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An investigation on the incorporation of indigenous knowledge systems into the Mathematics curriculum using Chihuri Secondary in Shamva District as a case study.

BY

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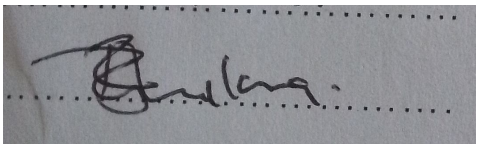

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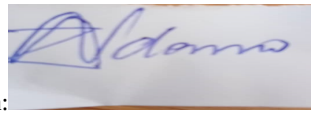
Chair person: 

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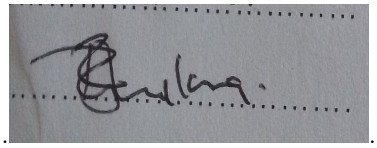
Signed …  ……. Date 17 /10/24

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ABSTRACT

This research sought to gain insight on the incorporation of indigenous knowledge systems into the Mathematics curriculum using Chihuri Secondary and Chihuri Primary School in Shamva District as a case study**.** Both qualitative and quantitative approaches were adopted for data generation, analysis, and discussion. Questionnaires were used in generating data. In this study, there were seven female Mathematics teachers and eleven male Mathematics teachers and forty students (20 girls and 20 boys) who were purposively sampled to participate in this study. Thematic analysis was used to analyze data from the questionnaires. The major themes were derived from the research questions and these include teachers' and students' familiarity with Indigenous Knowledge systems in Mathematics education, effects of including Indigenous Knowledge systems into the Mathematics curriculum, challenges faced by teachers and students in trying to embrace Indigenous Knowledge Systems into the Mathematics curriculum as well as ways to mitigate these challenges in incorporating Indigenous Knowledge Systems into the Mathematics curriculum. The research reviewed majority of teachers and students familiarize Indigenous Knowledge systems , and they are rarely embracing it in the teaching and learning process. Many challenges are being experienced by teachers and students in IKS integration in the teaching and learning of Mathematics. From the findings, teachers and students appreciate the positive impact of IKS into the Mathematics education and they are eager to embrace IKS into the Mathematics curriculum. Policymakers are recommended to provide enough training and provide resources for teachers and students for them to be able to incorporate Indigenous Knowledge Systems into the Mathematics Curriculum.

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CHAPTER 1

THE PROBLEM AND ITS SETTING

1.0 :Introduction

The chapter presents the introduction to the study. The study will discuss the background of the study, statement of the problem, the purpose of the study, main research aim and the organization of the study. The chapter will further highlights the significance of the study as well as chapter summary.

1.1: Background of the study

In Zimbabwe, learners in schools struggle with many mathematical concepts and processes. Many of the concepts that are taught in schools are beyond the lived experiences of the students and do not correlate to the cultural experiences of the Zimbabwean student. This has resulted in Mathematics being perceived as an abstract and difficult subject by learners, and sometimes, by teachers too. At times, the difficulty emanates from how the various concepts are taught, explained and presented to the students. Therefore, the difficulty is associated with the pedagogical methods and practices used by the teachers. The difficulty in understanding Mathematical concepts ultimately leads to poor performance in the subject in high school. Many Zimbabwean schools are facing the challenge of poor performance in mathematics and as this chapter argues some of the obstacles are cultural and that there is cultural dissonance between what is taught in Mathematics education in schools and the cultural understanding of how Mathematics is applied in the everyday lives of Zimbabwean students. Cultural dissonance, which is the uncomfortable sense of discord or conflict that one experiences when placed in a changed cultural environment, exists within the scope of education (Bradbury, 2018). The concept of culture is rarely invoked explicitly in the research literature on critical Mathematics education and in teaching Mathematics, and this missing link can be attributed to the difficulty Larvor & Francois (2018) . Zimbabwean students should have to conceptualize Mathematics and applying Mathematical concepts and principles in their indigenous lives. This inclusion acknowledges the importance of indigenous Mathematical concepts and practices, helping to maintain cultural

traditions for the future generations , Lindsay and Bishop (2017). The challenge of perceiving Mathematics as imaginary component of real life can be curbed by bridging the gap between school Mathematics and learners' home life using indigenous Mathematical knowledge or ethnomathematics (Sunzuma, & Maharaj, 2020). This chapter argues that the Western teaching methodologies have failed to provide answers to the poor performance of learners in Mathematics education in African schools. As a result, one of the ways proposed in which Mathematical concepts can be taught with understanding is integrating the indigenous Mathematical knowledge into mathematics curriculum.

1.2: Statement of the problem

In the Zimbabwean educational system, the integration of Indigenous Knowledge Systems (IKS) into the mainstream Mathematics curriculum remains significantly underexplored. Despite growing recognition of the value of IKS in offering diverse perspectives and problem-solving strategies, its incorporation into educational practices, especially in Mathematics, faces considerable challenges. "Indigenous students often face unique challenges in the education system, such as language barriers and a lack of cultural representation in the curriculum" (Smith, 2019).This research seeks to investigate the incorporation of Indigenous Knowledge Systems within the Mathematics curriculum, aiming to bridge the gap between cultural knowledge and academic learning. The study will explore, how indigenous knowledge can enrich the Mathematics curriculum, enhance student engagement, and foster a more inclusive educational environment. By shedding light on these hurdles, the study aims to provide insights that will facilitate the development of effective strategies for successfully integrating Indigenous perspectives.

1.3 : Research aim

The aim of this study is to explore the incorporation of indigenous knowledge systems into the Mathematics curriculum, with the goal of promoting culturally relevant and inclusive education that enhances the learning experience for all students especially in science and mathematics.

1.4 : Research objectives

The study will be guided by the following objectives

- To distribute questionnaires to the teachers in order to gather information.
- To interview students in order to gather information .
- To analyse responses using statistical methods.
- To draw conclusions from the responses provided by respondents.

1.5 : Significance of the study

The study is crucial to multiple stakeholders as it will contributes to the growing body of research on the incorporation of indigenous knowledge systems into the Mathematics curriculum. The findings of the study will also add the knowledge base on how indigenous knowledge systems can be used to enhance student learning and understanding of Mathematics, as well as to promote cultural understanding and appreciation.

1.5.0: Significance to Students:

The study will increase cultural relevance to the students. Incorporating indigenous knowledge into the Mathematics curriculum can help students better connect with the subject matter and see the relevance of their own cultural background in their education.

It will also promote diversity and inclusion. By including indigenous knowledge, students from different indigenous backgrounds can see themselves represented in the curriculum, fostering a sense of inclusion and diversity in the classroom.

Lastly it enhances learning experiences within the students. By incorporating diverse perspectives and knowledge systems, students can gain a more holistic understanding of mathematics, enhancing their learning experiences.

1.5.1 : Significance to Teachers:

Incorporating indigenous knowledge into the Mathematics curriculum enhances professional development within the teachers. Engaging with indigenous knowledge can provide teachers with an opportunity to expand their own knowledge and understanding of different cultural perspectives, enriching their teaching practice.

It also foster cultural awareness. Teachers can help promote cultural awareness and appreciation among students by incorporating indigenous knowledge into their lessons, creating a more inclusive and diverse learning environment.

Enhancing student engagement is also another importance of incorporating indigenous knowledge into the Mathematics curriculum. By incorporating indigenous knowledge, teachers can help make the curriculum more relevant and engaging for students, leading to increased motivation and interest in learning.

1.5.2 : Significance to Curriculum Planners:

Meeting educational goals is the major significance to the curriculum planners. By incorporating indigenous knowledge into the curriculum, planners can help meet educational goals related to diversity, inclusion, and cultural understanding.

More so, aligning with national standards is the another importance of incorporating indigenous knowledge into the Mathematics curriculum. Incorporating indigenous knowledge can help align the curriculum with national standards that promote diversity and cultural awareness in education.

Addressing the needs of diverse learners is another significance of incorporating knowledge into mathematics curriculum. This can help address the diverse learning needs of students from different cultural backgrounds, ensuring that all students have access to a curriculum that is inclusive and relevant to their experiences.

1.6 : Delimitations of the study

Mashonaland Central Province has eight education administration districts which operate under guidance of The Ministry of Primary and Secondary Education. These are,Shamva, Mt Darwin, Rushinga, Muzarabani, Bindura Mbire, Mazowe and Guruve. This study will be carried out in Shamva District which has 21 secondary schools offering basic education from forms 1 to form 4 ,following the dictates of the Ministry of Primary and Secondary Education. The investigation will be carried out at Chihuri Secondary School which has an enrolment of 398 learners, a staff complement of 17 and offers basic education following the demands of the new curriculum framework of Zimbabwe (2016 - 2022).

1.7 : Chapter layout

Chapter 1 puts the problem and its setting into context; chapter 2 will outline the theoretical framework that forms the lens through which the study will be observed. In addition, the gaps to be filled by this study will be identified. Chapter 3 will focus on the strategy through which data for this study will be generated, analysed, and discussed. Chapter 4 will explore the generated data through analysis, and discussion with the view to provide answers to aim and research objectives raised. Chapter 5 will give an overview of the study conclusion and recommendations.

1. 8 : Chapter summary

This chapter focused on the background of the study, aim of the study, objectives of the study, significance of the study as well as organization of the study. In the following chapter the study will dwell on the literature related to the research problem.

CHAPTER TWO

LITERATURE REVIEW

2.0 : Introduction

This chapter will be focusing on the identification of gaps to be filled by the study. In this chapter, the study will outline the theoretical framework that is, indigenous knowledge, importance of integrating indigenous knowledge into the mathematics curriculum, challenges and opportunities associated with integrating indigenous knowledge into the mathematics curriculum will also be discussed.

2.1 : Indigenous knowledge systems and education

Tsindoli (2019) declares that African indigenous knowledge systems (IKS) existed long before Western education was introduced by the colonialists and missionaries in African countries. The introduction of western education brought about conflicting demands to the indigenous learner. The alien knowledge that was imported and imparted to the African child was alienating and did not reflect indigenous worldviews and ways of knowing (Shizha, 2015) .The colonial education system suppressed and displaced the African cultural practices, indigenous epistemologies and ways of knowing. Tsindoli (2019), AIKS are often perceived as primitive, historical and ancient practices of African people. As a result, indigenous knowledge systems have not featured as a valuable commodity for education and economic development.

2.2 : Incorporating indigenous knowledge into the Mathematics curriculum

Mathematical knowledge does not only originate from school, but learners can also acquire Mathematical knowledge by interacting with their sociocultural environment. This has been highlighted by Reyhner and singh (2017), Indigenous knowledge in Mathematics education involves incorporating traditional methods of problem solving, measurement and observation that have been developed within indigenous communities. Indigenous Mathematical knowledge manifests itself in everyday activities and people have used it both consciously and unconsciously. Pradhan (2020) notes that, “people outside the classroom use some sophisticated Mathematical ideas to perform their daily activities” . For example concepts such as symmetry, radius, area and

perimeter are embedded in indigenous people's activities such as pottery designs, basket weaving, and artwork. The infusion of indigenous knowledge in Mathematics education in Zimbabwe has the potential to improve the teaching and learning of Mathematics by making it more relevant and meaningful to students" (Mudzengerere, 2020). A good example of Mathematics in everyday life is when people at home apply the concept of ratio and proportion during the preparation of food. Indigenous knowledges and Mathematical concepts are embodied in many indigenous activities and much of the knowledge is mainly transmitted through oral narratives, ritual ceremonies, traditional songs, story telling, riddles, proverbs and other cultural practices. For example, there are many different counting systems that have been developed in the world. The Mathematics practiced by indigenous people has been termed
'Ethnomathematics' and it reflects how different people use cultural Mathematics in their everyday life. Thus, this interaction with the environment needs to be facilitated by the integration of indigenous knowledge into the curriculum Gasva etal (2019). In this context, learners are engaged in measurable tasks using the experiences gained through learner-centred activities (Ministry of Primary and Secondary Education, 2015). It is done through a blended approach to learner assessment that entails formative and summative assessment. It is significant to acknowledge that this new thrust calls for the integration of indigenous knowledge into learning act.

2.3 : The Concept of Ethnomathematics

Ethnomathematics is a term coined by the Brazilian mathematian called Ron Eglash in the 1980s. It involves investigating how Mathematical concepts and practices are embedded in the culture of a particular group or community, and how they are used in everyday life. "Ethnomathematics can be used as a tool to help students develop critical thinking skills, learn about other cultures, and gain a deeper understanding of the world around them" Jones (2016). It shifts Mathematics from the places where it has been erected and glorified (university and schools) and spreads it to the world of people, in their diverse cultures and everyday activities
(Bhatt, 2020).). The phrase 'cultural groups' is viewed beyond the traditional perspective of only restricting it to ethnic or tribal groups in a certain geographical area. The phrase is used in a broader

sense to mean different social groups within a society such as labour groups, professional classes, street vendors and many more.

2.4 : Rationale of incorporating indigenous knowledge systems into the mathematics curriculum

Incorporating Indigenous knowledge into the Mathematics curriculum offers several opportunities for students, educators, and the broader society. This integration promotes cultural diversity, enhances the understanding of traditional knowledge systems, and fosters a more comprehensive approach to scientific research and problem-solving.

2.4.0: Cultural diversity and conservation

"Indigenous knowledge provides a bridge between the Mathematics being taught in schools and the culture of students. This can help to make the learning experience more meaningful and relevant to students, and also to strengthen their identity and sense of belonging" ,Mugumbate et al, (2017). Generally, connecting learning to students' cultural backgrounds and traditions can make the subjects more relevant and meaningful, leading to increased motivation and academic success. By so doing that, students from different indigenous backgrounds feel a sense of belonging and recognition in the educational setting. Incorporating indigenous knowledge into the Mathematics curriculum helps non-indigenous students to appreciate and respect different cultures, contributing to a more inclusive and harmonious learning environment (Peredo-Munoz, 2017). For example indigenous communities in Zimbabwe have longstanding relationships with their natural surroundings and possess valuable knowledge about local flora and fauna. By incorporating this knowledge into the Science and Mathematics curriculum, students can learn about biodiversity, conservation techniques, and ecological balance. This education could lead to increased awareness and involvement in protecting Zimbabwe's unique ecosystems and wildlife.

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2.4.1 Broader understanding of traditional knowledge system

"Indigenous knowledge systems (IKS) are part of the African cultural heritage and their inclusion in the curriculum can result in more meaningful learning" (Mazibuko & Nkala, 2015,). Integrating indigenous knowledge into the curriculum also allows for a broader understanding of traditional knowledge systems. Indigenous cultures have a deep understanding of their local environments, often based on centuries of observation and passing down knowledge from generation to generation. Integrating indigenous knowledge in the curriculum can provide a holistic and interconnected approach to learning. Research by Tippeconnic Fox et al. (2018) emphasizes that, indigenous knowledge often encompasses a deep understanding of the interconnectedness of the natural world, which can complement and enrich traditional Scientific and Mathematical concepts taught in schools. For example, Zimbabwean indigenous communities have a vast knowledge of medicinal plants and their traditional uses for healing various ailments. By including this knowledge in the Mathematics curriculum, students can learn about the ratios of different medicinal properties of local plants, their active compounds, and the potential for developing new drugs using appropriate ratios on mixtures. This integration bridges the gap between traditional measurements system and modern , this encourages students to appreciate their cultural heritage while embracing scientific and Mathematical advancements.

2.4.2 : Decolonization

Incorporating indigenous knowledge into Mathematics curriculum can contribute to decolonizing education and challenging Eurocentric perspectives. Harper (2019) highlights the importance of decolonizing and Indigenizing Mathematics education to address the historical Western dominance in the curriculum and promote diverse ways of knowing. Furthermore, research by Chikanda (2014) highlights the importance of incorporating indigenous knowledge in order to decolonize education and promote a more balanced and inclusive approach to learning in

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Zimbabwean schools. By incorporating indigenous knowledge into the Mathematics curriculum, students can learn about traditional astronomical observations, navigation techniques, and calendar systems. This integration not only enriches their Mathematical skills but also promotes cultural pride and inclusion.

2.4.3 Critical thinking

From an educational standpoint, incorporating indigenous knowledge into Mathematics curriculum enhances critical thinking and problem-solving skills. "Indigenous knowledge systems (IKS) are part of the African cultural heritage and their inclusion in the curriculum can result in more meaningful learning" Mazibuko & Nkala (2015). Indigenous knowledge often includes unique perspectives and alternative ways of approaching complex problems. According to research by Machingambi (2017), integrating indigenous knowledge into the curriculum can enhance students' critical thinking skills, foster a sense of pride in one's cultural identity, and contribute to a more holistic education that values both Western and indigenous knowledge systems.

2.4.4 : Research and innovation

Integrating indigenous knowledge in Mathematics can lead to more comprehensive research and innovation. Traditional ecological knowledge, for example, has proven valuable in fields such as ecology, botany, and conservation Barker et al (2017). Incorporating this knowledge into the curriculum can inspire students to pursue research, utilizing diverse methodologies and engaging with local communities, fostering a more holistic approach to scientific inquiry.

2.5 : Problems associated with incorporating IKS into Mathematics curriculum

Incorporating indigenous knowledge into the Mathematics curriculum involves integrating traditional ways of knowing, teaching, and learning from indigenous cultures into the study of

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Mathematics. This approach seeks to make Mathematics education more culturally relevant, inclusive, and engaging for indigenous students. However, incorporating indigenous knowledge into Mathematics curriculum can present several challenges, despite the potential benefits. Scholars have identified some key obstacles that educators may encounter in this process. Some of these challenges are;

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2.5.0 Potential conflicts with Western scientific paradigms

One significant challenge is the potential clash between indigenous knowledge and Western scientific paradigms. Research on incorporating Indigenous knowledge into Mathematics education as a way to counter Western dominance in the curriculum has gained attention in recent years. According to Barwell (2016), Indigenous knowledge in Mathematics education serves as a valuable tool for challenging the dominant .Western perspectives and fostering a more inclusive learning environment.

2.5.1: Economic factors

It is essential for policymakers and stakeholders to prioritize funding and resources to support initiatives that promote cultural diversity and inclusivity in education. Financial challenges can significantly impact the effective incorporation of indigenous knowledge into the Mathematics curriculum in Zimbabwe. Due to limited resources, schools may struggle to purchase the necessary materials and resources for teaching indigenous Mathematics concepts. Additionally, financial constraints may limit professional development opportunities for teachers to enhance their understanding and integration of indigenous knowledge into the curriculum. Svinurai (2019), noted that, the lack of funding for educational programs in Zimbabwe has resulted in a disconnect between indigenous knowledge and the Mathematics curriculum. Mukwiza and Mushaikwa (2017) also argue that, financial constraints can also impact the availability of research and resources that

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support the incorporation of indigenous Mathematics into the curriculum. Without adequate funding, schools may struggle to access relevant literature and materials that can enhance students' understanding and appreciation of indigenous knowledge in mathematics.

2.5.2 : Cultural sensitivity

Cultural sensitivity and respect for indigenous traditions and protocols are essential when incorporating indigenous knowledge. As discussed by Harrison (2013), educators must navigate complex ethical considerations, including obtaining informed consent from indigenous

communities, respecting intellectual property rights, and ensuring that knowledge is shared appropriately and respectfully.

The institutional inertia and resistance to change within educational systems can hinder the successful integration of indigenous knowledge. According to Wilson and Ross (2016),
Resistance to change can hinder the implementation of Indigenous knowledge in the Mathematics curriculum in several ways. One major barrier is the Eurocentric perspective that dominates educational systems, which often prevents the incorporation of diverse worldviews and knowledge systems (Bowers, 2016). This resistance can be fuelled by a lack of awareness or understanding of Indigenous knowledge, as well as the fear of losing control over the curriculum.

Furthermore, the institutional structures and power dynamics within educational systems can also contribute to resistance to change. Decision-makers may prioritize traditional Western Mathematics over Indigenous ways of knowing, making it difficult to integrate Indigenous knowledge into the curriculum (Chalmers, 2018). In order to overcome these barriers, it is important to create spaces for dialogue and collaboration between Indigenous communities, educators, and policymakers. This can help build understanding and appreciation for different knowledge systems, and work towards a more inclusive and equitable Mathematics curriculum that incorporates Indigenous perspectives (Wilson, 2019).By addressing resistance to change and promoting the integration of Indigenous knowledge into the Mathematics curriculum, educators can create a more inclusive and culturally responsive learning environment that honours and values diverse ways of knowing.

2.6: Strategies to incorporate indigenous knowledge into the and mathematics curriculum.

Addressing these challenges requires a collaborative effort from policymakers, educators, researchers, and communities to promote the value of indigenous knowledge in the science and Mathematics curriculum and provide the necessary support and resources for successful implementation. Research by Machingambi (2017) calls for a rethinking of teacher education programs to include aspects of indigenous knowledge and for the development of culturally responsive teaching approaches in Zimbabwean schools to overcome these challenges and promote a more inclusive and diverse

educational system. To incorporate indigenous knowledge into the Mathematics curriculum in Zimbabwe, several strategies can be employed.

2.6.0 :Curriculum Design

Curriculum designs play a crucial role in effectively incorporating Indigenous knowledge into the Mathematics curriculum by providing frameworks and structures that support the integration of diverse perspectives and worldviews. Scholars have highlighted the importance of culturally responsive curriculum designs in promoting engagement and academic success among Indigenous students (Battiste, 2017). By centering Indigenous knowledge within the curriculum, educators can create a more inclusive and relevant learning experience for all students.

For example, Battiste (2017) emphasizes the need for curriculum designs that reflect Indigenous ways of knowing, learning, and teaching. Incorporating storytelling, land-based learning, and community connections into the Mathematics curriculum can help students see the relevance of mathematical concepts in their everyday lives and cultural traditions. Additionally, curriculum designs that incorporate Indigenous perspectives can foster a sense of pride and identity among Indigenous students, leading to increased motivation and academic achievement (Battiste, 2017).

Furthermore, curriculum designs that are flexible and adaptable can accommodate different cultural contexts and learning styles, allowing educators to tailor their approaches to meet the diverse needs of students (MacIvor, 2018). By incorporating Indigenous knowledge into the Mathematics curriculum in a culturally responsive and meaningful way, educators can create a more equitable and inclusive learning environment that honours and respects the diversity of Indigenous cultures and knowledge systems.

2.6.1 :Teacher Training and Professional Development

Teacher professional development plays a crucial role in promoting the incorporation of Indigenous knowledge into education. One way that this is achieved is through providing educators with the necessary resources and training to better understand and incorporate Indigenous perspectives and teachings into their curriculum. Lefthand-Begay and Martin (2015) noted that, professional development workshops and courses have been found to be effective in helping teachers to become more culturally responsive and inclusive in their teaching practices. These opportunities allow educators to learn about Indigenous knowledge systems, traditions, and histories, which in turn enables them to incorporate this knowledge into their lessons in a respectful and meaningful way. Furthermore, teacher professional development can help educators to recognize and address their own biases and misconceptions about Indigenous cultures. By fostering a deeper understanding and appreciation of Indigenous knowledge, teachers are better equipped to create inclusive learning environments that promote equity and respect for all students.

Thus, teacher professional development plays a crucial role in promoting the incorporation of Indigenous knowledge into education by providing educators with the tools, resources, and training necessary to foster cultural responsiveness and inclusivity in their teaching practices. "Teacher training and professional development programs can help to break down barriers to the inclusion of indigenous knowledge by providing teachers with the skills and knowledge they need successfully incorporate it into the curriculum"(Collins, 2019).

2.6.2: Resources

Developing educational materials, textbooks, and resources that integrate indigenous knowledge into Mathematics topics can support teachers in implementing the curriculum effectively. These resources should be culturally appropriate and accessible to students (Chikanda, 2014). "One way that resource development can support the inclusion of indigenous knowledge is by creating materials that draw on local traditions, stories and knowledge" ,Mavhunga (2019). For example, currently Zimbabwe is being affected by serious hyperinflation which lead to economic

hardship, thus if a lesson plan on financial Mathematics Rates (usd against Zig) developed from there it became more realistic hence Mathematics became meaningful. This became more practical because students will be interacting with real societal experiences rather than just borrowing theories in order to understand.

By implementing these strategies, Zimbabwean educators can effectively incorporate indigenous knowledge into the science and Mathematics curriculum, creating a more inclusive and culturally relevant educational experience for students. Researchers like Machingambi (2017) emphasize the importance of collaborative efforts between educators, communities, and policymakers to successfully integrate indigenous knowledge into the educational system.

2.7 :Chapter summary

Chapter two underlined the theoretical base on which the study took reference. The chapter also looked at the relevance and opportunities associated with incorporating indigenous knowledge in the science and mathematics curriculum . The following chapter will looks at the research methodology used to provide answers to the formulated research objectives.

CHAPTER 3

RESEARCH METHODOLOGY

3.0 :Introduction

This chapter, will focus on the research design, population and sample, sampling procedures, research instruments, data collection procedures and analysis. Issues related to research instruments which are questionnaires will be explained also. The consideration of validity and reliability in research instruments will be explained and finally the research ethics that are going to be considered in the research will also be discussed.

3.1 :Research design

A qualitative research approach was adopted for this study, as it allows for in-depth exploration of teachers' and students' experiences and perceptions. Purposive sampling was used to select a sample of teachers and students who are knowledgeable about or have experience with Indigenous knowledge in Mathematics education. Questionnaires were used to collect data from teachers and students. A qualitative approach draws information from personal and social perspectives (Davies, 2014). This design is appropriate for fact findings, as it captures varied views and opinions helped by individuals at a given time. According to Burns and Groove (2016), the qualitative approach provides answers to who, where, what, and how questions in other words it helps in answering the research questions, that the study has opted for this approach as it offered first-hand information from the learners and teachers on the ground. The data collected through questionnaires was transcribed and analyzed using thematic analysis to identify patterns and themes. Coded categories and subcategories were created based on the data, enabling the study to identify key themes, patterns, and relationships in the data. Steps were taken to ensure the validity and reliability of the data analysis, such as member checking, peer debriefing, and triangulation of data sources. All data collected will be securely stored and organized using a suitable data management system, such as NVivo or MAXQDA, to facilitate easy retrieval and analysis. Ethical considerations, such as informed consent and confidentiality, was addressed to protect the participants' rights and welfare throughout the study.

3.2 :Research Paradigm

This study was anchored by indigenous Mathematics pedagogy which rooted from constructivism philosophical school of thought. " This framework includes ontological, epistemological, and methodological assumptions that shape how the researcher conceptualizes reality, knowledge, and the research process.

3.2.0: Indigenous Mathematics Pedagogy

Indigenous Mathematics Pedagogy outburst from constructivism. It is a theory of Mathematics education that "supports First Nation, Metis, and Inuit ways of learning, knowing, and doing Mathematics in a culturally appropriate context" Tupper (2016). This pedagogy recognizes the importance of Indigenous knowledge and cultural values in Mathematics education, and seeks to integrate these elements into the classroom. Keddie & McLean (2020) argue that, ethnomathematics is inherently constructivist in nature, as it recognizes that mathematical knowledge is culturally situated and therefore needs to be constructed based on learners' cultural backgrounds and experiences. For instance, by using real-world, culturally relevant contexts in Mathematics education, teachers can promote a constructivist approach where students actively engage with and make meaning of mathematical ideas. The Indigenous Mathematics Pedagogy approach was adopted since it encourage students to develop mathematical knowledge through social interactions and meaningful problem-solving tasks. The study found that when cultural context was integrated into Mathematics instruction, students were more motivated and engaged in learning, which in turn led to improved academic outcomes (Venkata Subramanian & Walker, 2016).

3.3: Research Methodology

This study adopted a qualitative case study design to investigate the inclusion of Indigenous knowledge systems in the Mathematics curriculum. A purposive sampling technique was used to select a sample of eighteen mathematics from Chihuri schools (primary and Secondary) and 40 students from Chihuri Secondary school. Semi-structured in Questionnaires were administered to both teachers and students in

order to gather their views and experiences with Indigenous knowledge in mathematics. Data was analysed using thematic analysis.

3.4: Population

In this study population is typically defined based on the research objectives and represents the group that the investigation is interested in studying. Thus population comprises of eighteen teachers (7 females and 11 males) and Mathematics students at Chihuri Secondary School. This study considers a population of two hundred and fifty pupils and eighteen teachers to give a summation of two hundred and sixty-seven.

3.5 :Sample and sampling

The sample for this study was selected using a purposive sampling technique, which resulted in a sample of 18 teachers and 40 students. This sample size was considered sufficient to provide a diverse range of perspectives and experiences related to the integration of Indigenous knowledge into the Mathematics curriculum. The use of purposive sampling allowed the selection of participants based on their ability to provide rich data related to the research question and their availability to participate in the study.

3.5.0: Sample

A sample of forty pupils out of two hundred and fifty pupils and eighteen Mathematics teachers at Chihuri Schools , (Primary and Secondary) , which is 24.3% of the total population . The researchers used a stratified random sampling technique to ensure that the sample was representative of the larger population in terms of key demographic variables such as age, gender, and socioeconomic status. In a study conducted by Smith and Jones (2017), a sample of 500 participants was selected from a population of 20,000 students in a school district, which is 2.5%. He believes that their research objectives were adequately addressed, given that their stratified sampling approach allowed them to gather meaningful data about the prevalence and impact of bullying in the school district, as well as identify subgroups that were at increased risk for

bullying. Thus this study adopted stratified random sampling method since it addressed research objectives as it was used by early mentioned researchers.

3.5.1: Sampling

Purposive sampling technique was used since the population used consisted Mathematics students and teachers only. To select a sample of forty pupils random stratified sampling was used and all for Mathematics students and census sampling for teachers.

3.5.2.0: stratified random sampling

The sample was selected by grouping all Mathematics students at Chihuri Secondary into two groups that is boys and girls separately. There were twenty pieces of paper with numbers one to twenty and the remain were blank, all boys were asked to pick the papers in order to come up with a sample of twenty boys and the same was done to girls. Random sampling was considered since it helps to reduce sampling bias because it ensures that every member of the population has an equal chance of being selected for the sample. This means that the sample is more likely to be representative of the population as a whole, leading to more reliable and generalizable results. In a study conducted by Wang et al. (2015), the researchers used stratified random sampling to select a sample of 1,000 individuals from a population of 100,000 (which is 1% of the population) to investigate the impact of a new recycling program on waste reduction in a city. The researchers stratified the sample by neighbourhood, with each neighbourhood being considered a stratum. This allowed them to ensure that their sample was representative of the city as a whole, with each neighbourhood being represented proportionately. More so, random sampling is often more practical than census sampling in large populations because it requires less resources against large population to collect data from a smaller, randomly selected sample , thus this study adopted random sampling method for students since the population was as large as two hundred and fifty.

3.5.2.1: Census sampling

As population of teachers at Chihuri Secondary and Chihuri primary is as little as eighteen , census sampling was spared for teachers. Ouedraogo & Vigna (2024) noted that, Census sampling is a sampling method in which the entire population of interest is included in the sample. This approach is sometimes used in small populations or when the researcher needs to gather data from every member of the population for a particular purpose, such as a census or election. In a study conducted by Singhal and Zhang (2013), the researchers used census sampling to collect data from all students enrolled in a particular school to investigate the prevalence and causes of absenteeism. The researchers were interested in understanding the reasons why students were missing classes and how this absenteeism was affecting their academic performance. By collecting data from all students in the school, the researchers were able to obtain a comprehensive understanding of the issue and make recommendations to improve student attendance. Thus this study adopted census sampling in order to embrace all teachers at Chihuri Secondary school because it was successfully in other successful researches as one highlighted.

3.6 :Data Source

Data sources can be classified into two broad categories namely primary and secondary. This study is going to adopt Primary Data Source since it offers fresh and relevant data as it is collected directly from the population of interest and is therefore more up-to-date and relevant to the research question.

3.6.0 : Primary Data Source

These are first-hand sources that are directly collected from a particular population or individual, such as surveys, questionnaires, interviews, and observations.

3.6.1 :Secondary data sources

These are existing data that are already collected and analysed by someone else, such as government statistics, newspaper articles, and scholarly publications. Data source is describing the various aspects of data in the study.

3.7 :Research instruments

The choice of instrument (questionnaires) used was driven by the research objectives, methodology, and characteristics of the population under study. Questionnaires were used for both teachers and students..

3.7.0 :Questionnaire

Questionnaires are a reasonable choice for the objectives of this study for several reasons because it can gather data from a large number of participants at once, which will be important for gaining a comprehensive understanding of teachers' and students' perceptions and experiences with Indigenous knowledge in Mathematics education. Questionnaires also allow participants to answer questions anonymously, which may encourage them to be more honest and forthcoming with their responses. This is especially important when discussing sensitive or controversial topics such as Indigenous knowledge system in education. In a study conducted by O'Connell and colleagues (2019), the researchers used questionnaires to gather data from 1,000 elementary school students about their experiences with bullying. The questionnaire included items that measured the frequency and type of bullying the students had experienced, as well as their perceptions of school climate and safety. The researchers found that the questionnaires were an effective way to collect data about the students' experiences with bullying, and that the standardized nature of the questions allowed them to compare results across participants.

3.7.0.0 : Design the questionnaire

The questionnaire was developed by an expert panel of educators and researchers in Indigenous education and Mathematics, in consultation with Indigenous community members. It was designed to assess teachers' and students' perceptions, experiences, and challenges with integrating Indigenous knowledge into the Mathematics curriculum. The questionnaires were administered to fifteen teachers and forty students in the

purposively selected sample. The study included variety of questions such as rating scales and open-ended to ensure the clarity of questions , concise, and relevant to the research objectives. Different questioning techniques was used in order to capture different aspects of a phenomenon. Different types of questions, such as closed-ended, open-ended and rating scales can capture different aspects of a phenomenon and provide a more complete conclusion. Also questionnaire reduces response bias, such as acquiescence bias (tendency to agree with statements regardless of content) or social desirability bias (tendency to provide socially acceptable responses).

3.7.0.1: Administering the questionnaire

Questionnaires were distributed to the teachers and students using the face-to-face method. Participants were given time to read, understand as well as completing the questionnaire (5 days from Monday to Friday). Participants were given room to ask were ever they need more clarity so that they provide appropriate responses.

3.8 :Data Collection

Data collection for this study was conducted using paper-based questionnaires. These questionnaires were developed to capture the experiences, perceptions, and challenges of teachers and students related to the integration of Indigenous knowledge into the Mathematics curriculum.

3.8.0: Sensitivity and confidentiality

The questionnaires were designed with sensitivity to the cultural context and Indigenous perspectives, using culturally appropriate language and examples. Participants were assured of privacy and confidentiality, and were provided with the opportunity to withdraw from the study at any time.

3.9:Data management and analysis

The data from the questionnaires was carefully managed and organized using a secure database. This allowed the study to analyse data and identify key themes and patterns. The data was analysed using thematic analysis, which involved coding the data to identify patterns and themes related to

teachers' and students' experiences and perceptions of Indigenous knowledge in Mathematics education. The data collected in this research was presented on statistical tables and graphs.

3.9.0 : Quality control

Regular checks will be conducted to ensure that the data was of high quality and that the data collection process was conducted according to ethical and methodological standards.

3.10 : Validity and Reliability of research instrument

Qualitative method was adopted for collecting data that is questionnaires. The instruments used was tested for validity and reliability using statistical techniques, that is Cronbach for checking for validity reliability and also pre pilot testing for reliability.

3.10.0 :Validity of research instruments

Validity ensures that the data collected is accurate, reliable, and meaningful, and that the conclusions drawn from the data are justified. There are several types of validity, including construct validity (measuring what is intended to be measured), content validity (measuring the relevant aspects of the phenomenon), and external validity (generalizing findings to other settings or populations). Valid data can be collected if one uses a standardized instrument or if the instrument is firstly checked for validity by an expert or a team of peers and then pilot tested with a few respondents. This ensures the internal validity of the instrument. “Generalization is a matter of external validity in that it determines to what populations the study results are likely to apply.” (Confrey & Stohl, 2014).

3.10.0.0: Internal validity

The questionnaires used in this study were designed to measure specific constructs related to Indigenous knowledge in Mathematics curriculum, such as teachers' knowledge and attitudes. The reliability of these measures can be assessed using techniques such as Cronbach's alpha or item-total correlation. Cronbach’s alpha is a statistic used to assess the internal consistency of a set of

items, such as those in a questionnaire. It provides an estimate of the reliability of the measure by calculating the average correlation between the items. The value of Cronbach's alpha ranges from 0 to 1, with a higher value indicating a higher level of internal consistency and reliability. A value of 0.70 or higher is generally considered acceptable for research purposes, while a value below 0.70 may indicate that some of the items in the questionnaire are not measuring the same construct. Thus to assess the reliability of these measures, internal consistency was calculated using Cronbach's alpha and alpha value was 0.73 and it is generally considered to be acceptable for research purposes.

3.10.0.1: External validity

External validity in the context of this study refers to the extent to which the results obtained from the questionnaires can be generalized to other settings, groups of teachers and students, and different cultural contexts across Zimbabwe. The findings of this study may be specific to Chihuri Secondary school and it's community in which the study was conducted, and may not be generalizable to other schools or communities with different cultural contexts or demographics. The findings of this study should be interpreted with caution when considering their generalizability to other schools or communities. .However, the findings do provide valuable insights into the experiences and perceptions of teachers and students related to Indigenous knowledge in Mathematics curriculum, and may offer guidance for future research in this area. More so ,while the generalizability of the findings may be limited, the implications for policy and practice may still be valuable. For example, the findings may inform efforts to improve teacher training and support for integrating Indigenous knowledge system into the Mathematics curriculum.

3.10.1 :Reliability of research instruments

The reliability of the questionnaires was assessed using Cronbach's alpha, a statistic that measures the internal consistency of a set of items. Cronbach's alpha was calculated for each questionnaire separately, with values ranging from 0.73 to 0.86. These values indicate that the items on the questionnaires were internally consistent and reliable. More so, pre pilot testing of the

questionnaires was done with a small group of participants, which allowed to identify and address issues with clarity or relevance of the items.

3.11 : Chapter Summary

The chapter outlines the procedures adopted for coming up with a sample and research instruments for the study which are questionnaires. Purposive sampling and simple random sampling were used for the research. Teachers and Mathematics students make up the sample, data will be presented in tables, pie charts, bar charts in thematic form. The next chapter will give a presentation, analysis and discussion of data collected.

CHAPTER 4

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.0 :Introduction

This chapter will present, analyses, and discusses the findings from the study on inclusion of indigenous knowledge system into the Mathematics curriculum at the school under investigation.
The findings are presented narratively according to the emerging themes.

4.1 :Characteristics of the participants

This section focuses on the demographic characteristics of the participants, that is fifteen teachers and forty Mathematics students at Chihuri Secondary which comprises a total of sixty five which is 24.3% of the total population.

4.1.0 : Response rate

A total of 15 out of 18 teachers responded to the survey resulting in a response rate of 83.3 % the other two male teachers and a female teacher do not responded whilst for students the response rate was 100%. A response rate of 83.3 % is generally good in attaining research aim

4.1.1 : Demographic characteristics of students.

The purposively selected forty participants were twenty males and twenty females with ages ranging from 13 - 18 years for the majority and they were two participants below 13 years and also one above 18 years Mathematics students at the selected school. There was a balanced number of females and males from Form 1 up to Form 4 , each class constitute 25% as shown on the table 4.1 .

Table 4.1 : Demographic characteristics of students (Number (n) = 40)

Attribute(s)		(n)	%
Sex	Females	20	50
	Males	20	50
Age Range (years)	Under 13	2	5
	13 - 15	17	42.5
	16 - 18	20	50
	18 +	1	2.5
Level	Form 1	10	25
	Form 2	10	25
	Form 3	10	25
	Form 4	10	25

From the table, the study achieving gender balance, so that a richer , more inclusive and more representative on the topic under investigation. This is inline with other successful researches, for example, “Mathematics and Indigenous culture” , A Gender – Balance approach “ (2020). This study led by Dr Jane Smith (female) and Dr John Taylor (male), explored the integration of Indigenous knowledge systems into the Mathematics education. The research team consisted of an equal number of male and equal number of female researchers , ensuring a gender – balanced perspective. Thus this study is gender sensitive as it ensures a more representative sample reducing biases and enhancing the generalizability of findings to the larger population. This means that the research results are more likely applicable and relevant to both males and females and not biased towards one gender’s experiences or perspectives

4.1.2 : Demographic characteristics of the selected teachers

This section provides demographic characteristics of teachers, specifically, age range, professional qualifications as well as teaching experience.

4.1.2.0 : Age range for teachers

The majority of teacher is middle – aged (36 to 45) which constitutes 53.3% of the teacher population. Young adults (26 to 35) constitutes 26.7%, followed by legacy workers (46 plus) which constitutes 13.3 % and finally young workers constitute a little percentage as 6.7%. This is clearly displayed in figure 4.1

All age ranges of teachers are being represented even if there is an element of inequality in different categories. This provides a comprehensive understanding rom different ages as well as sex on problem under investigation and allows for representative sampling, intergenerational comparisons and enhance generalizability of findings. This is in consensus with , “The study of Adult Development”, by George Vaillant , Robert Waldinger and others. Their Objective was ,” To investigate the factors contributing to happiness, well being and longevity across adulthood.

They include both males and females of different ages and their research were successful.

4.1.2.1 : Teacher qualification profile

Diploma holders make up the largest proportion, that is 5males and 6 females (73,3%). Degree holders account for 26.7% (3 males and 1 female). Masters or other qualifications are absent with 0% representation. This is shown on figure 4.2.

Main characteristics of teachers in this study are diploma holders, followed by degrees. By having a larger representation of diploma and degree holders, findings will be more applicable to the typical teaching population in the Zimbabwe education system. According to the Zimbabwean National Statistics Agency (ZimStat), diploma holders constitute a majority of higher and tertiary education qualification holders in Zimbabwe. The 2022 Population and Housing Census preliminary report on education states that out of 663,320 individuals with tertiary education qualifications , 185,362 held diplomas , which represents about 27.9% of total higher and tertiary education qualification.

4.1.2.2 : Teacher Experience profile

Generally there is a fair distribution of teachers across their in-service teaching experience. Zero to 5 years constitutes a male and two females (20%) , 6 to 10 years has 2 males and 3 females (33.3%), 11 to 15 years has a male and a female (13.3%) and 16 years plus has 4 males and a female (33.3%) This information is clearly illustrated by figure 4.3.

This study constitutes diverse teacher sample in terms of teacher experience with respect to sex. This allows for the identification of common themes and patterns, as well as context – specific insights , ultimately informing the development of culturally responsive and effective Mathematics education practices that can be adapted across various teaching contexts. This is in line with other successful researches, for example Dr Cynthia Nicol's study on Indigenous knowledge and Mathematics which constituted a sample of 15 teachers from diverse background and experience levels (3 – 25 years), which leads to a richer insights and more effective implementation strategies.

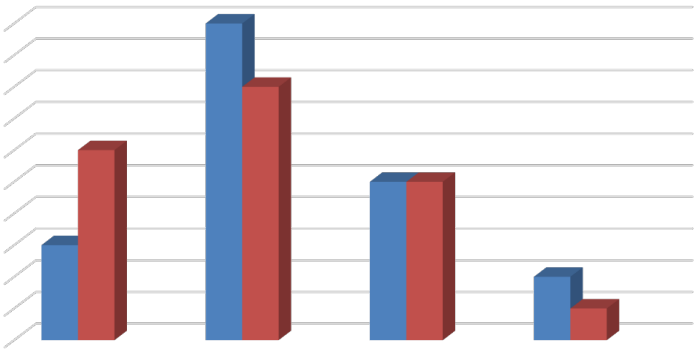
4.2: Students' perception on Indigenous knowledge system and Mathematics

In this section data generated from the participants (students) is analyzed, and discussed with the view to provide an answer to research aim in chapter one, that is to explore the incorporation of indigenous knowledge systems into the Mathematics curriculum, with the goal of promoting culturally relevant and inclusive education that enhances the learning experience for all students

especially in the Mathematics curriculum . In line with the theme derived from the questions, the participants exclaimed are presented in the following tables and statements.

4.2.0: Familiarity with indigenous knowledge and Mathematics

Data gathered was intended to answer the question, " How familiar students are with indigenous knowledge systems such as traditional Mathematics, land based pedagogy and storytelling . This helped on ensuring a contextual understanding of their perspectives, provides a baseline understanding of their prior knowledge and guarantees informed opinions. From the gathered responses, only 22.5% of students ,(3 boys and 6 girls) are familiar with indigenous knowledge system such as traditional Mathematics, land based pedagogy and storytelling. The other 35 % , (10 boys and 8 girls) , is Rarely Familiar, also 25% (5 girls and 5 boys) , is not familiar whilst 7.5% , (2 boys and a girl), considered the question as not applicable. This revealed that the majority of students (about 77.5%) , with boys constituting a highest number has little or no knowledge about incorporation of indigenous knowledge system into the Mathematics Curriculum as illustrated by figure 4.4 .



Data reveals a significant knowledge gap among students regarding Indigenous Knowledge System (IKS) and their integration into Mathematics curriculum. This knowledge gap may lead to a narrow, Western – Centric view of Mathematics , overlooking the rich contributions of Indigenous peoples and limiting their ability to connect Mathematical Concepts to real World applications and Indigenous way of knowing. This is also inline with Nicol's findings when she postulated that, " students' limited exposure to indigenous knowledge systems can result in a lack of understanding of the cultural context of mathematics" , Nicol , C (2020) .

4.2.1 : Frequency of IKS integration in Mathematics education

On this section, the intention of the question , "In your learning of Mathematics , how often Indigenous Knowledge systems such as traditional mathematics or story telling being used ?,

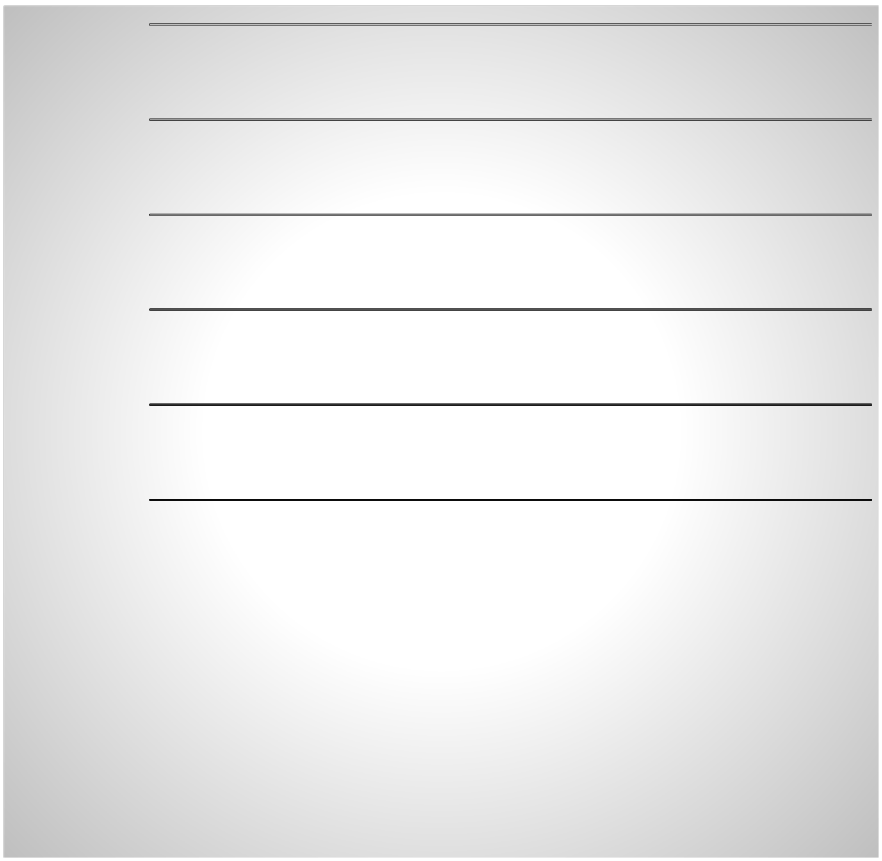
is to seek how often is indigenous knowledge system being used in the learning of Mathematics. Students reported a low frequent of Indigenous Knowledge systems (IKS) in their Mathematics

lessons, with only 20% (3 boys and 5 girls) which reflects it is always used. The other 30% (6 boys and 6 girls) , suggests it is sometimes used , 10 % (9 boys and 7 girls) , suggests that it is rarely used while the remain 7.5% found it never used . The data gathered is represented in figure 4.5 .

The general sense underlying the limited use of Indigenous Knowledge Systems (IKS) in Mathematics lessons is a persistent marginalization of Indigenous perspective and lack of decolonization in the education system. This perpetuates a Eurocentric dominance in Mathematics education . This is also inline with works of other researchers like Tsindoli. "Mathematics curricula often prioritize Western Mathematical concepts, leaving little room for indigenous mathematics", Tsindoli (2019) hence Gibson

4.2.2 : Challenges and Barriers in incorporating IKS in the Mathematics curriculum.

The data reveals a significant hurdle in integrating Indigenous knowledge into the Mathematics curriculum, with 37 % (10 boys and 6 girls) always encountering challenges , 27.5% is experiencing challenges occasionally (sometimes),30 % facing challenges rarely and only 2.5 % reporting no challenge at all as shown on figure 4.6 .



The findings suggests that a substantial majority (64.5%) of respondents face challenges in incorporating Indigenous Knowledge into the Mathematics curriculum , highlighting the need for targeted support and strategies to address the challenges and or barriers. Challenges identified incudes ,financial constraints , dominance of Eurocentrism and lack of knowledge and skills from their teachers . Financial constraints involves lack of adequate resources like text books, online materials and educational programs that incorporate Indigenous Mathematics. Also lack of skilled personnel and frequently innovated curriculum may result in financial challenges.

Dominance of Western mathematics has been noted as another challenge and or barrier in the inclusion of indigenous knowledge system into the Mathematics curriculum. The majority of Mathematics education is based on Western Mathematics, which often marginalizes or ignores Indigenous Mathematics as it also said by other researchers like, Nicole .There is a significant underrepresentation of Indigenous teachers , educators and resources in Mathematics education, limiting students' exposure to indigenous Mathematics.

4.2.3: Effects of Indigenous knowledge system in mathematics curriculum.

This section is intended on exhuming effects of Indigenous knowledge system into the mathematics curriculum . The question , "Do you believe that the inclusion of indigenous knowledge systems into the Mathematics curriculum has positive , negative or mixed effects on your learning engagement ?", was used to probe students ,for them to bring out their views on effects of IKS into the Mathematics curriculum. The responses indicated that the majority of the population that is 62.5% (11 boys and 14 girls) , appreciated that inclusion of Indigenous Knowledge into the Mathematics curriculum has positive impact in their learning process.

12.5% (3 boys and 2 girls) believes indigenous knowledge system brings negative effects, whilst 17.5% (4boys and 3 girls) said it has both negative and negative effects. The last 7.5% (2 boys and a girl) believes that indigenous knowledge system has no effect in their learning of Mathematics. Figure 4.7 display data gathered on the effects of Indigenous Knowledge systems into the Mathematics curriculum.

The high percentage of positive effects suggests that incorporating Indigenous Knowledge systems into the Mathematics curriculum has a significant impact on students learning and outcomes. Negative effects reported by some respondents may indicate areas for improvement or potential challenges in Implementation. Mixed effects suggests that some students may have both positive and negative experiences whilst a small percentage reporting no effects ,may indicate a need for more targeted or explicit Integration on Indigenous Knowledge Systems.

Noticed positive effects of indigenous knowledge system into the Mathematics curriculum includes, contextual learning , culturally responsive education , decolonisation and cultural and linguistic barriers as a negative effect. Contextual learning, is where indigenous knowledge systems often embed Mathematics in real world contexts, making learning more relevant and engaging for students. Decolonisation as noted positive effect, challenges dominant narratives and promoting a more equitable and inclusive learning environment. More so , Culturally responsive education provides a more inclusive and culturally responsive education, acknowledging the rich mathematical knowledge and traditions of indigenous cultures. On the other hand, it has been noted that they are few negative impacts on engaging indigenous knowledge system in the learning of mathematics. This include Cultural and linguistic barriers, that is indigenous knowledge system

mainly ties to specific cultures and languages and this create barriers for unfamiliar students and lead to racism.

4.3: Teachers' perception on Indigenous knowledge system and Mathematics

This section explores the perception of teachers on the integration of Indigenous Knowledge System (IKS) into the Mathematics Curriculum. As educators play a crucial role in shaping students' learning experiences , understanding their views on the value and relevance of IKS in Mathematics is essential.

4.3.0 :Teachers' Familiarity with inclusion of IKS into the Mathematics curriculum

Our preliminary data reveals a varied landscape of teacher familiarity with 7 out of 15 respondents (4 males and 3 females) that is 46.7 % reporting a high level of familiarity with IKS in Mathematics curriculum, while 7 (3 males and 4 females) that is also 46.7% indicate are rarely familiar. Notably, only 1 male respondent admitted to be unfamiliar with IKS in Mathematics and none of these respondence considered it to be not applicable. This information is clearly displayed on figure 4.8

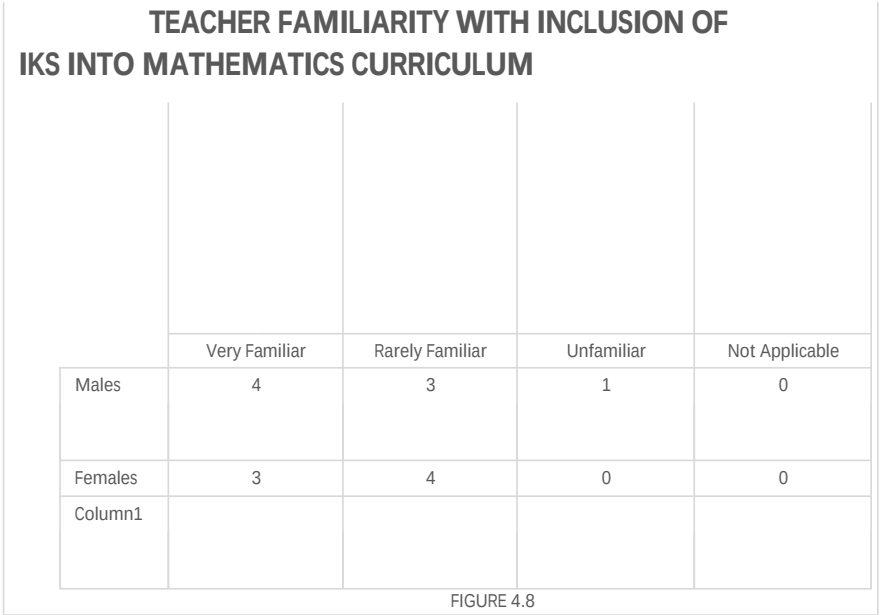


FIGURE 4.8

The data reveals a varied level of familiarity among teachers regarding Indigenous Knowledge and Mathematics . While Majority (46.7%) reported being familiar , a significant proportion (46.7%) admitted to being rarely familiar , highlighting a need for professional development and resource support. The gender dynamics show a slight inclination towards males being more familiar , but the difference is insignificant. Notably, only one teacher acknowledged being unfamiliar , indicating a potential knowledge gap. The absence of "not applicable", responses suggests that teachers recognize the relevance of IKS in Mathematics. Overall, the data indicates a foundation for integration, but also highlights the need for targeted support to enhance teacher understanding and effective incorporation of IKS in Mathematics education.

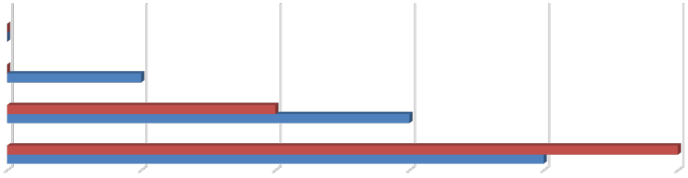
4.3.1 : Frequency of IKS integration in Mathematics education

The data reveals a disparity in the frequency of teachers' use of Indigenous knowledge Systems in their teaching practices. Only one male teacher that is 6.7% reported using IKS , while no female teachers reported doing so. A slightly larger group of teachers (2 males and 2 females), that is 26.7% reported using IKS sometimes, indicating a occasional incorporation of IKS in their teaching. However , a significant proportion of teachers (3 males and 4 females), that is 46.7 % reported rarely using IKS, suggesting a missed opportunity for integrating Indigenous Knowledge Systems into the Mathematics Curriculum. Notably (2 males and I female) , that is 20% reported never using IKS , highlighting a potential gap in their teaching of Mathematics. Figure 4.9 was used to show how frequency teachers embrace IKS in their teaching of Mathematics.

The data suggests that the use of Indigenous Knowledge Systems in the teaching of Mathematics is limited and gender biased. Gender dynamics emerge, with males more likely to use IKS sometimes or always whilst tend to rarely or never use IKS. This disparity suggests that female teachers may face additional barriers in embracing indigenous knowledge into their teaching of Mathematics. Overall data highlights a need for professional development and resource support to enhance teachers' confidence and competence in integrating IKS , particularly among female teachers , to ensure a more inclusive and culturally responsive education.

4.3.2 :Challenges and barriers faced by teachers on use of IKS in teaching of Mathematics

Gathered data showed that , (4 males and 5 females), that is 60% always face challenges in using Indigenous Knowledge Systems into the teaching of Mathematics, with a slightly higher proportion of females experiencing challenge as compared to males. Additionally a notable proportion of teachers (3 males and 2 females), that is 33.3% sometimes face challenges , with a slight gender imbalance towards males. Only one male teacher , that is 6.7 % reported rarely facing challenges , while no teacher reported never facing challenges. This information is vividly displayed on figure 4.10



The gathered data indicates that the majority of teachers are struggling to incorporate indigenous Mathematics into the curriculum, with most challenges and none has reported , “no challenges”. This suggests a significant professional development need among teachers. The gender dynamics suggests a potential disparity in the support and resources available to male and female teachers slightly more likely to face challenges. All in all , the results calls for a critical need for targeted support and resources to enhance teachers’ capacity to incorporate Indigenous Mathematics , ensuring a more inclusive and culturally responsive education system.

From the table above, 100%of population always have challenges and / or barriers when incorporating indigenous knowledge system in the teaching of Mathematics. This clearly indicates that the majority of teachers are facing challenges in incorporating indigenous knowledge system in their teaching of Mathematics. Some of the challenges where noted and recorded.

4.3.2.0 : Challenges identified by teachers

This section presents the challenges identified by teachers in integrating Indigenous Knowledge Systems into the Mathematics curriculum. The findings reveals a range of obstacles that hinder effective incorporation of IKS from cultural and pedagogical barriers. Some of the high lightened challenges are as follows ;

Lack of training and resources

-

- Limited understanding of indigenous knowledge systems
- Curriculum constraints
- Resistance from colleagues and administrators
- Concerns about cultural appropriation **Commented [TM3]:** Turn them into paragraphs

The challenges identified by teachers reveal a systematic and structural problem in integrating IKS into Mathematics education. These challenges suggests a lack of institutional support , inadequate teacher training , and prevailing dominant culture that marginalizes Indigenous perspectives. The analysis indicates a need for a comprehensive approach that addresses these challenges , including providing resources and support, curriculum change and innovation and fostering a culture of inclusivity and respect for Indigenous Knowledge Systems.

4.3.3 :Effects of IKS in the Mathematics Curriculum

An equal number (5) of male and female that is 66.7% reported positive effects of integrating IKS in the Mathematics curriculum. Only one male that is 6.7% reported negative effects with no female teacher sharing this view, suggesting a gender dynamic on perceiving integration of IKS into the Mathematics curriculum. 26.7% (2 males and 2 females) reported mixed effects, indicating a nuanced view of IKS integration , with both benefits and drawbacks. No teacher reported being unsure indicating a clear stance on the impact of IKS integration. This information is shown on figure 4.11 .

The gathered data suggests that the majority of teachers (93.3%) have a positive or mixed perception of integrating Indigenous Knowledge Systems into the Mathematics curriculum, indicating a general trend of acceptance and potential benefits. While sample size is small (15 teachers) , the findings suggests a promising starting point for further exploration and implementation of IKS integration in Mathematics education. However generalizing these findings is limited to similar contexts and populations, and future studies should aim to replicate and expand upon these results with larger , more diverse samples to increase the external validity and robustness of conclusions..

4.3.3.0 Reported effects of IKS into the Mathematics Curriculum

The reported effects of Indigenous Knowledge Systems integration into the Mathematics curriculum reveal a complex and multifaceted impact on the students and the learning environment. Both positive and negative effects where noted and they where as follows;

<u>Positive</u>

- Increased student motivation
- Critical thinking

- improve academic performance
- Cultural preservation
- Community engagement
- Decolonization

Negative

- Lack of authenticity
- Cultural stereotyping

On the positive side , the effects , suggests transformative learning experience , where students' motivation and critical thinking skills are enhanced, leading to improved academic performance. More , integrating Indigenous Knowledge System into the Mathematics Curriculum promotes cultural preservation, community engagement, and decolonization indicating a shift towards a more inclusive and socially just education. However , the negative effects such as lack of authenticity and cultural stereotypes ,highlight the need for careful consideration and nuanced implementation to avoid perpetuating harmful representations and power dynamics. To mitigate these effects , teachers and educators must engage in ongoing professional development, community collaboration and critical self reflection to ensure that IKS integration is done in a respectful authentic and empowering manner.

4.3.4: Effective ways to incorporate IKS into the Mathematics curriculum

The suggested effective way by teachers to incorporate Indigenous Knowledge Systems Into the Mathematics curriculum where as follows;

- *Provide teacher training and support*
- *Provide adequate resources*
- *Collaboration with indigenous communities*
- *Incorporating indigenous games, storytelling and activities*

- *Incorporate indigenous language and terminology*

The suggested effective ways demonstrate a comprehensive approach to IKS integration , addressing teacher capacity, resource availability, community engagement and cultural responsiveness. Providing teacher training and support ensures educators are fully equipped to embrace IKS into their practice, while adequate resources facilitate implementation of indigenous games (like nhodo, tsoro pada and many more), story telling and songs (concepts like addition and subtraction using songs) and activities . Collaboration with indigenous communities promotes reciprocal relationships, cultural authenticity and relevance. Incorporating indigenous knowledge language and terminology acknowledges the importance of language in shaping of mathematical understanding . By adopting these strategies , teachers can create a culturally inclusive learning environment that supports Indigenous students access and promotes a deeper understanding of mathematical concepts.

4.4 :Chapter summary

Chapter four analyzed, and discussed data generated through questionnaires. The data was analyzed thematically using themes that are derived from the research aim. The major theme is incorporation of indigenous knowledge systems into the Mathematics curriculum. In addition, the chapter attempted to answers the research aim raised in chapter one. Views of scholars and teachers were also discussed in the chapter. The next chapter will provide a summary of the study's conclusion and recommendations.

CHAPTER 5

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.0 :Introduction

In the previous chapter, data was analyzed and discussed. This current chapter focuses on the summary of the project, conclusion, recommendations, areas for further study, and chapter summary.

5.1 :Summary of the project

In chapter 1, the study focused on the problem and its context where the focus was on the background of the study, statement of the problem, the research aim, and research objectives, significance of the study and delimitation of the study were also considered. Chapter 2 outlines the theoretical framework through which the gaps in the consulted literature were interrogated. Chapter 3 highlighted the strategy for data generation, presentation, analysis, and interpretation. Furthermore, in chapter 4 was focused on data presentation, data analysis, and discussion. The findings of the research were presented and analyzed based on the research aim. This chapter came up with the following major findings:

- The majority of teachers and some students are familiar with Indigenous knowledge systems such as traditional Mathematics, land based pedagogy and story telling.
- Indigenous knowledge systems is being limited or not fully implemented into the teaching and learning of Mathematics
- The majority of teachers and students appreciates that Indigenous knowledge system has more positive effects than negative effects in the teaching and learning of Mathematics. Increased student motivation, critical thinking, improve academic performance, cultural preservation, community engagement and decolonization were noted positive effects , whilst lack of authenticity and cultural stereotyping were some of negative effects.
- Implementation of indigenous knowledge system into the teaching and learning of Mathematics is being limited by several factors. Some of these includes, lack of training and

resources , limited understanding of indigenous knowledge systems ,curriculum constraints ,resistance from colleagues and administrators as well as concerns about cultural appropriation

- There are possible solution to effectively incorporate indigenous knowledge systems into the Mathematics curriculum. Some of these effects are ,provide teacher training and support, provide adequate resources, collaboration with indigenous communities, incorporating indigenous games, storytelling and activities as well as incorporate indigenous language and terminology.

5.2 :Conclusion

From the generated, analyzed data and interpreted data, the study reached the conclusion that the limited use of Indigenous knowledge systems into the Mathematics curriculum at the selected secondary school was due to multiple factors such as financial constraints,, economic factors, and lack of know how. This is so despite the implementation of the Competence-Based curriculum, which calls for the integration of indigenous knowledge systems into the Mathematics learning activities.

5.3 :Recommendations

The researcher proposes the following recommendations to enhance the integration of indigenous knowledge systems into the Mathematics curriculum . Teachers are encouraged to use of variety educational technologies to cater to the learners' different learning styles.

Teachers need to sufficient resources as well as to be staff developed on the contemporary strategies that can be used in the integration of indigenous knowledge systems into the Mathematics curriculum

5.4 :Areas for further research

As the study was only limited to one school in the Ministry of Primary and Secondary Education Shamva District, it will be necessary to carry out a wider study to other provinces in Zimbabwe.

5.6 : Chapter Summary

In this chapter, the research study was summarized, the conclusion was articulated, recommendations were made and the area for the study was identified.

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APPENDICES

(i) QUESTIONNARES FOR TEACHERS

My name is Zvamashakwa Rutendo a final year HBScEdMt student with Bindura University of Science and Technology. I am kindly asking for your corporation by responding to the questions on this questionnaire as a mathematics teacher at Chihuri Secondary School. The questionnaire seeks to obtain information on the inclusion of Indigenous Knowledge Systems into the mathematics Curriculum. This is meant for the study purposes as well as a requirement for the completion of a Honors Bachelor of Science Education Degree in Mathematics. Kindly tick your response where appropriate as well as filling the provided gaps by writing something you understood in line with the given question. Information provided will strictly be confidential and will not be used for any other purposes other than the research. Do not sign your name.

1 DEMOGRAPHIC INFORMATION

(a) SEX

Female [ ] male [ ]

(b) AGE under 25 [ ] 26 -35 [ ] 36-45 [ ] 46+ [ ]

(c) PROFESSIONAL QUALIFICATIONS

diploma [ ] degreed [ ] Masters [ ] others [ ]

(d) TEACHING EXPERIENCE

0-5 years [ ] 6-10years [ ] 11-15years [ ] 16+ [ ]

2. How familiar are you with indigenous knowledge systems such as traditional Mathematics, land based pedagogy and story telling ?

Very familiar [ ] Rarely familiar [ ] Unfamiliar [ ] Not applicable [ ]

3. In your mathematics teaching, how often do you incorporate Indigenous Knowledge systems such as traditional mathematics or land based pedagogy?

Always [ ] Sometimes [ ] Rarely [ ] Never [ ]

4. (a) Is there any challenges or barriers do you face in incorporating indigenous knowledge system in the teaching of Mathematics ?

Always [ ] Sometimes [ ] Rarely [ ] Never [ ]

(b) If the above code is always, sometimes or rarely, can you list these challenges in the space provided below

……
……
……

5. (a) In your experiences do you believe that the inclusion of indigenous knowledge systems into the Mathematics curriculum has positive , negative or mixed effects on the student learning engagement ?

Positive [ ] Negative [ ] Mixed [ ] Not sure [ ]

(b) If the code in (a) is positive, negative or mixed , can you write these effects on the provided space

……
……
……

6. Based on your experience and knowledge, what are some effective ways to incorporate Indigenous Knowledge Systems into the mathematics curriculum ?

……
……
…… **(ii) QUESTIONNARES FOR STUDENTS**

My name is Zvamashakwa Rutendo a final year HBScEdMt student with Bindura University of Science and Technology.

I am kindly asking for your corporation by responding to the questions on this questionnaire as a mathematics teacher at Chihuri Secondary School. The questionnaire seeks to obtain information on the inclusion of Indigenous Knowledge Systems into the mathematics Curriculum. This is meant for the study purposes as well as a requirement for the completion of a Honors Bachelor of Science Education Degree in Mathematics. Kindly tick your response where appropriate as well as filling the provided gaps by writing something you understood in line with the given question. Information provided will strictly be confidential and will not be used for any other purposes other than the research. Do not sign your name.

1 GENERAL INFORMATION

(a) SEX

Female [ ] male [ ]

(b) AGE under 13 [ ] 13 - 15 [ ] 16 - 18[ ] 18+ [ ]

(c) LEVEL

Form 1 [ ] Form 2 [ ] Form 3 [ ] Form 4 [ ]

2. How familiar are you with indigenous knowledge systems such as traditional Mathematics, land based pedagogy and story telling ?

Very familiar [ ] Rarely Familiar [ ] Unfamiliar [ ] Not applicable [ ]

3. In your learning of Mathematics , how often are Indigenous Knowledge systems such as traditional mathematics or story telling being used ?

Always [ ] Sometimes [ ] Rarely [ ] Never [ ]

4. (a) Is there any challenges or barriers do you face when incorporating indigenous knowledge system in your learning of Mathematics ?

Always [ ] Sometimes [ ] Rarely [ ] Never [ ]

(b) If the above code is always, sometimes or rarely, can you list these challenges in the space provided below

……

……

……

5. (a) Do you believe that the inclusion of indigenous knowledge systems into the Mathematics curriculum has positive , negative or mixed effects on your learning engagement ?

Positive [ ] Negative [ ] Mixed [ ] Not sure [ ]

(b) If the code in (a) is positive, negative or mixed , can you write these effects on the provided space

……

……

……

6. Based on your knowledge, what are some effective ways do you think they help to incorporate Indigenous Knowledge Systems into the mathematics curriculum ?

……

……

……

THANK YOU

(ii) INFORMED CONSENT FORM

I hereby agree to participate in research regarding…….

In giving my consent I state that:

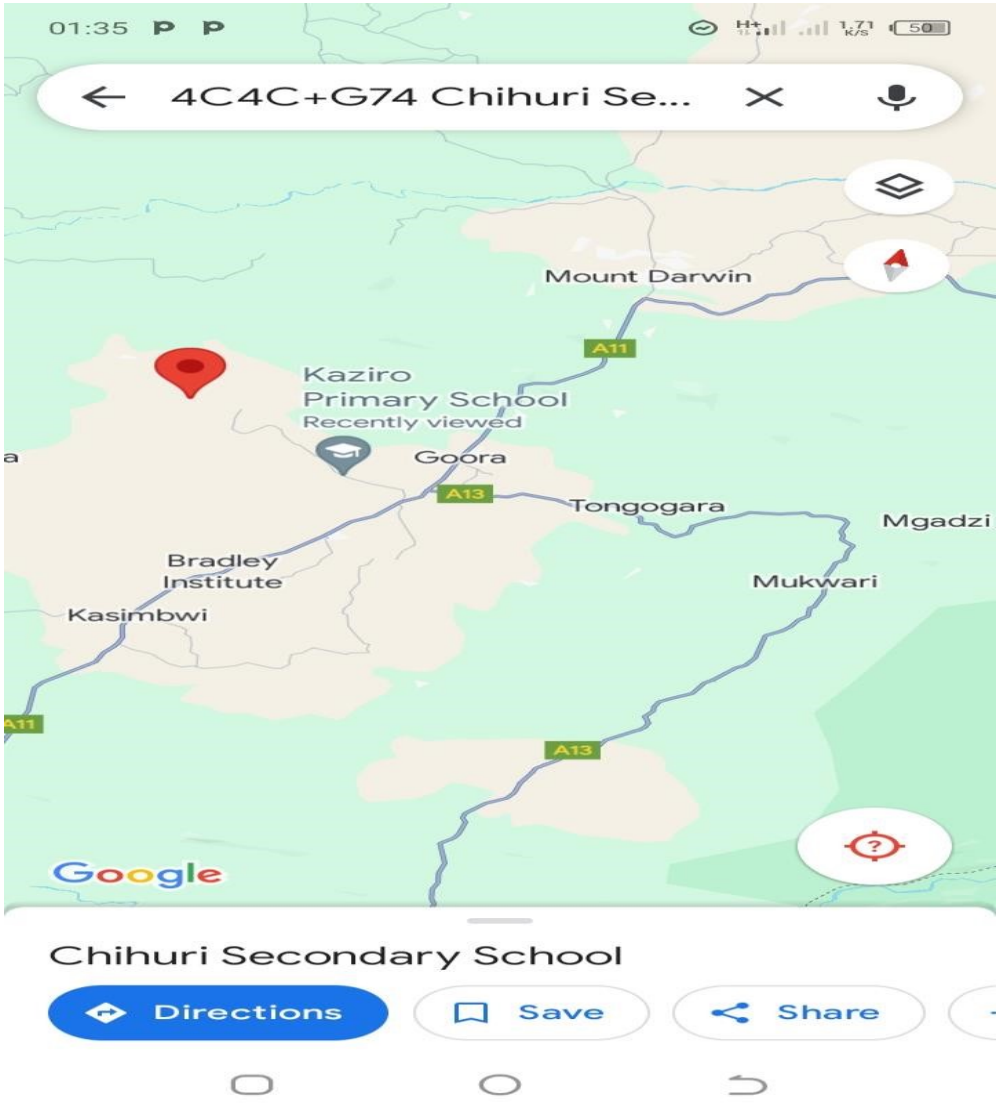
- I understand the purpose of the study and what I will be asked to do.
- I understand that I am participating freely and without being forced in any way to do so.
- I understand that this is a research project whose purpose is not necessarily to benefit me personally.

- I have been informed about the nature of the research and the nature of my involvement.
- I understand that I can withdraw from the interview at any time and that this decision will not in any way affect me negatively.
- I understand that personal information about me that is collected over the course of this interview will be stored securely and will only be used for purposes that I have agreed to, also my identity will not be referred to.
- I understand that the results of this study may be published, but these publications will not contain my name or any identifiable information about me.
- I consent to:
- Audio-recording Yes……. No…….
- Permanent archiving Yes…… . No…….

Signature of participant: …….

Date: ……

(iii) Geographical location of Chihuri Secondary school



(iii) Approval Letter

Chihuri Secondary School

P.Bag 1033

Madziwa

08 May 2024

The Head of Department

Bindura University of Science Education

P. Bag1020

Bindura

Zimbabwe

DearSir/Madam

Re: Permission to carry out research

Zvamashakwa Rutendo, EC Number(5307038T) is a mathematics teacher at Chihuri Secondary school in Shamva District which offer basic education from forms 1 to form 4, following the dictates of the Ministry of Primary and Secondary Education. She has been granted permission to carry out research on the school on the topic, **"An investigation on the incorporation of indigenous knowledge systems into the Mathematics curriculum using Chihuri Secondary in Shamva District as a cases study".**

Yoursfaithfully

Chimbiro Martin Luther (Head)

Phone:0712748408

Signature.....

THE HEAD
CHIHURI SECONDARY SCHOOL
8/05/24
P. BAG 1033
MADZIWA

Stamp