexity and nuance. This

make it an effective tool for the researcher to explore around the Heritage Based Curriculum in Zimbabwe and understand the phenomenon associated with the implementation of IKS in the teaching of mathematics at primary level.

The qualitative research case study gives priorities to the voice and experiences of those under the study that is teachers, learners and administrators who are involved in the learning process. Qualitative research is a collaborative, participatory and emancipatory project that seeks to understand the world from the perspective of those being studied (Denzin and Lincoln, 2011). By engaging into the use of interviews and observations, the study can reveal the thoughts and perceptions of the individuals towards the integration of IKS in the teaching of mathematics at primary level. The qualitative research is a flexible, adaptive and iterative process that seeks to understand the meaning, interpretation of experiences (Merriam, 2000). The qualitative research case study offers flexible methods of collecting data which can help the researcher to adjust to suitable methods that can be effective in unique circumstances. For instances, the use of observation method in a classroom situation which can provide a clear insights into the classroom interaction than the use of a qualitative approach.

The qualitative research case study is justified for this research as it allows an in-depth understanding through in-depth explorations based on the use of uncompromised research methods that can effectively explore the integration of IKS in the teaching of mathematics at primary level at Kondo Primary school. By giving priority to uncompromised person's views, thoughts, experiences and meaning- making, provides an important insights in the integration of IKS in the teaching of mathematics in the Heritage based Curriculum of Zimbabwe.

3.4. Instruments used in each research question

Interviews are used in this question. Interviews are ideal for this question as they get deeper into a person's thoughts, feelings and experiences in terms of Indigenous Knowledge Systems. Direct interaction with the participant pave way of gaining insight of person's experiences and challenges professionally encountered when dealing with Indigenous Knowledge Systems in teaching and learning, a phenomenon that guide an individual on deciding what IKS that can be integrated in the teaching of mathematics at primary level. Interviews provide a required platform for the establishment of trust and understanding among individuals enabling the researcher to capture participant's thoughts, feelings and experiences (Patton, 2020). Participants will provide detailed data of their concerns, difficulties in their own words.

Observations are used in this research question. Observations enables the researcher to face reality on the classroom situation in teaching and learning and weigh the approaches that prove effective in integrating IKS in the teaching of mathematics. Observations can reveal actual behavior that the researcher can have greater contextual understanding based on the participants' actions (Creswell, 2014). It offers an insight into challenges that arise in the classroom situation that can limit or hinder the effectiveness of various approaches when integrating IKS in teaching and learning of mathematics. Exposure of practical challenges in real- time such as class control, explaining concepts is achieved through observations.

Interviews are used in answering the questions. Interviews are effective to answer the research question as they allow a deeper understanding of challenges faced by both educators, learners and community members on integrating IKS in teaching of mathematics. It provide a platform for personal perspective, interviewers can be able to capture experiences, thoughts and feelings

of the interviewee, (Merriam. 2009). Interviews does not limit one's expressions, thoughts and explanations on the challenges faced when one is using IKS in his/her teaching of mathematics in primary level class.

Interviews are used to answer this question. Interviews are more ideal to answer this question as it allow a detailed discussions on the approaches used to minimize the challenges faced when integrating IKS in the teaching of mathematics at primary level. The interview provide the necessary platform for expert insights, educators , administrators to give best of their experiences in the identification of the necessary approaches that are effective in minimizing challenges encountered when integrating IKS in the teaching and learning of mathematics at primary level. Interviews have higher degree of flexibility that can be utilized for further clarification of concept as the interviewer can be able to probe questions (Patton, 2020). The use of interviews maximize contextual understanding, it facilitates the provision of specific information regarding IKS integration challenges and their solutions. Above all interviews create mutual understanding and a bond between the interviewee and the interviewer which is critical in answering the research question as it create the comfort zone for the interviewee to provide the needed data through expressions, word responses and give references based on their experiences.

3.5. Instruments used to collect data

The study used three study instruments that is observations and interviews. Three grade seven teachers and three school administrators were interviewed. Participant observations were done during lessons to figure out approaches that can be used in the integration of IKS in the teaching of mathematics at primary level. Below is a presentation of each of the three research methods that were used.

3.5.1 Interview

An interview is a conversation with a purpose, Kvale, (2007). It is a structured or semi-structured conversation done between a researcher and a respondent, with aim of gathering data on a specific research question. Creswell, (2009) defines an interview as a process of obtaining knowledge through open communication between two or more individuals. The researcher adopted in-depth interviews in this study which he felt are a useful qualitative data collection technique. Interviews stand as suitable when an individual wants to employ open ended questions to gain information from few people. This is contrary to surveys as the latter is more in quantitative nature and require a large number of people to be conducted. In this study interviews were done with 6 participants, three grade seven teachers and three administrators. The researcher also consider the use of interview guide questions to gain detail on the views , attitudes and experiences of teachers on the integration of IKS in the teaching of mathematics.

Flick, (2006) stated that when interviews are conducted properly they reveal existing knowledge in an amazing way. In this study the use of interviews gave the researcher a better insight on the integration of IKS in the teaching of mathematics at primary level. The researcher used the interviews to address the research question and it also allowed the researcher to have one- on-one encounter with the respondents which create the opportunity to observe other variables that the researcher could not get on paper only. These other variable include the mood and freedom of respondents in the provision and sharing of the information the researcher needed The use of interviews in this case study is also justified by their ability to facilitate in-depth exploration of

participants' experiences and perceptions regarding the integration of IKS in the teaching of mathematics .

Interviews are also known of their flexibility, they facilitate a flexible dialogue which allow participants express their thoughts and perceptions in their own words leading to richer and more nuanced data. Since the researcher need in-depth information from the participants, the use of interview is ideal for the researcher. Its flexibility allowed the researcher to have access to unlimited information from the participants. The researcher was able to probe and pose follow up questions for further clarification but safe guiding respondents' views and opinions that could not be done using other instruments. Interview provide a unique opportunity for in-depth exploration of individual's experiences, thoughts and feelings, Patton (2002). The other advantage of the use of the instrument is that the respondent is not influenced by group or other person's and the responses provided are genuine and best from the respondents' knowledge.

3.5.2. Observation

Observation is a method that allows the researcher to get an insider's view through observing and participating in social settings that reveal reality as lived by members of these settings, (Kumar (2006). Observation also is a method of observe and describe the behavior of a subject and it involves the basic technique of simply watching the phenomena until some hunch or insight is gained. Observations allow researchers to directly see the teaching practices and classroom interactions, (Creswell, 2014). Merriam (2009) adds that observation is a fundamental method of data collection in qualitative research, providing firsthand information about social phenomena. In this study the researcher employed a participant observation to gather data and answer research questions. Kvale (2007) explains that participant observation is a method where

the researcher participates in the social setting being studied while simultaneously observing and recording data.

Participant observation allows the researcher to get deep insight and firsthand information on approaches that work well with the integration of IKS in the teaching of mathematics at primary level. The method does not rely on people's willingness or ability to provide information hence has no challenges on persuading participants to release their information. Merriam, (2009). States that observation provide rich, detailed insights into participants' behaviors and contexts. Observing classroom practices provide authentic data on teaching methods and student engagement. In this study observation method used helped the researcher have a physical conduct and observe approaches that can be used in integrating IKS in teaching of mathematics. Observation is ideal for capturing complex materials which can be impossible when using other methods.

3.6. Population, sample and techniques to be used in the study.

3.6.1 Target Population

A population is the totality of all subjects that conform to a set of specifications comprising the entire group of persons that are of interest to the researcher and to whom research results can be generalized, (Polit and Hungler, 1999). Best and Khan (1993), echo a similar view as they define a population as any group of individuals that have one or more common characteristics that are of interest to the researcher. A population is therefore, a collection of individuals or objects that are the main focus of the research. It should be well defined. The population in this particular study comprised of ninety six people .Ninety grade seven learners of mixed ability, three grade seven teachers and three administrators .

3.7. Sample selection

3.7.1 Participants

The researcher employed a purposive sampling in selecting 6 teachers to participate in the study. The researcher prioritizes the use of this method in his sample selection because it allows the researcher target individuals who may possess needed knowledge on the integration of IKS in the teaching of mathematics at primary level. The view was that these teachers are expertise in integration of IKS into mathematics teaching, have experience in using IKS based approaches and are familiar with local IKS practices and traditions hence would provide valuable insights into the issue under study.

3.7.2 School

The primary school was selected from a total of 65 primary schools in Mudzi District. The school was selected after it satisfy the selection process which strategically align with the study focusing on the integration of IKS in the teaching of mathematics at primary level. The selection process consider evaluating the school basing on its accessibility for data collection. The school is the most nearby school to the researcher which reduces cost and increase time for carrying out the research. Kondo primary school is a public school in rural settings located inside the community where there is local IKS practices and traditions making it an ideal site for investigating the integration of IKS in the teaching of mathematics. The school was also considered for its implementation of IKS - integrated mathematics curricula. The school also experiences low pass rate in mathematics at grade 7 a scenario which prompted the researcher to

carry out the study. Above all members at Kondo primary school co-operated well and show greater willingness to have maximum participation in the study.

3.8. Data presentation and analysis procedures

The researcher presented data from interviews and observations. Researchers also collected a qualitative data gathered from interviews and observations. The research questions have guided the researcher on creating observation checklist and interview schedules. Responses were gathered and documented for data analysis. Researcher used cell phones to gather data from respondents by recording them. The respondents were informed on the purpose of the study and we're encouraged to exercise their freedom to respond.

3.9. Validity and reliability

Two types of validity are considered in every educational research. These two validity are internal and external validity. Internal validity is the extent to which a causal relationship can be inferred from the observed association between variables (Creswell, 2014). Kirk, (2013) also explains that internal validity ensures that changes in dependent variables are due to the manipulation of the independent variable, rather than extraneous variables. While external validity according to Campbell and Stanely, (1963) refers to the extent to which the finding of the research can be generalized across different populations, settings and times.

Validity is the extent to which a measure accurately reflects the concept it is intended to measure (Creswell, 2024). It is the degree to which a research instrument measures what it claims to measure (Gay et al, 2012). Shadish et al ,(2002) also supported that validity concerns the accuracy

of inferences drawn from research findings. On the other hand reliability is the extent to which a measurement instruments yields consistent results (Gays et al, 2012). A study is considered reliable if two or more of its instrument used are in harmony and show same results. Reliability ensures that research findings are dependable and replicable (Merriam, 2009). In order to maintain reliability of the study, the researcher ensures that there is a reliable data collection. A thorough verification of the contents of interview and observation guide was done by an independent body comprises of educators and colleagues who are expertise in area of mathematics education and Indigenous Knowledge Systems to ensure that the contents of the interview and observation guide were in harmony and serves the intended purpose to the maximum degree.

3.10 Ethical consideration

Ethical consideration is one of the critical aspect considered in this study. Ethics can be reviewed as moral principles and standards that govern a person's behavior in conducting a research. On carrying out this research the researcher has taken into account a number of ethical consideration. Firstly he seeks approval from Bindura University of Science Education to carry out the study. In carrying out his study the researcher take into consideration the rights of the participants. The researcher firstly engaged the participants and address them concerning the research being conducted in order to make them understand fully the nature of the study , it's risk and benefits so that they make informed decision on whether to participate or not. The researcher also uphold the confidentiality of the participants, their responses were kept from a third part. The right to privacy and right to fairness was assured to each and every participant.

3.11 Summary

This chapter looked into research design, research instruments, population and sample and sampling procedures. Research instruments used include interview, observation and data analysis. The researcher gives his justification for choosing the research instruments. Given also are benefits and limitations of the research instruments employed. The study followed a qualitative research design, the researcher defended why he choose qualitative as his research design. The researcher also outlined measures he undertook to uphold ethical considerations in his study.

4.0 CHAPTER FOUR

INTERPRETATION

DATA PRESENTATION, ANALYSIS AND

4.1 Introduction

The data gathered during the inquiry into the incorporation of Indigenous Knowledge Systems (IKS) in basic mathematics teaching is thoroughly analyzed in this chapter. The study aims to shed light on the diverse experiences and viewpoints of educators and students with regard to IKS integration through the use of both observations and interviews. The qualitative information acquired from observations and interviews is methodically arranged to emphasize important themes, difficulties, and tactics related to successful integration procedures. The chapter seeks to offer a nuanced explanation of how IKS affects pedagogical practices and student results by combining these data, thus advancing our understanding of culturally responsive mathematics instruction. This chapter lays the groundwork for making significant inferences that can guide future educational policies and practices targeted at promoting inclusion in the mathematics curriculum through careful analysis and interpretation of the data. Crucially, the results will also form the basis for further talks in the next chapter, where recommendations and consequences will be outlined to assist teachers in successfully incorporating Indigenous Knowledge Systems into their instructional strategies.

4.2 Interview Responses

4.1.1 What Indigenous Knowledge Systems that can be integrated in the teaching of mathematics at primary level?

The study sought answers regarding what indigenous knowledge systems that can be integrated in the teaching of mathematics at primary level. Themes and sub-themes were gathered through

interviews. The table below shows the themes and sub-themes of indigenous knowledge systems that can be integrated in the teaching of mathematics at primary level.

Theme	Sub-Themes
1. Traditional Mathematical Tools	Use of indigenous or traditional counting methods (stones, sticks)
	Problem solving strategies (storytelling and practical scenarios)
2. Cultural Contexts in Learning	Integration of local environmental elements such as landforms, seasons into math lessons
	Emphasis on oral traditions to contextualize mathematical problems
3. Collaborative Learning	Group activities that encourage teamwork and collaboration among students
	Inclusion of family and community members in learning activities to enhance cultural relevance

Traditional Mathematical tools

The study identified a number of Indigenous Knowledge Systems (IKS) that can be effectively included into the teaching of primary mathematics. One notable tactic was the application of traditional number systems and counting techniques, which are very consistent with local cultural norms. The study through interviews managed to gather that traditional mathematical tools are indigenous knowledge systems that can be integrated in the teaching of mathematics at primary level. Students were encouraged to use Indigenous counting sticks as a tool that

introduced them to basic arithmetic concepts while also allowing them to identify with their ancestry.

Through interviews, the study was able to determine that one of the indigenous knowledge systems that can be incorporated into primary school mathematics instruction is the use of traditional or indigenous counting techniques. This was supported by participants in this study through interviews...Teacher A explains that.....*The students can always use tiny stones for counting. We can relate to the exercise more how to count with stones. For me as a student, it makes numbers easy and less complicated. This strategy is still being used currently in some schools and we even use it at our school.*

On the other hand Teacher B says*I personally adventure in learned how to count with sticks during my school days. I urge my student to collect sticks from the outdoors because it gives them a hands-on experience and makes counting seem like an.*

Regarding the issue of traditional counting method Teacher C asserts that....*It is a good strategy because here at school we sometimes count with clay balls. We enjoy counting the number of shapes we make and modeling them. This makes math feel relevant and enjoyable.*

Admin A says..."*In our community, we used to count using seeds. My grandmother would give me a handful of seeds and ask me to count them. It was a fun way to learn numbers. I've started using this method with my students, and they love it!*"

Admin B says..."*I remember my father teaching me how to count using sticks. He would draw marks on the sticks to represent numbers. It was a simple but effective way to learn. I've incorporated this method into my teaching, and it's helped my students develop their one-to-one correspondence skills.*"

Admin C provide the same view asserting that *"In our culture, we use a traditional counting system based on the number of fingers on our hands. It's a clever system that helps children learn numbers quickly. I've adapted this system for my students, and it's been very effective in helping them understand place value."*

The findings of the study highlight the use traditional counting tools as one of the aspect that can be incorporated in IKS integration. Traditional counting tools like stones, sticks and fingers were mentioned in the study. Traditionally sticks and stone were used to relate numbers, a mathematical concept that is passed on from generation to generation hence this traditional idea of using sticks and stones in the mathematical concept of counting proved to be of greater significance in fostering one-to-correspondence skills in learners. At primary level learners develop the concept of counting by relating figures to number of objects that is stones, sticks, fingers and clay ball. Addition and subtraction of numbers is effectively enhanced through the use of traditional tool as learners understand values. Nyagura (2019) explains that traditional counting tools can provide a concrete and tangible representation of mathematical concepts, which can help primary school pupils to understand and internalize these concepts. Mhakure and Chigwedere, (2018) mentioned that traditional counting tools such as stones, seeds and fingers can help primary school leaners develop their numeracy skills and understanding mathematical concepts in more meaningful way. Indigenous knowledge systems offer a wealth of mathematical concepts and practices that can enrich mathematics education... For example, the traditional African method of multiplication using sticks or stones can be used to teach multiplication and division concepts (Mahoo, 2015) .Mwakapenda (2009) also added that the use of traditional methods such as counting on fingers, using stones or seeds to represent numbers, and drawing diagrams in the sand can help learners develop their mathematical concepts and

problem-solving skills. Traditional methods such as using measurement units based on body parts, such as the length of a foot or the width of a hand, can be used to teach measurement concepts. (Langa, 2012).

Problem-Solving Strategies

Problem-solving strategies were pointed out as the Indigenous Knowledge Systems that can be integrated in the teaching of mathematics at primary level. The participants underscored the following regarding problem solving strategies that include storytelling and practical scenarios.

Teacher A upon interviewed says....*"I personally incorporate storytelling into math problem-solving. When students solve problems through stories about their communities, their engagement is good, and they learn collaboratively through this."*

Teacher B asserts that....*"The problem-solving strategies that utilize local practical stories allow most students to see significance or importance in what they are learning. It's culturally educational and academically beneficial for students especially for those in primary school stage."*

Teacher C also contributed by saying*"I really, really enjoy when our teacher tells stories about to explain math problems. Stories especially when told in Shona make it simple and makes math more exciting."*

On the same concept upon interviewed Admin A says.....*"In our community, we have a tradition of using proverbs to teach problem-solving skills. For example, we have a proverb that says, 'If you want to go fast, go alone. If you want to go far, go together.' I use this proverb to teach my students about the importance of collaboration in problem-solving."*

Admin B also says....*"I've found that using real-life scenarios helps my students develop problem-solving skills. For example, I'll ask them to calculate the cost of ingredients for a traditional recipe. It's a practical way to apply math concepts to everyday life."*

Admin C responded by asserting that....*"I use a traditional storytelling approach called 'folk telling' to help my students solve math problems. It involves telling a story that incorporates math concepts, and then asking the students to solve the problem. It's a fun and interactive way to learn math."*

Data gathered suggest that students' engagement and understanding of the subject matter can be improved by using storytelling as part of the IKS integration to bridge and contextualize mathematical ideas within the framework of their cultural backgrounds. Problem solving strategies like storytelling, feeble and riddles are said to be more effective in building and foster mathematical concepts. Riddles as one of the problem solving strategies in IKS present a good example on how such traditional strategy develop problem solving skills, encourage critical thinking and foster collaboration learning through presenting real life mathematical problem experiences . For example at primary level learners can be asked to solve the riddle which state that “how can a man weighing 50kgs can transport a goat weighing 50kgs, a hyena weighing 50kgs and a 50kgs bag of rapoko to the other side of a river using a boat capable of carrying 100kgs only without letting the hyena eat the goat and the goat eat rapoko as well. This riddle call for critical thinking and introduce learners to concept of weight and its bearing in everyday human life experiences. Mawere, (2018) states that IKS can help learners develop critical thinking and problem solving skills , essential for mathematics education activities such as storytelling among others. Use of storytelling is said to be effecting in making maths lesson interesting and make learners understand the significance of the mathematical concepts in their

life. The use of storytelling and riddles in traditional African cultures can be used to teach mathematical concepts such as patterns, sequences, and problem-solving (Owuor, 2007).

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Cultural Contexts in Learning

The study was able to identify that cultural circumstances are important when it comes to learning mathematics. Teachers can make mathematics teachings richer and more meaningful by tying them to oral traditions, seasonal calendars, and local natural components.

Integration of Local Environmental Elements

The integration of local environment elements into mathematical element was identified as an IKS that can be integrated into mathematical lessons at primary levels.

Teacher A says *“I include things like landscapes in my classes. The pupils can see and talk about hills and valleys as we relate shapes to them.”* Teacher B gave his views by saying *“I feel proud when we use things from our village to learn, like learning about triangles with local huts.”*

On the same note Teacher C asserts that *“I take my students on a nature walk around the school compound to teach them about measurement. We measure the length of objects in the environment, the width of the river, and the circumference of rocks. It's a hands-on way to learn math concepts while appreciating the local environment.”*

Administrators also have their views pertaining the integration of local environment elements in the integration of IKS in the teaching of mathematics at primary level.

Admin A says... *"In our community, we use local plants and animals to teach math concepts. For example, we use the patterns on a leaf to teach symmetry, and the number of seeds in a fruit to teach multiplication. It's a way to connect math to the students' everyday lives."*

Admin B explains that... *"I incorporate local weather patterns into my math lessons. For example, we track the rainfall patterns and calculate the average rainfall per month. It's a way to teach math concepts while promoting environmental awareness."*

Admin C gave her views by saying that.....*"I use local building materials like mud, sticks, and rocks to teach math concepts like geometry and measurement. The students love building structures and calculating their dimensions. It's a practical way to learn math while appreciating the local environment."*

The above responses made it clear that the use of local environment elements are a vital IKS strategies that are more effective in the teaching of mathematics concepts at primary level. Local environment elements such as seed, seedpods, local huts, animals, fruits and traditionally weaved items such as traditional hats, Winnowing baskets and clay pots can be used to simplify mathematical concepts. The concept of shapes in geometry can effectively be taught and learned using huts, axes, fruits, clay pots and kraals to learn shapes like triangles, spheres, circles and rectangles. Seeds and seed pods and animals are more ideal in developing the concept of multiplication for example $2 \times 4 = 8$, two cows with 4 legs we get 8 legs altogether. Juma and Nyongesa (2022), support that including local context into mathematics instruction improves students' comprehension of mathematical ideas while also making the subject matter more interesting and relevant.. In support with the given view Mahoo, (2015), asserts that the use of local environment elements such as plants, animals, and natural features can be used to teach mathematical concepts such as measurement, geometry, and patterns. Kasanda,(2016) has it that

the local environment provides a rich source of mathematical concepts and problems. Indigenous knowledge systems emphasize the importance of observing and learning from the natural environment. Teachers can help children develop a better appreciation for mathematics by using common environmental factors to generate meaningful problem-solving scenarios that are relevant to their everyday lives. Incorporating local environment elements is said to be a practical way of learning while appreciating the environment.

Emphasis on oral traditions to contextualize mathematical problems

Oral traditions to contextualize mathematical problems is one of the IKS that can be integrated into mathematics in primary school. This was presented by participants in this study. When asked about the IKS that can be integrated in the teaching of mathematics at primary level.

Teacher A says *“Oral traditions are a powerful tool which most of the teachers do not know. They improve mathematical and also promote cultural heritage.”*

When interviewed Teacher B asserts that...*“The good thing about stories from our culture to learn math, it makes it us understand the subject more and most of the students understand most aspects through storytelling.”*

Teacher C says....*“I use storytelling to help my students solve math problems. For example, I'll tell a story about a farmer who needs to count his cattle, and then ask the students to help me solve the problem. It's a fun way to make math relevant and engaging.”* Admin A also says

“In our community, we have a tradition of using proverbs to teach problem-solving skills. For example, we have a proverb that says, 'If you want to go fast, go alone. If you want to go far, go together.' I use this proverb to teach my students about the importance of collaboration in problem-solving.

Admin B gave his opinion by asserting that.....*"I've found that using real-life scenarios helps my students develop problem-solving skills. For example, I'll ask them to calculate the cost of ingredients for a traditional recipe. It's a practical way to apply math concepts to everyday life."*

Admin C says.....*"I use a traditional storytelling approach called 'folk telling' to help my students solve math problems. It involves telling a story that incorporates math concepts, and then asking the students to solve the problem. It's a fun and interactive way to learn math."*

The findings suggest that oral traditions have been effective in various cultures to conceptualize mathematical concepts. Oral traditions includes storytelling, narratives, folktales, mathematical puzzles and mathematical riddles. A good example of oral tradition that require to solve a mathematical concept is a mathematical puzzle which states that “a snail is at the bottom of a 15M deep well. Each day, it climbs up 3M, but at night it slips back 2M. How many days it will take for the snail to reach the top of the well”. Such oral tradition way of teaching promote problem solving. Incorporation of oral traditions into mathematics instruction in Zimbabwean schools is examined by Masingila, (2007) who stress that riddles and puzzles can used to develop critical thinking and problem solving-solving skills in mathematics. Traditional Indigenous cultures have a rich history of storytelling, which can be used to contextualize mathematical problems and make them more meaningful and relevant to students' lives, (Lipka, 2002) .The author contend that using well-known stories helps students develop their critical thinking and problem-solving abilities in addition to making mathematical ideas more approachable. Semali(1999) explains that traditional Indigenous cultures have a rich history of storytelling, which can be used to contextualize mathematical problems and make them more meaningful and relevant to students' lives. Teachers can also establish a more welcoming classroom atmosphere

that connects with students' origins by introducing local tales and examples (Nkhata and Zulu, 2020).

Collaborative Learning

The other theme identified through gathering data was collaborative learning. In addition to encouraging teamwork, collaborative learning activities also improve mathematical engagement and cultural relevance. This theme looks at how to promote cooperation in mathematics education amongst families, communities, and students.

Group Activities Encouraging Teamwork

Upon interviewed Teacher A asserts that *"....from what I have noticed, group activities allow students to learn from each other's while solving mathematical problems. They share their knowledge which builds a strong community in the classroom."*

Teacher B explains her views saying....." *Facilitating collaboration in math lessons has shown great improvements in student engagement and understanding, making learning a collective effort. In our culture we are taught about Ubuntu working together as one and its part of our IKS"*

Teacher C also was interviewed and gave his opinion, he says..."*Working with my friends on math problems makes it easier. We help each other when we do not understand something. Working with each other helps a lot and teamwork is the best"*

Administrators were interviewed and gave their views regarding collaboration in the integration of IKS in the teaching and learning of mathematics at primary level.

Admin A asserts... *"When teaching math, I make sure to include group activities that promote teamwork. For example, I divide the students into groups and ask them to work together to solve a math problem. This approach helps them develop essential skills like communication, collaboration, and problem-solving."*

Admin B says....*"In our math lessons, we use group activities like 'Math Relay' where students work in teams to complete math challenges. This approach encourages teamwork, healthy competition, and mutual support. It's amazing to see how it boosts their confidence and motivation to learn math."*

Lastly Admin C says...*"I believe that group activities are essential in math education. They help students develop critical thinking, creativity, and problem-solving skills. In my class, we do group projects where students work together to design and create math-related products. It's a great way to promote teamwork, innovation, and math literacy."*

The above claims by participants supported that collaborative learning is essential in IKS integration. It allows learners to work in groups in solving their mathematical concepts. Group work allow learners be able to learn from each other , share their knowledge, promote engagement and understanding making learning a collective learning. Mavindidze (2020, explains that educational strategies that value teamwork and honor cultural variety can make the classroom a more productive learning environment. According to the study, students who participate in cooperative problem-solving improve not just their mathematics abilities but also critical social skills including cooperation and communication (Johnson & Johnson, 1989). In many Indigenous cultures, group work and teamwork are highly valued, (Lipka, 2002).

Mathematics education can benefit from incorporating group activities that promote teamwork, communication, and problem-solving. Mahoo ,(2015), valued the use of group work activities in IKS stating that indigenous knowledge systems often emphasize the importance of collaboration and mutual support, group activities in mathematics education can help to promote these values and develop students' problem-solving skills . Moyo (2017) also stipulated that in Zimbabwean culture, group work is highly valued... Mathematics education can benefit from incorporating group activities that promote teamwork, communication, and problem-solving, such as the traditional game of 'Tsoro'. On the other aspect collaboration learning promote communication skills, team work, innovation and math literacy.

4.2.1 What challenges faced when integrating Indigenous Knowledge Systems in teaching of mathematics?

The study explored the challenges faced when integrating indigenous knowledge systems in teaching of mathematics. A number of challenges were identified in this study.

Theme	Sub-Themes
Curriculum Constraints	Lack of Alignment
Resource Limitations	Insufficient Training
	Limited Educational Materials
Community and Parental Resistance	Lack of Support from Stakeholders

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Curriculum Constraints

Due to a number of factors that restrict the alignment and flexibility required for such an integration, including Indigenous Knowledge Systems (IKS) into the mathematics curriculum frequently faces substantial obstacles. Teachers' and students' perspectives highlight the real-world effects of these issues.

Lack of Alignment

The lack of curriculum alignment to accommodate the integration of IKS in the teaching of mathematics was discovered as one of the challenges in IKS integration in school mathematics.

Participants gave their perspective regarding lack of curriculum alignment as a challenge to integrating IKS in primary school.

Teacher A interviewed to give his side of views says.... *“As a teacher, I usually feel that Indigenous knowledge is not given enough time in the curriculum. I try to use traditional counting systems, but they always do not align well with the strict curriculum we must follow.”*

Teacher B asserts..... *“There is a significant difference between the national curricular and our local knowledge. Although we accept the value of IKS, teachers find it difficult to include these understanding viewpoints in their classes since the curriculum lacks clear integration pathways of IKS’.* Teacher C made her contribution by saying..... *“We normally study mathematical ideas in class that have no impact on our everyday lives. I once asked my teacher how we could use*

what we learnt, but because of the constraints of the curriculum, we never really looked into that further. Using IKS would mean it aligns with our culture and tradition."

School administrators were also interviewed concerning the challenges that have a negative impact on the integration of IKS in the teaching of mathematics at primary level. All three administrators have their responses noted down as follows,

Admin A says..... *"One of the biggest challenges I face in integrating Indigenous Knowledge Systems (IKS) into my math teaching is the lack of alignment with the national curriculum. The curriculum is very rigid, and it's hard to find space to incorporate IKS without feeling like I'm compromising on the required content'.*

Admin B asserts.....*"I've tried to incorporate IKS into my math lessons, but it's hard when the curriculum doesn't explicitly support it. I feel like I'm taking a risk by deviating from the prescribed curriculum, even though I know it would benefit my students to learn about IKS."*

Admin C also gave her explanation saying.....*"The curriculum is not designed with IKS in mind, so it's hard to integrate it in a way that feels authentic and meaningful. I've tried to use IKS examples and case studies, but they often don't align with the specific learning outcomes and assessment requirements outlined in the curriculum."*

Above claims pointed that lack of curriculum alignment present a major challenges in the integration of IKS in the teaching of mathematics. Findings suggest that there is a gap between national curriculum and the local existing knowledge. The curriculum is rigid and lack clear pathways of integrating IKS. Methodologies used in the teaching of mathematics in current curriculum does no value long standing traditional methods used for generations and proved effective in teaching primary concepts. According to Bishop (2014), traditional educational

frameworks frequently ignore the cultural contexts in which Indigenous pupils learn. Mugambiwa, (2017) stipulated that there is lack of policy and curriculum support for incorporating IKS into mathematics education. Mahoo,(2015), explains that one of the major challenges facing the integration of IKS into the curriculum is the lack of alignment between IKS and the existing curriculum. Students are further alienated from mathematical concepts by teaching strategies that prioritize rote learning and standardized evaluation, which may be seen as unrelated to their real-world experiences. The lack of curriculum alignment is a major challenge in integrating IKS into education in Zimbabwe, as it requires a significant shift in the way education is delivered, (Shizha, 2013). On the other hand Chivore, (2008) exposed that the curriculum in Zimbabwean schools does not adequately reflect the Indigenous Knowledge Systems of the local communities, making it difficult to integrate IKS into the curriculum. Curriculum alignment is a challenge that need to be addressed for effective integration of IKS to improve understanding of mathematical concepts.

Resource Limitations

Lack of resources was identified in this study as a major obstacle to successfully incorporating Indigenous Knowledge Systems into maths instruction. These restrictions include challenges obtaining conventional knowledge sources, a shortage of educational resources, and insufficient training for teachers.

Insufficient Training

Insufficient training is a sub-theme of resource limitations gathered in this study. Insufficient training was identified as a major challenge to IKS integration in mathematics.

Teacher A said*"I had no training on how to incorporate Indigenous knowledge into my classes and I still do not know how to do it correctly. We were not given proper training regarding how to use IKS. Most of the teachers still do not know the methods of IKS especially in this subject"*

Teacher B said.....*"In order for teachers to better appreciate and comprehend Indigenous knowledge systems, there is great need workshops or extra training that can result in proper teachings of maths through IKS."* Teacher C also contributed by saying.....*"I know my teachers wish to assist us through some of these methods, but they are unsure of how to do it. They claim that this is not how they ever learnt."*

Data gathered on the challenges faced when integrating IKS in the teaching of mathematics at primary level which formulate the above subtheme take into consideration three administrators who gave their responses to the interview questions.

Admin A responded saying.....*"I'm interested in incorporating Indigenous Knowledge Systems (IKS) into my math teaching, but I don't feel confident in my ability to do so. I haven't received any training on how to integrate IKS into my teaching practices, and I'm not sure where to start."*

Admin B said.....*"I've tried to incorporate IKS into my math lessons, but I've realized that I need more training and support to do it effectively. I've had some cultural sensitivity training, but I need more specific guidance on how to integrate IKS into my math teaching."*

.Lastly Admin C gave her respond saying.....*"One of the challenges I face in integrating IKS into math teaching is the lack of training and resources available for teachers. We need more*

professional development opportunities that focus specifically on IKS integration, as well as resources and support to help us develop our skills and confidence."

Findings suggest that insufficient training among teachers present a big challenge in IKS integration in teaching of mathematics at primary level. Teachers proved to have limited knowledge on integrating IKS when teaching mathematics. Many teachers lack a deep understanding of IKS, its principles, and its relevance to mathematics. This limited knowledge hinders their ability to effectively integrate IKS into their teaching practices. McKinley, (2005) explains that teachers need training and support to develop the pedagogical skills necessary to effectively integrate Indigenous Knowledge System into their teaching practices. This lack of teacher training was also noticed by Chitate, (2015) who indicate that lack of teacher training in incorporating IKS into mathematics education have drawbacks in the implementation of IKS in teaching. The integration of IKS into mathematics education in Zimbabwe is hindered by the lack of training and resources for teachers, as well as the lack of relevant curriculum materials, (Chivore, 2008). More to that Machingambi,(2017) pointed that teachers' lack of understanding of IKS and their relevance to mathematics education is a significant challenge to IKS integration in Zimbabwe. Shizha, (2013) observed the challenge of insufficient training among teachers and states that teachers in Zimbabwe require training and support to effectively integrate IKS into mathematics education, but such training is often not available.

This lack of training and resources for teachers can hinder the effective integration of IKS into education, leading to inconsistent and unfair assessment practices. Understanding cultural relevance and modifying instructional techniques to foster inclusivity and respect for Indigenous knowledge systems are both necessary for implementing Indigenous pedagogy.

Limited Educational Materials

Since indigenous knowledge system also need learning material. Through interviews the study gathered that there was limited learning material for the successful integration of IKS in schools.

Teacher A said.....*"There are not any resources available, even though we would love to incorporate local stories or tools into mathematics lessons. There is limited learning material especially in schools around this side of Zimbabwe. There should be at least textbooks guiding this".*

Teacher B said.....*"There are no mathematics texts that discuss how our culture counts or measures things. We simply receive the same old material."*

Teacher C said.....*"It would be really good if we had math activities that show how our community does things, like fishing or planting or any other material that shows how IKS can be used in maths."*

Administrators were also interviewed on the challenges faced when integrating IKS.

Admin A said..... *"One of the biggest challenges I face in integrating Indigenous Knowledge Systems (IKS) into my math teaching is the lack of educational materials that reflect IKS perspectives. Most textbooks and resources are Eurocentric and don't provide adequate representation of IKS concepts and principles."*

Admin B asserts.....*"I've tried to incorporate IKS into my math lessons, but its hard when there are limited resources available. I've had to rely on online resources and community members to provide me with information and materials, but it's not always reliable or consistent."*

Admin C*"The lack of educational materials that incorporate IKS is a major challenge for teachers. We need more textbooks, workbooks, and digital resources that reflect IKS perspectives and provide practical examples of how to integrate IKS into math teaching."*

Lack of educational materials that reflects Indigenous Knowledge Systems perspectives was identified as major challenges. Most textbooks used in schools are Eurocentric and they lack material that reflects and incorporate Indigenous Knowledge Systems. The lack of educational materials that reflect local Indigenous Knowledge Systems is a significant challenge to IKS integration in Zimbabwe, particularly in rural areas, (Machingambi, 2017). Limited access to IKS based educational resources, including textbooks, and digital materials, hinders the ability of teachers to effectively integrate IKS into their teachings Nawesab, (2012). The views given by Chivore, (2008) suggest that In Zimbabwe, there is a need for educational materials that incorporate Indigenous Knowledge Systems to support the integration of IKS into mathematics education. This limited documentation of concepts and practices of mathematics and other subject area was also acknowledged by Nyathi, (2013). Limited digital resources, such as online courses, educational software, and multimedia materials are not available to support IKS integration. Teachers in Zimbabwe face challenges in finding relevant educational materials that incorporate Indigenous Knowledge Systems, which hinders the effective integration of IKS into mathematics education,(Shizha, 2013)

Community and Parental Resistance

The issue of community and parental resistance is a major issue when it comes to challenges being faced in integrating IKS in mathematics. Additional obstacles to incorporating IKS into mathematics education may arise from parental and community resistance. The difficulties stem

from a cultural mismatch between education and community values as well as a lack of support from stakeholders.

Lack of Support from Stakeholders

Lack of support from the stakeholder is a major issue of great concern with regards to integration of IKS in schools.

Upon interviewed on major issue concerning the integration of IKS Teacher A said.... *"Stakeholders usually express reluctance when we suggest curricular adjustments. They are concerned about how it will affect the current setup."* Teacher B also forward his views saying *"My parents do not understand how IKS can be linked with maths, but I think they want the best for me. It's very difficult for our parents to understand that you can use traditional and cultural ideas to do maths"* Teacher C said.....*"I've tried to incorporate Indigenous Knowledge Systems (IKS) into my math teaching, but I've faced resistance from school administrators who don't see the value in it. They're more focused on meeting standardized testing requirements than on incorporating culturally relevant content."*

Administrators also gave their responses, Admin A asserts..... *"I've noticed that some parents are skeptical about the inclusion of IKS in math education. They think it's not relevant to the 'real world' or that it's not rigorous enough. It's hard to get buy-in from stakeholders when they don't understand the value of IKS."*

Admin B said.....*"One of the biggest challenges I face is the lack of support from policymakers and government officials. They don't provide adequate funding or resources to support the integration of IKS into math education. It's hard to make progress when we don't have the support of those in power."*

Lastly Admin C said.....*"I think one of the reasons why IKS is not more widely integrated into math teaching is that stakeholders don't see it as a priority. They're more focused on other educational initiatives and don't understand the importance of incorporating IKS into math education. We need more advocacy and awareness-raising to get stakeholders on board."*

Above claims pointed that the lack of support from stakeholders present a major challenge when integrating Indigenous Knowledge Systems in teaching mathematics in schools. To begin with the government itself as the major stakeholder does not consider IKS as valuable teaching approach that can maximize understanding of concepts in schools. The Zimbabwe's educational policy framework does not explicitly support the integration of IKS into the mathematics curriculum. On the other hand school administrators lack awareness about the importance and benefits of IKS integration in mathematics education hence they prioritize western knowledge systems over IKS, perpetuating the marginalization of Indigenous Knowledge. In schools the administrators focus more on meeting standardized test requirements which are centered on Eurocentric methods of teaching and assessments. Zuze, (2016) asserts that the lack of support from stakeholders, including education officials, is a significant challenge to IKS integration in mathematics education in Zimbabwe.

Lack of parental support also have negative impact on IKS integration. Many parents and community members lack understanding of IKS integration in mathematics education, leading to resistance. Aikenhead and Michell, (2011) point out that opposition from different stakeholders can be a major barrier to implementing important educational reforms, particularly when it comes to culturally appropriate methods. Teachers in Zimbabwe require support from stakeholders, including the government, to integrate IKS into mathematics education effectively." (Makura, 2017). This resistance to adopting new pedagogical paradigms is

frequently caused by deeply embedded attitudes and practices inside the educational system (Holliday, 2022). This problem is made more difficult by community members' concerns that culturally appropriate modifications would jeopardize established curriculum and cause disputes amongst educational stakeholders.

4.2.3 What approaches employed to minimize the challenges that encountered when integrating Indigenous Knowledge Systems at primary level?

Through interviews the participants were asked what approaches were employed to reduce the challenges encountered when integrating indigenous knowledge systems at primary level. The table below shows the themes and sub-themes through these interviews.

Theme	Sub-Themes
Professional Development	Targeted Training
	Peer Learning
Community Engagement	Collaboration with Indigenous Communities
	Involvement of Elders and Knowledge Holders
Resource Development	Culturally Relevant Materials
	Access to Traditional Mathematical Tools
Curriculum Flexibility	Customized Curricula

Professional Development

In order to give teachers, the knowledge and abilities they need to successfully incorporate Indigenous Knowledge Systems (IKS) into the core curriculum, professional development is essential. Teachers and administrators can better address issues and modify teaching methods

that respect and consider Indigenous viewpoints by creating an atmosphere of continuous learning.

Targeted Training

Targeted training was discussed by participants as one aspect that is needed to counter challenges faced in integrating. Following are responses from the participants regarding targeted training as an effective approach under professional development in minimizing challenges encountered when integrating Indigenous Knowledge Systems at primary level.

Teacher A said..... *“even if it’s difficult, focused training has had a big impact. We make sure that teachers feel comfortable incorporating Indigenous knowledge systems by establishing clear goals.”* Teacher B explained his view saying.... *“Although the training gave me tips on how to make our lessons more available, I was initially overwhelmed. For example, we studied the integration of traditional knowledge into maths classes. It now seems more relevant to the lives of our students.*

Teacher C..... *“Videos about Indigenous people's use of nature were shown to us by our teacher. It was real and did not feel like a textbook, which helped me understand in a different way.’*

In order to come up with this sub theme the administrators put forward their views on countering challenges faced in integrating IKS.

Admin A said.... *“I've found that targeted training on Indigenous Knowledge Systems (IKS) integration has been instrumental in helping me overcome the challenges I faced when trying to*

incorporate IKS into my math teaching. The training provided me with the knowledge, skills, and confidence I needed to effectively integrate IKS into my lessons."

Admin B also said.....*"Our school has provided targeted training for teachers on IKS integration, which has been really helpful. The training focused on practical strategies for incorporating IKS into math lessons, and it also provided us with resources and support to help us implement IKS integration in our classrooms."*

Lastly Admin C asserts.....*"I think targeted training is essential for teachers who want to integrate IKS into their math teaching. The training should focus on the specific challenges and needs of primary school teachers, and it should provide them with the knowledge, skills, and resources they need to effectively integrate IKS into their lessons."*

Teachers feel more capable and secure in their teaching strategies when they receive professional development that is especially focused on comprehending and applying Indigenous knowledge. Targeted training that include workshop and seminars, community-based training, mentorship programs and online training programs are more effective approaches in minimizing challenges encountered in IKS integration. The primary aim of the training programs is to improve teacher confidence in IKS integration, develop cultural responsive teaching and improve learner outcome. Paisley, (2015) suggested that targeted training for teachers is essential to minimize challenges associated with IKS integration in mathematics education. Targeted training is essential to ensure that teachers have the necessary skills and knowledge to integrate IKS into mathematics education effectively, (Makura, 2017). In Zimbabwe, targeted training for teachers can help to promote the integration of IKS into mathematics education, which can improve

student learning outcomes, (Zuze, 2016). Targeted training can result in a more successful integration of cultural relevance and local knowledge in the classroom, improving the educational experience for all students, claim Hill and Wang (2019). Additionally, teachers who participate in Indigenous knowledge-focused professional development can build stronger linkages with Indigenous communities and give children access to a more inclusive and rich learning environment.

Peer Learning

The study upon investigating approaches to minimize challenges on IKS integration in mathematics education, the data collected identified peer learning as key approach to address these challenges. Below are the responses given by the participants...

Interviewed teachers gave their responses as follows, Teacher A said.....*"We talk about incorporating Indigenous knowledge into our classrooms in our regular peer learning groups. I recall that one of my classmates introduced us to classic games that use mathematical ideas."*

Teacher B asserts..... *"My teacher demonstrated a fascinating Indigenous game for us. Mainly because we played rather than just worked from a book, I was able to learn mathematics more effectively. It was authentic and enjoyable."*

Teacher C also said..."*I've found that peer learning has been really helpful in supporting me to integrate Indigenous Knowledge Systems (IKS) into my math teaching. I've been working with a colleague who has experience with IKS integration, and she's been providing me with guidance and support as I develop my skills and confidence."*

The interviews carried out also involve school administrators who gave their responses pertaining to approaches that can minimize the challenges faced on IKS integration the following responses were obtained from the administrators.

Admin A said.....*"Our school has established a peer learning program that brings together teachers who are interested in IKS integration. We meet regularly to share our experiences, ask questions, and provide support to one another. It's been a great way to learn from each other and overcome the challenges we face."*

Admin B asserts ...*"I think peer learning is an essential approach for supporting teachers to integrate IKS into their teaching practices. When teachers work together and learn from each other, they can develop the skills and confidence they need to overcome the challenges of IKS integration."*

Admin C said....*"We've found that peer learning has been particularly effective when it's combined with other forms of support, such as coaching and mentoring. Our teachers appreciate the opportunity to work with peers who are facing similar challenges, and they value the guidance and support provided by our coaches and mentors."*

Effective implementation of IKS in schools depends on educators working together and feeling a sense of community, which is fostered via peer learning. Various peer learning strategies can be implemented as effective approach to counter challenges in IKS integration. These peer learning strategies include teacher study groups, peer mentoring, and collaborative lesson planning and reflective. Mahoo, (2015) describe peer learning as an effective approach to minimize challenges associated with IKS integration in mathematics education, as it allows teachers to learn from each other's experiences. Hence peer learning is a collaborative approach that can help teachers

to share their knowledge and experiences of IKS integration in mathematics education. Nyagura, (2019), states that teachers' attitudes towards integrating multiple knowledge systems into their curricula are positively impacted by collaborative professional development. Peer learning is an effective way to promote teacher professional development, which is essential for IKS integration in mathematics education, (Machingambi, 2017) .In addition to that, Chivore, (2008), made it clear that teachers in Zimbabwe require peer learning opportunities to develop their ability to design and implement IKS-based mathematics lessons. Peer learning is a collaborative approach that can help teachers to develop their understanding of IKS and how to integrate them into mathematics education.

Community Engagement

To ensure that the integration of Indigenous Knowledge Systems is genuine and respectful, the research figured out that it is imperative to engage with Indigenous communities. Relationships that enhance the learning environment and offer understanding of culturally significant behaviors are fostered by this kind of community participation.

Theme: Collaboration with Indigenous Communities

Collaboration with Indigenous communities was among the aspects mentioned as an effective tool in minimizing the challenges faced when integrating IKS in the teaching and learning of mathematics.

Following are responses given by the teachers upon interviewed.

Teacher A said *"It's amazing how much richer our lessons become when we work with Indigenous communities. Being open to engage with our local Indigenous community is very important. Their understandings help us tailor our curriculum to be more reflective of our students' lives."*

Teacher B also asserts.... *"I did not think about community partnerships before, but now I see how important they are. It's important that our pupils understand the cultural background and see how what they are studying is applied in the actual world. These days, it's not simply classroom material."*

Teacher C said..... *"I've found that collaborating with Indigenous communities has been instrumental in helping me to integrate Indigenous Knowledge Systems (IKS) into my math teaching. By working closely with community members, I've been able to gain a deeper understanding of IKS principles and practices, and to develop culturally responsive teaching materials."*

Administrators were interviewed and have their responses as follows., Admin A said... *"Our school has established a partnership with a local Indigenous community, which has been incredibly valuable in supporting our IKS integration efforts. Community members have shared their knowledge and expertise with us, and have helped us to develop teaching materials that are culturally responsive and relevant."*

When interviewed Admin B said... *"I think collaboration with Indigenous communities is essential for authentic IKS integration. By working together, we can ensure that IKS principles and practices are represented accurately and respectfully, and that our teaching practices are culturally responsive and effective'."*

Lastly Admin C asserts....*"We've found that collaboration with Indigenous communities has helped us to address some of the challenges we faced in integrating IKS into our math teaching. By working together, we've been able to develop solutions that are tailored to our specific context and needs, and that reflect the unique cultural and historical experiences of our Indigenous students."*

The above claims exposed that working together with Indigenous communities creates deep relationships that enhance teaching methods. Community collaboration strategies like community-based projects, indigenous knowledge holders, cultural camps and joint curriculum developments are helpful in dealing with limiting the challenges in IKS integration. Sincere interaction with Indigenous communities can improve students' educational experiences by promoting cultural pride and adding significance to their academic path, claim Barnhardt and Kawagley, (2015). Collaboration with indigenous communities is essential to ensure that IKS are represented accurately and respectfully in mathematics education,(Machingambi, 2017). Collaboration with indigenous communities can provide teachers with the necessary knowledge and understanding of IKS to design and implement IKS-based mathematics lessons. Zuze, (2016) explains that collaboration with indigenous communities can help to address the challenges associated with IKS integration in mathematics education, including the lack of resources and support. Kasanda, (2016) also says collaboration with indigenous communities can provide teachers with the necessary knowledge and understanding of IKS to integrate them into mathematics education. By working together with indigenous communities, educators can develop a deeper understanding of IKS and their relevance to contemporary education, Shizha,(2013). The development of positive relationship between educators and indigenous communities is critical for the successful integration of IKS to education.

Resource Development

The findings indicated that creating materials that are culturally appropriate is essential to incorporating Indigenous Knowledge Systems into the elementary school curriculum. Creating an inclusive environment where all children can succeed is facilitated by making sure that the resources utilized in the classroom represent Indigenous perspectives.

Culturally Relevant Materials

The findings suggested that culturally relevant materials are a promising approach for minimizing challenges on IKS integration in mathematics education. The findings were collected from the data below....

Teachers were interviewed and gave their perspective as follows, Teacher A said.... *"We need to have books that highlight Indigenous cultures and stories. I discovered that it increases the children's interest in the lessons. They can identify with the ideas and characters, and it leads to fruitful conversations."*

Teacher B also gave his responses saying, *"Developing culturally relevant content is a continuous activity rather than a one-time event. In order to help teachers, integrate Indigenous knowledge, we have should establish a resource bank that includes lesson plans and activities."*

Teacher C made her contribution by saying....*"I've found that using culturally relevant materials has been really helpful in making IKS integration more accessible and engaging for my students. By incorporating local stories, images, and examples into my teaching, I've been able to make connections between the math concepts we're learning and the students' everyday lives."*

Administrators were interviewed as well and put forward their perspectives pertaining to issue of minimizing the challenges of IKS integration.

Admin A was interviewed and asserts that...*"Our school has developed a range of culturally relevant materials to support IKS integration, including math textbooks that incorporate Indigenous stories and examples. These materials have been really well-received by our students, who are excited to see themselves and their cultures reflected in the math curriculum."*

Admin B also asserts....*"I think culturally relevant materials are essential for effective IKS integration. By using materials that reflect the cultural backgrounds and experiences of our students, we can help to build their confidence and motivation, and make math more meaningful and relevant to their lives."*

Admin C responded to the interviews saying....*"We've found that culturally relevant materials have helped to address some of the challenges we faced in integrating IKS into our math teaching. By incorporating local knowledge and perspectives into our teaching, we've been able to make IKS more accessible and engaging for our students, and to promote a more inclusive and culturally responsive math curriculum."*

Providing culturally appropriate resources is said to be essential in helping students develop a feeling of identity and belonging. According to research, using materials that represent students' origins significantly improves motivation and involvement. The need for textbooks that incorporate culturally relevant content which include the use of local stories, games, images and indigenous examples in teaching. Furthermore, by respecting students' cultural experiences and viewpoints, culturally responsive teaching methods have been demonstrated to enhance academic results (Nyagura , 2019). Teachers can provide more meaningful learning experiences

by bridging the gap between students' home cultures and the classroom by incorporating culturally relevant teaching. Teachers in Zimbabwe require access to culturally relevant materials to develop their ability to integrate IKS into mathematics education effectively. (Chivore, 2008). Teachers in Zimbabwe can benefit from using culturally relevant materials, which can provide them with the support and guidance they need to integrate IKS into mathematics education." (Shizha, 2013).

Culturally relevant materials are essential for addressing challenges on IKS integration by developing and using materials that are respectful, accurate, and authentic, educators can promote Indigenous student's engagement, motivation, and academic success.

Access to Traditional Mathematical Tools

Access to traditional mathematical tools is greatly needed. It was pointed out by participant how traditional mathematical tools are needed to foster integration of IKS in mathematics.

Three of the teachers interviewed gave their responses and were recorded .Teacher A said...."*I truly enjoy solving puzzles with the abacuses and stones from my culture. It feels more natural to me than using just paper and pencil. However out teacher has always told us there are more traditional tools that are not available*".

Teacher B also responded saying...."*The children were more excited when we used conventional tools in our maths classes. They were learning more than just numbers, they were learning about their heritage,*"

Teacher C put forward her view and said... "*I've found that having access to traditional mathematical tools has been really helpful in making IKS integration more authentic and engaging for my students. By using tools like counting sticks, measuring baskets, and geometric*

patterns, we've been able to explore math concepts in a way that's culturally relevant and meaningful."

Administrators also gave their views which were noted down as follows...

Admin A responded saying....*"Our school has partnered with a local Indigenous community to develop a collection of traditional mathematical tools that we can use in our teaching. Having access to these tools has helped us to create a more immersive and interactive learning environment that reflects the cultural heritage of our students."*

Admin B asserts... *"I think access to traditional mathematical tools is essential for effective IKS integration. By using tools that are grounded in Indigenous cultures and traditions, we can help to promote a more nuanced and accurate understanding of math concepts and their cultural significance'.*

Lastly Admin C responded saying... *"We've found that having access to traditional mathematical tools has helped to address some of the challenges we faced in integrating IKS into our math teaching. By incorporating these tools into our lessons, we've been able to create a more engaging and interactive learning environment that reflects the cultural diversity of our students."*

From what is gathered above, access to traditional mathematical tools helps to address challenges encountered in IKS integration. Traditional tools that includes counting stones , sticks (used for counting and also taken as measuring rods),weaved items like traditional hats, clay pots, traditional artifacts among others plays a crucial role in conceptualize learners in various concepts like counting of numbers, adding and subtracting numbers, concept of measuring, ratio, and geometrical concepts. Incorporating traditional tools into maths lessons creates a more

interactive lesson and more engagement as well. According to Smith, (2012), who contends that the contextual connection makes learning more relevant, the use of traditional methods improves comprehension and appreciation of mathematics. The results Chigwedere ,(2017), who points out that concrete experiences can enhance learners' conceptual frameworks, demonstrate that the use of conventional instruments not only improves comprehension but also encourages engagement with mathematical topics. According to Eglinton, (2020), who emphasizes the significance of context in creating a pleasant learning environment, incorporating cultural artefacts into mathematics instruction also promotes inclusivity and relevance. Traditional mathematical tools are an essential approach to minimize IKS integration.

Curriculum Flexibility

Teachers can integrate Indigenous Knowledge Systems in a way that best suits the needs of their varied student body when there is curriculum flexibility. Teachers can make learning more powerful and relevant by incorporating traditional knowledge into a variety of areas through curriculum customization.

Customized Curricula

There is need for a customized curriculum according to the findings of this research to deal with the challenges of IKS integration.

Following are responses given by teachers upon interviewed regarding approaches that can be taken to minimize challenges encountered when integrating IKS.

Teacher A says.....*"We should have modified our curriculum to incorporate Indigenous viewpoints in maths. The curriculum does not give much attention to IKS hence most teachers are not even teaching using these knowledges, more need to be done"*.

Teacher B responded saying...*"I like how some of my fellow teachers have developed Indigenous initiatives. These specialized curricula teach all students about other viewpoints while also assisting students"*. Teacher C asserts...*"We encourage teachers to be creative in their approach towards IKS integration. Flexible curricula will allow them to incorporate Indigenous perspectives, which leads to more engaged classrooms and happier students."*

The interviews on approaches to minimize the challenges of IKS integration was also carried out among the school administrators whose responses were noted down as follows.

Admin A said... *"I've found that developing customized curricula that incorporate Indigenous Knowledge Systems has been really helpful in making math more relevant and engaging for my Indigenous students. By tailoring the curriculum to our local context and cultural traditions, we've been able to create a more inclusive and culturally responsive math program."*

Admin B asserts....*"Our school has worked with Indigenous community members to develop a customized math curriculum that reflects the unique cultural and historical experiences of our Indigenous students. This approach has helped us to address some of the challenges we faced in integrating IKS into our math teaching, and has resulted in improved student engagement and outcomes."*

Admin C responded saying... *"I think customized curricula are essential for effective IKS integration. By tailoring the curriculum to the specific needs and contexts of Indigenous*

students, we can help to promote a more nuanced and accurate understanding of math concepts and their cultural significance.”

For Indigenous Knowledge Systems to be meaningfully integrated in the teaching of mathematics in schools, the need for customized curriculum should not be undermined. A customized curriculum with mathematical concepts contextualized within Zimbabwean cultures and environment make learning more and effective. There should be community involvement in the process of developing the curricula to ensure cultural accuracy and relevance. Customizable teaching methods enable richer information and can significantly increase student engagement and comprehension of various viewpoints, as explained by Lee and Smith (2019). Additionally, creating lesson plans that included IKS was essential to the integration's success. According to the study observations, maths education was more contextualized and pertinent when teachers were conversant with Indigenous ideas. To make sure that students felt appreciated and included in the learning process, the data also showed a significant emphasis on cultural awareness and respect. The integration of IKS offered a multifaceted method to teaching mathematics that was both successful and culturally affirming by actively incorporating local Indigenous settings and resources, such as Indigenous languages in mathematical explanations and discussions.

Additionally, as students come to understand and value many worldviews, incorporating Indigenous Knowledge Systems into curricula fosters critical thinking and problem-solving abilities in addition to increasing cultural awareness (Battiste, 2013). Studies show that pupils are more motivated and perform better academically when they perceive that the curriculum reflects their cultural identities (Deyhle and Swisher, 2017). Customized curricula are an effective approach to minimize challenges faced when integrating IKS in mathematical teaching.

4.3. Chapter Summary

A thorough examination of the information gathered from observations and interviews about the incorporation of Indigenous Knowledge Systems (IKS) in the teaching of primary mathematics is provided in chapter four. In order to demonstrate the advantages of integrating IKS into teaching, the students and teachers emphasized issues such the application of conventional mathematical tools, cultural contexts in learning, and collaborative approaches. However, issues including curricular restrictions, resource shortages, and community opposition were also noted, highlighting the necessity of focused professional development and community involvement. In the end, the results indicate that although integrating IKS into the mathematics curriculum can improve student engagement and comprehension, successful integration requires systematic support and cultural align

5.0 CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The research's final chapter, summarizes the main conclusions and revelations discovered throughout the investigation into the incorporation of Indigenous Knowledge Systems (IKS) in the teaching of primary school mathematics. This chapter opens with the summary of the study, emphasizing the key aspects of the study. Following the overview, the conclusions will highlight the key findings and offer insights into the possible effects of incorporating IKS into mathematics instruction on student involvement and comprehension. Finally, the chapter offers useful suggestions targeted at educators, legislators, and community stakeholders to enable the successful integration of Indigenous knowledge into the curriculum, thereby promoting a more inclusive and culturally sensitive learning environment. These recommendations are based on the data and insights offered in the preceding chapters.

5.2 Summary of the Research

This research study's main purpose was to analyze integrating indigenous knowledge systems (IKS) in primary school mathematics. The aim of the study was to investigate on the integration of Indigenous Knowledge Systems in the teaching and learning of mathematics at primary level at Kondo primary school. Kondo primary school has experienced poor performance in mathematics at grade 7 which resulted in low pass rate on this particular subject at grade 7 examination. The study was guided by four research questions mainly, what Indigenous

Knowledge Systems that can be integrated in the teaching of mathematics at primary level? What approaches used in the integrating Indigenous Knowledge Systems in the teaching of mathematics at primary level? What challenges faced when integrating Indigenous Knowledge Systems in teaching of mathematics? Lastly, what approaches employed to minimize the challenges that encountered when integrating Indigenous Knowledge Systems at primary level? This particular study followed interpretivist model of paradigm centered on qualitative research approach to explore on the Integration of Indigenous Knowledge Systems in the teaching of mathematics at primary level mainly focusing at Kondo Primary school in Mudzi District. The research design adopted in this study is a qualitative research design which uses qualitative methods. The study used two study instruments that is observations and interviews. The population in this particular study comprised of learners of mixed ability, grade seven teachers and administrators from Kondo Primary School in Mudzi District. The researcher employed a purposive sampling in in the study.

The study concluded that students' engagement and comprehension of mathematical ideas are improved when Indigenous Knowledge Systems (IKS) are incorporated into elementary mathematics instruction. Students' connection to their mathematics learning was strengthened through the use of indigenous measurement techniques, traditional counting systems, and culturally-based problem-solving methodologies. The use of traditional methods such as counting on fingers, using stones or seeds to represent numbers, and drawing diagrams in the sand can help learners develop their mathematical concepts and problem-solving skills. (Mwakapenda, 2009). Examples like counting with stones and sticks, utilizing local natural features, and utilizing narrative strategies to solve problems gave students meaningful and culturally appropriate contexts to study mathematical concepts. These methods not only made

learning easier, but they also inspired students to connect mathematical ideas to their own cultural background, which helped them understand the material more deeply.

The results also demonstrated the value of cooperative learning settings where community service and teamwork supported academic achievement. Incorporating family members and group activities promoted a positive learning environment where students could gain from each other's experiences and knowledge. In addition to enhancing each student's mathematical proficiency, this cooperative approach bolstered classroom relationships. Overall, the study confirmed that using IKS in maths classes fosters a more engaging, inclusive, and culturally sensitive learning environment, which eventually improves primary-level students' academic performance.

The study concluded that a wide range of instructional strategies and resources catered to the different learning levels of the students were necessary for the successful integration of Indigenous Knowledge Systems (IKS) into basic mathematics education. Teachers were able to make mathematics more interesting and relevant by using diversified teaching strategies, such as narrative and hands-on activities using conventional instruments. Students were able to apply mathematical ideas in meaningful ways through collaborative learning experiences that were facilitated by the inclusion of culturally relevant situations. Additionally, incorporating Indigenous perspectives and emphasizing cultural awareness into lesson planning improved students' sense of belonging, resulting in a comprehensive approach to mathematics instruction that was both successful and culturally affirming.

The study concluded that there were several obstacles to overcome while incorporating Indigenous Knowledge Systems (IKS) into the mathematical curriculum, chief among them being curriculum restrictions, resource shortages, and community opposition. In Zimbabwe, the

curriculum is not aligned with the local Indigenous Knowledge Systems, making it difficult to integrate IKS into the curriculum. (Moyo, 2017) The strict national curriculum, which values standardized information over indigenous knowledge, and traditional Indigenous customs are consistently out of sync, according to participants. Because of this misalignment, teachers frequently felt unable to successfully integrate IKS into their lessons, which caused a gap between mathematical ideas and students' real-world experiences. Additionally, the rigid curriculum frameworks alienated Indigenous students from the educational process by contributing to the marginalization of Indigenous cultures. The lack of curriculum alignment is a significant challenge in integrating IKS into education, as it requires a significant overhaul of the existing curriculum. (Paisley, 2015)

The study also found that a lack of resources, such as inadequate teacher training and a dearth of instructional materials that consider Indigenous contexts, was a major barrier. According to Shizha,(2013) teachers in Zimbabwe require training and support to effectively integrate IKS into mathematics education, but such training is often not available. Despite feeling unprepared and unsupported, several educators stated a willingness to include IKS. Finally, the study revealed a significant cultural misalignment, showing a gap between Indigenous approaches and parental views on schooling. Fostering an inclusive curriculum that recognizes Indigenous knowledge was thought to require involving parents and communities in the educational process. All things considered, the results indicated that resolving these issues is essential to developing a fairer and culturally appropriate learning environment for Indigenous students.

The study concluded that a multifaceted strategy including curriculum flexibility, professional development, community participation, and resource development is needed to integrate Indigenous Knowledge Systems (IKS) at the primary level. Participants emphasized the value of

specialized training and peer learning as crucial resources for giving educators the skills and self-assurance they need to integrate Indigenous viewpoints into their lessons. Teachers improved their pedagogical abilities and their relationships with Indigenous communities by creating a collaborative professional development environment. This improved student learning and promoted cultural relevance in the classroom.

The study also acknowledged the need of community involvement in fostering an inclusive learning environment, in addition to the creation of culturally appropriate resources and the availability of conventional mathematical instruments. Teachers were able to increase student motivation and engagement by working with Indigenous communities and using resources that represent the cultural backgrounds of the students. According to the findings, more meaningful learning experiences and better academic results may result from a flexible curriculum that permits customization and incorporates Indigenous perspectives. All things considered, incorporating IKS into elementary school improved the curriculum and helped pupils develop a greater awareness and respect for cultural variety.

5.3. Conclusion

The integration of Indigenous Knowledge Systems (IKS) into mathematics education at the primary level is crucial for promoting cultural relevance, improving student learning outcomes, and decolonizing the education system. However, this integration is faced with several challenges, including insufficient training, limited educational materials, and lack of support from stakeholders, and inadequate access to traditional mathematical tools. To address these challenges, several approaches can be employed. Targeted training programs can be designed to enhance teachers' understanding and integration of IKS into mathematics education. The

development and use of culturally relevant materials can also help to promote IKS integration. Furthermore, collaboration with indigenous communities and the use of customized curricula can facilitate the effective integration of IKS into mathematics education.

5.4. Recommendations

- To help instructors successfully incorporate these viewpoints into their mathematics instruction, the study advises educational institutions to put in place focused professional development programs that emphasize Indigenous Knowledge Systems (IKS).
- To establish cooperative learning opportunities and produce culturally appropriate materials that represent Indigenous viewpoints in the mathematics curriculum, the researcher advises cultivating close relationships with nearby Indigenous communities.
- The study suggests using indigenous measurement methods and traditional counting systems in maths classes since they give pupils relevant settings and improve their comprehension of mathematical ideas.
- To ensure that teachers have easy access to culturally relevant resources when teaching IKS, the study proposes creating a resource bank that contains lesson plans, instructional materials, and traditional mathematical instruments.
- In order to make mathematics education more interesting and relevant for students, the study suggest curricular flexibility that enables teachers to develop specialized curricula including Indigenous Knowledge Systems.
- In order to foster a positive learning atmosphere and strengthen students' ties to their cultural heritage, the study recommends involving family and community members in the educational process.

- To ensure that instructional strategies continuously adapt to the needs of every student, the researcher advises regular review and assessment of the integration of IKS in mathematics education in order to pinpoint areas of success and room for development.
- In order to exchange materials and best practices for incorporating Indigenous knowledge into mathematics classes, the researcher advised promoting teacher collaboration and peer learning.
- In order to increase acceptability and support for these projects, the study suggests developing awareness programs aimed at communities and parents that highlight the advantages of integrating Indigenous Knowledge Systems into the classroom.
- In order to create a more inclusive and equitable learning environment in mathematics education, the study proposes encouraging culturally responsive teaching methods that acknowledge and value students varied cultural origins.

5.5. Recommendations for Further Research

The long-term effects of incorporating Indigenous Knowledge Systems (IKS) into the mathematics curriculum on student involvement, academic achievement, and cultural identity should be investigated. This study may shed light on how well IKS integration works over time and assist teachers in creating best practices that promote Indigenous students' academic achievement and cultural relevance in primary school.

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Appendix

Interview Guide for Administrators

Title of Study: Investigating the Integration of Indigenous Knowledge Systems (IKS) in Primary Mathematics Education

Researcher: Tsingano Shephard

Section 1: School Context and Policy

1. What initiatives have been implemented in your school to promote the integration of Indigenous Knowledge Systems (IKS)?
2. How do existing school policies support the integration of IKS within the curriculum?
3. Can you describe how your school addresses diverse learning needs, particularly regarding IKS?
4. What professional development opportunities are available for teachers to enhance their understanding and implementation of IKS integration

Section 2: Vision for IKS Integration

1. How do you envision the integration of IKS enhancing mathematics education at the primary level?
2. Which specific IKS concepts or practices do you find most relevant for primary mathematics education?
3. What strategies would you recommend for implementing IKS integration school-wide?

4. What resources or support systems do you believe are necessary to facilitate effective IKS integration?

Section 3: Implementation and Challenges

1. How do you plan to address any potential resistance to the integration of IKS among staff or the wider community?
2. What budgetary considerations are important for supporting IKS integration initiatives?
3. How do you evaluate the effectiveness of IKS integration in enhancing learning outcomes?

Section 4: Teacher Support and Development

1. What training or professional development programs do you think would best prepare teachers for integrating IKS into their teaching?
2. How would you ensure ongoing support for teachers who are implementing IKS-based lessons?
3. How can you address any concerns or needs that teachers have regarding the integration of IKS?

Section 5: Sustainability and Scalability

1. What strategies would you propose to sustain IKS integration beyond the initial implementation period?
2. How can schools effectively scale up IKS integration across different grade levels and subjects?

3. In what ways can successful IKS integration practices be shared with other schools in the district?

Section 6: Conclusion

1. Do you have any additional thoughts or recommendations regarding the integration of Indigenous Knowledge Systems in mathematics education?

Is there anything else you would like to share regarding this initiative?

Interview Guide for Teachers

Title of Study: Investigating the Integration of Indigenous Knowledge Systems (IKS) in Primary Mathematics Education

Researcher: Tsingano Shepard

Introduction

Section 1: Background and Experiences

1. What is your experience in teaching mathematics at the primary level?
2. How would you define Indigenous Knowledge Systems (IKS)?
3. To what extent have you integrated IKS into your mathematics teaching practices?
4. What cultural backgrounds do your learners represent?

Section 2: IKS Concepts and Practices

1. What specific IKS concepts do you believe enhance primary mathematics education?
2. How can traditional mathematical tools for example abacus, counting stones be effectively incorporated into lessons?
3. Can you share local environmental or cultural contexts that illustrate mathematical concepts?
4. What examples of IKS-based mathematics activities or lessons have you implemented?

Section 3: Integration Strategies

1. How would you incorporate IKS into existing mathematics curricula?

2. What resources or support systems do you believe are necessary for effective IKS integration?
3. How do you balance IKS integration with standardized curriculum requirements?
4. What targeted professional development or training would enhance your capacity for integrating IKS?

Section 4: Classroom Implementation

1. How do you include IKS in your lesson planning?
2. What teaching methods do you find most effective for facilitating IKS integration (e.g., storytelling, hands-on activities)?
3. How do you assess student understanding of IKS-integrated concepts?
4. Can you share any feedback from students regarding IKS-based lessons?

Section 5: Challenges and Opportunities

1. What challenges have you encountered when attempting to integrate IKS into your mathematics instruction?
2. How have you addressed or overcome these challenges?
3. What opportunities do you see arising from the integration of IKS?
4. In what ways do you think IKS integration can improve student engagement and learning outcomes?

Section 6: Conclusion

1. Do you have any additional thoughts or recommendations regarding the integration of Indigenous Knowledge Systems in mathematics education?

Is there anything else you would like to share about your experiences?

Observation Guide

Title of Study: Investigating the Integration of Indigenous Knowledge Systems (IKS) in Primary Mathematics Education

Researcher: Tsingano Shepard

Observation Criteria for Teachers

Section 1: Teaching Methods

1. Are hands-on activities used that incorporate IKS into the lesson?
2. What traditional or Indigenous problem-solving approaches are employed during the lesson?
3. What different teaching strategies are utilized throughout the lesson?
4. How does the teacher facilitate group work and collaborative learning through IKS-integrated mathematical tasks?
5. What examples of IKS integration exist in the lesson?

Section 2: Resource Utilization

1. What traditional materials are used during the lesson?
2. Are local environmental resources effectively utilized in the lesson?
3. How does the teacher incorporate Indigenous artifacts into the lesson?
4. Does the teacher leverage technology in the lesson, and if so, how?

Section 3: Observation Areas for Teachers

1. Teacher Preparation

- Are lesson plans incorporating IKS concepts?
- Is the teacher familiar with IKS concepts?
- Are there preparations of IKS-related resources?

2. Teaching Methods

- Are storytelling and cultural examples employed?
- Are hands-on activities and traditional tools effectively utilized?
- Are there differentiation strategies for diverse learning levels?

3. Teacher-Student Interaction

- Are students engaged and actively participating?
- Is there effective feedback and support provided by the teacher?
- How is cultural sensitivity ensured during interactions?

4. Lesson Delivery

- How clear and effective is the integration of IKS?
- Are students demonstrating understanding and engagement with the concepts?
- Is the lesson well-paced and organized?

5. Cultural Relevance

- Is there incorporation of local Indigenous contexts?
- Is there respect shown towards Indigenous cultures and perspectives?
- Are Indigenous languages and resources used effectively?

Section 4: Observation Criteria for Learners

Learning Environment

1. In what types of IKS-related activities do learners engage during mathematical lessons?
2. How do learners respond to traditional cultural methods used in the classroom?
3. What interactions do learners have with IKS-related resources during lessons?
4. What challenges do learners face while engaging with IKS-integrated mathematics content?

Understanding and Engagement

1. How do learners express their understanding or confusion regarding IKS integration in mathematics lessons?
2. What traditional Indigenous approaches help or hinder learners' grasp of concepts?
3. How do learners collaborate with peers during group work using IKS-integrated tasks?

Observation Areas for Learners

1. Learner Engagement

- Are students actively participating in IKS-integrated mathematics activities?

2. Critical Thinking

- Do learners demonstrate critical thinking through IKS-integrated tasks and justify their mathematical solutions using IKS?

3. Concept Understanding

- How accurate are learners' responses and applications of concepts?

4. Problem Solving

- Are students effectively applying IKS concepts to solve mathematical problems?

Rating Scale for Observations

Teacher Observations

Area	Indicator	Notes
Teacher Preparation	Lesson plans incorporate IKS	
	Familiarity with IKS concepts	
	Preparation of IKS-related resources	
Teaching Methods	Use of storytelling and cultural examples	

	Hands-on activities and traditional tools	
	Differentiation strategies for diverse learning	
Teacher-Student Interaction	Pupil engagement and participation	
	Teacher feedback and support	
	Cultural sensitivity and respect	
Lesson Delivery	Clarity and effectiveness of IKS integration	
	Pupil understanding and engagement	
	Lesson pacing and organization	
Cultural Relevance	Incorporation of local indigenous contexts	
	Respect for indigenous cultures and perspectives	
	Use of indigenous language and resources	

Learner Observations

Area	Indicator	Notes
Learner Participation	Engages in IKS-integrated mathematics	
Critical Thinking	Demonstrates critical thinking through IKS integrated tasks	
	Uses IKS to justify mathematical solutions	
Concept Understanding	Accuracy of responses	
	Application of concepts	
Problem Solving	Applies IKS concepts to solve mathematical problems	

