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EXPLORING TRADITIONAL ZIMBABWEAN GAMES FOR TEACHING MATHEMATICAL CONCEPTS AT PRIMARY SCHOOL LEVEL.

By

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ABSTRACT

This study explores the use of traditional Zimbabwean games as a pedagogical strategy for enhancing the teaching and learning of mathematical concepts at the primary school level. The research is grounded in the recognition that indigenous knowledge systems contain rich mathematical ideas that are often overlooked in formal education. Games such as *nhodo, tsoro,* and other culturally embedded activities were examined to identify mathematical concepts including counting, sequencing, pattern recognition, spatial reasoning, and problem solving. A qualitative research design, situated within the constructivist-interpretive paradigm, was employed. Data were collected through semi-structured interviews with ten teachers who were purposively selected. The findings reveal that traditional games provide an effective and culturally relevant means of supporting conceptual understanding in mathematics while simultaneously fostering learner engagement, collaboration, and confidence. The study demonstrated that traditional games such as *Tsoro*, *Pada*, *Nhodo*, and *Fishi-fishi* hold significant potential as culturally relevant tools for enhancing mathematics teaching and learning. Furthermore, the integration of such games bridges the gap between learners' everyday cultural practices and the formal school curriculum, thereby situating mathematical learning within familiar and meaningful contexts.

Key words: Traditional games, Mathematics education, Indigenous knowledge, Zimbabwe, Primary education.

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CHAPTER 1: INTRODUCTION

Chapter 1

1.1 Introduction

Zimbabwe is home to a rich heritage of traditional games that not only serve entertainment purposes but also embody cultural significance and pedagogical potential. With the increasing emphasis on interactive and engaging methods of teaching in primary education, integrating these games into the mathematics curriculum can be a powerful approach to enhance students' mathematical understanding and reasoning skills. In the quest for effective ways to teach mathematical concepts to primary school students, teachers are increasingly turning to traditional games as a valuable resource. Traditional games in Zimbabwe, such as "Hwenje," "Chimurenga," and "Ngoma," not only provide recreation but also offer opportunities for learning. These games encourage critical thinking, problem-solving, and strategic planning which are key components of mathematical learning. By exploring these games, teachers can create contexts for learners to apply and grasp mathematical concepts in a practical and enjoyable way. The use of culturally relevant materials in education has been shown to enhance learners engagement and comprehension. Traditional games encapsulate the history, values, and community practices of Zimbabwean society, making learning more relatable and enjoyable. Not only do these games bring fun into mathematical learning, but they also foster social skills, critical thinking, and problem-solving abilities among students. Thus, this study therefore, explores the use of traditional Zimbabwean games to teach mathematics, focusing on their cultural significance, mathematical principles, and practical applications in the classroom. Engaging with these games not only promotes mathematical understanding but also strengthens cultural identity among learners.

1.2 Background of the study.

Traditional games present a unique repertoire of activities performed particularly by learners and for learners. The use of games, particularly cultural games, in the teaching and learning of mathematics is the area of particular interest in schools. Zimbabwe’s traditional games are rich sources of mathematics instructional activities at primary school level. They are played in and out of school. Madusise (2022) posits that learners learn best through play and fun. Due to this fact, primary school teachers use games in their teaching of mathematics. Mathematics instruction at primary school level, according to Kamla Raj (2014) should move away from an information-transition model where the teacher is the supplier and learners are passive-recipients of mathematical knowledge and skills to the gaming model where learners can learn

through play. This is a call to shift mathematics instruction to an engaging activity where learners become active participants in the learning process.

According to Moss (2022), the cultural approach examines an organisation from a humanistic perspective by taking into account the artefacts, values, and presumptions that result from member interactions. Thus, in teaching mathematics, teachers ought to endeavour to utilize a cultural approach to help learners understand and grasp the mathematics concepts taught, since learners' performance in mathematics continues to decline (Ali et al., 2023). Mathematics teachers in Zimbabwe can use indigenous cultural practices set up as games to be a creative teaching strategy to improve the teaching of mathematics, especially in the foundation phase, in order to elevate learners' interest and motivation in the subject. Sibaya (2019), who claimed that giving lessons of mathematics from the cultural context would be a great gain, because learners would learn mathematics from within two familiar environments, namely home and school, affirms this. This is an important issue, as Zimbabwean teachers are faced with the multicultural diversity of racial and ethnic groups. Brahier (2020) indicated that good performance in mathematics could be achieved through incorporating of indigenous games in the mathematics classroom.

Sibaya (2019) claimed learners integrate their play with mathematical ideas as mathematics teacher properly disseminated mathematics skills. This means that concepts or mathematical terms presented by teachers is then integrated into play. This develop mathematical skills of learners to learn mathematical concepts as allowed for by traditional games. McKinney and Tyler (2019) argued that in many schools, the confluence between school and indigenous knowledge is rarely the object of importance in mathematics classes. The shift of indigenous knowledge obtained by the learners in their daily lives to their schoolwork is not always respected or promoted, and some teachers do not understand indigenous ways of knowing. As a result, few studies have been conducted on using traditional games to teach mathematics for better understanding of mathematical concepts (Bhuda, 2021). Simple mathematical concepts could be learned through using traditional games, making learning more interesting and culturally important. Bhuda (2021) assumed that traditional games can be used in the lessons of mathematics in schools.

The Zimbabwe's Heritage-Based Junior Mathematics syllabus (2024-2030) seeks to give learners an appreciation of Mathematics as a learning area in their education and to equip them

with Heritage-based life skills. The syllabus is based on learner-centred approaches in the teaching and learning of Junior learners. The emphasis is on adopting methods that will enable pupils to acquire competencies in the physical, social, emotional and cognitive domains using tangible and intangible heritage. It promotes self-confidence, ethics, *Unhu/Ubuntu/Vumunhu* and learners' rights and responsibilities among others. Thus the Heritage-Based Junior Mathematics syllabus for primary Schools (2024-2030) allows for the possibility of using games by asserting that for the study of relationships "games and puzzles" are to be used and concepts developed and established through practical activities.

While very, little direction is given regarding the intention of the games or even the types of games appropriate, the inclusion of games were viewed as a means to promote indigenous mathematics through cultural games played in local communities. Learners in every Zimbabwean community play cultural games. Many of these games involve significant mathematical content. As learners observe, interact with each other and physically participate in the games, they are gradually inducted into the cultural mathematical heritage. Learners learn mathematics relevant to their everyday activities. Much of this content bears direct relationship to the primary mathematics curriculum.

Most of the learners are familiar with cultural games and can learn mathematics through such games. The knowledge learners acquire while playing these games could serve as a foundation for their mathematical development. The use of games may play an important role in linking home and school. Fenske (2016) posits that the complementary use of traditional games for mathematics instruction at primary school may be ideal for teachers and students to discover remedial activities to assist them understand mathematics concepts.

According to Bollmer and Suddarth (2022) the advantages of using games in the teaching and learning of mathematics include the following:

- Meaningful situations for the application of Mathematical skills are created by games for example counting, grouping, comparing, sharing, problem solving among others.
- Positive attitude: Games provide opportunities for building self-concept and developing positive attitudes towards Mathematics, through reducing the fear of failure and error.

- Increased learning: In comparison to more formal activities, greater learning can occur through games due to the increased interaction between children, opportunities to test intuitive ideas and problem solving strategies.
- Assessment: learners' thinking often becomes apparent through the actions and decisions they make during a game, so the teacher has the opportunity to carry out diagnosis and assessment of learning in a non-threatening situation.
- Home and school: Games provide 'hands-on' interactive tasks for both school and home. That is the games can be played both at school and at home.
- Independence: learners can work independently of the teacher. The rules of the game and the learners' motivation usually keep them on task.

Charamba (2021) proposes that, interactive learning accepts that learners are not empty containers waiting to be filled with a substance called `knowledge. ` They are individuals with different personalities, intelligence and imagination. Sometimes teachers unconsciously suppress this personality, intelligence and imaginative development by not exposing learners to different situations provided by traditional games in teaching.

A study by Moloi et al. (2021) reports that a teacher who confessed that being a good teacher was not limited to being interesting and someone who could talk in a lively way for a whole lesson. Good teaching depended much on the teacher being interested in what learners have to say themselves. The interactive mode of teaching and learning is critical. In the teacher`s opinion, another way of being interactive is to be interested as well as interesting. At primary school level, learners and their teacher need to be the centre stage in their learning and teaching activity.

The view of Mosimege (2020) is that there are two extremes to educational spectrum in terms of the way teachers set about their tasks. The teacher centred approach is the one in which learners are treated like empty bottles into which facts simply have to be poured. That is what Moss (2022) calls the banking system of education. The banking system works on the assumption that good teaching consists of little more than just telling, that is simply dishing out information to learners who sit and listen in passive and stony silence. Learners are not provided with the opportunity to be active or creative, or to discover things for themselves. The other extreme is the learner-centred approach where learners are provided with the opportunity to be creative or to discover things for themselves. The teacher's role in games is just give guidance and focus learners on the mathematics in each game. Therefore, if well planned,

games are a form of entertainment and most learners enjoy playing them, more likely to generate greater understanding and retention. They are an active approach to learning, inculcate and foster good attitudes towards mathematics.

According to Odenyi (2020), traditional games are essential element of infant pedagogy in Zimbabwe. Games, in the teaching of infant mathematics was recognized by Tachie and Galawe (2021) as a vehicle for learning. Fenske (2016) argues that traditional games enable learners to demonstrate their own learning and at the same time help scaffold the learning of others. The idea supports the thrust of the heritage- based curriculum (HBC) that teachers are grappling to implement through games. Thus, the inclusion of the games in the school curriculum is purposeful and a means to promote indigenous mathematics through cultural games played in local communities. Many of these games involve significant mathematical content. As learners observe, interact with each other and physically participate in the games, they are gradually inducted into the cultural mathematical heritage. Learners learn mathematics relevant to their everyday activities. The knowledge learners acquire while playing the games could serve as a foundation for their mathematical development.

Matiure and Matiure (2014) argues that most of the learners' learning is spontaneous from the games that they voluntarily participate in every time. Thus, the games learners play include those that are handed over to them by their adults through their culture. According to Pinder (2016), games based learning consist of competition, engagement and immediate inherent personal and group rewards. Learners get into a competition that involves learners versus learners, learners versus teacher or learners trying to be the best player. Matiure and Matiure (2014) asserts that naturally learners get engaged in games to satisfy curiosity, socialization and imagination. Thus, the mathematics learning aspect such as counting, sets, sharing and approximation is gained unnoticed. Through the interactions in playing games, learners gain many experiences such as counting, strategizing, problem-solving and competing among others. Games help learners to learn cultural values and mathematical systems in a meaningful way.

Although the Zimbabwean mathematics syllabus prescribe what to teach at each level,
it does not identifies specific games nor suggests ways they could be used in the mathematics classroom. While the use of games are seen as opportunity to incorporate indigenous mathematics to increase relevance for learners, teachers rarely use traditional games for

teaching mathematics in the classroom. There is general lack of interest and knowledge among teachers on the value of traditional games for classroom instruction (Mozelius et al., 2017). Some teachers downplay the value of traditional games in favour of digital games from Western cultures. Tachie and Galawe (2021) contend that teachers today prefer digital games, which are evolving beyond the solitary context into a ubiquitous, social, and collaborative experience to traditional games. Digital games have been extremely attractive in classroom instruction as compared to traditional games (Mozelius et al., 2017).

The literature shows that there is gap between curriculum reforms and teachers' mathematics practices. For teachers to use these cultural games in their mathematics classes, they need to recognize their value and purposefully identify and incorporate cultural games that are relevant to their community and that are related to the mathematics curriculum. There is need to foster and support fruitful teaching and learning mathematics through games. Smith (2017) sees integration of traditional games in classroom instruction as enabling learners to understand important concepts and generalizations. It is against this backdrop of the existing discrepancies between curricular prescriptions and curricula realities that this study was undertaken to explore traditional Zimbabwean games for teaching mathematical concepts at primary school level.

1.3.Statement of the Research Problem

According to recent literature failure rate in mathematics in the country is related to different factors, such as teaching methods and the inability of teachers to be creative in using indigenous games in teaching mathematics (Ali and Tangkur, 2023). According to the Heritage based curriculum of Zimbabwe (2024-2030), teachers should value indigenous knowledge systems, acknowledging the rich history and heritage of this country as important contributors to nurturing the values contained in the Constitution. This means that teachers should tap into Zimbabwean’s wealthy diversity of cultures and integrate traditional games as part of the education system in teaching and learning mathematics.

Although theory emphasizes the use of games in mathematics, it has limited information on the use of Zimbabwe’s traditional games for primary school mathematics teaching and learning. Consequently, primary school mathematics teaching and learning is done through lecture rather than participatory play. This study explores traditional Zimbabwean games for teaching mathematical concepts at primary school level.

1.4 Research questions

1.4.1 What mathematics pedagogical characteristics are embedded in Zimbabwe's traditional games?

1.4.2 What are the experiences and perspectives of primary school teachers in the use of traditional games in the mathematics classroom?

1.4.3 What are the teachers' awareness and knowledge of traditional games for mathematics teaching and learning?.

1.4.4 What are the challenges of using traditional games in the mathematics classroom?

1.5 Research objectives

1.5.1 To establish mathematics pedagogical characteristics embedded in Zimbabwe's traditional game

1.5.2 To establish experiences and perspectives of primary school teachers in the use of traditional games in the mathematics classroom.

1.5.3 To establish the teachers' awareness and knowledge of traditional games for mathematics teaching and learning.

1.5.4 To establish the challenges of using traditional games in the mathematics classroom.

1.6 Significance of the study

It is anticipated that this research will benefit many role players, including teachers, and learners. The study will assist teachers to successfully use traditional games as a strategy in the teaching and learning mathematics. This may result in improved teaching and learning that may reduce the failure rate in schools, thus benefiting the learners. Incorporating of traditional games in the classroom will make teaching and learning effective. Learners will likely enjoy the lessons mainly because play is incorporated which makes concepts easy for learners to remember.

This will help teachers with their strategies and teaching methods that will enhance the achievement of learner in mathematics. This study will address elements that affects the high failure rate in the primary schools. It explores the use of traditional games in the teaching and learning of mathematics at primary school level. Few studies to date have examined teachers' instructional perspectives of using traditional games in mathematics. Consequently, this search to understand and describe Zimbabwean teachers' experiences with traditional games will

contribute to understanding the possibilities and challenges of using games in the mathematics classroom. On a smaller scale, it also examines efforts of teachers to enact a culturally relevant curriculum using traditional games. Teachers' experiences and perspectives influence decisions about using traditional games in the classroom.

The study on teachers' perspectives on the use of traditional game in mathematics is a way of capturing the current curriculum recommendations. Such insights about teaching practices regarding traditional games will enrich the understandings of classroom teachers and policy makers. The study also aims to provide knowledge about how some primary school teachers utilize traditional games in the classroom and unearths their concerns about the use of traditional games to inform policy decisions.

1.7 Limitations

The main study limitation was that the findings of this study might not be transferable nationally since the study was delimitated to particular schools. As Charamba (2021) points out, no method of data collection is absolute. This implies that it may not be possible to capture absolute views of individuals within the study. In particular, interviewing teachers is incomplete because it infers teaching mathematical formulations from teachers' accounts of what they think they do without knowing whether they actually do it (Madusise, 2022).

1.8 Delimitations

This study was carried out in primary schools in one District of Zimbabwe to explore traditional Zimbabwean games for teaching mathematical concepts at primary school level.

1.9 Definition of key terms

1.9.1 Game

Pinder (2016) describes a game as any simulated contest or play among adversaries (players) operating under constraints (rules) for an objective (winning). Fenske (2016) takes a broader perspective and suggests that games are a subset of play that binds the mind and body together and are based on the need to develop the whole person-body, intellect and emotions. Charamba (2021) offers a comprehensive definition of a mathematical game as a pedagogical activity that:

- has specific mathematical cognitive objectives,

- requires students to use mathematical knowledge to achieve content-specific goals and outcomes in order to win the game,

- is enjoyable and with potential to engage students

- is governed by a definite set of rules and has a clear underlying structure,

- involves a challenge against either a task or an opponent(s) and interactivity between opponents,

- Includes elements of knowledge, skills, strategy, and luck, and has a specific objective, process and a distinct finishing point.

1.9.2 Traditional games

Fenske (2016) asserts that traditional games broadly refer to those contests or playful activities shared by the members of the community over several generations. In
Zimbabwe, there are many cultural groups and traditional games. Some traditional games are specific to particular cultures and others cut across different cultures. Traditional games as situated activities are visibly played for pleasure but potentially involve significant
Mathematics learning. Thus, traditional games broadly refer to those contests or playful activities shared by the members of the community over several generations.

1.10 Organization of the study

This study is arranged into six chapters. Each chapter of this study was written with the focus on exploring traditional Zimbabwean games for teaching mathematical concepts at primary school level. Each chapter covers a certain aspect of the study. Below are summaries of each chapter's main points.

1.10.1 Chapter 1: Introduction and Background

The first chapter provides context by focusing on the background information about the research topic, statement of the problem, significance of study, justification of the study, Objectives of the study, research questions the study sought to answer, limitations and delimitations of study.

1.10.2 Chapter 2: Literature Review

Chapter 2 provides a review of the literature, and the work done by other researchers on traditional games as a teaching strategy to improve mathematics. The conceptual and theoretical frameworks underpinning the study are outlined.

1.10.3 Chapter 3: Research Methodology

Chapter 3 presents the methodology of the study by articulating the theoretical basis of the methodology. This chapter includes discussions of research paradigm, research design, research approach, research strategy and research methods, data analysis, data trustworthiness, reliability and validity as well as ethical issues.

1.10.4 Chapter 4: Data Presentation, and Analysis of results

This chapter presents and analyses both qualitative (QUAL) and quantitative (QUAN) data emanating from the research questions.

1.10.5 Chapter 5: Summary, Conclusion, and Recommendations

Chapter 6 presents the summary of research study, conclusions and recommendations based on the findings of the study.

Chapter 2: Literature Review.

2.1. Introduction

This chapter delves in the theoretical framework and related literature on the exploration of traditional Zimbabwean games for teaching mathematical concepts at primary school level. Precisely, the chapter discusses mathematics pedagogical characteristics embedded in Zimbabwe's traditional game**,** experiences and perspectives of primary school teachers in the use of traditional games in the mathematics classroom, the teachers' awareness and knowledge of traditional games for mathematics teaching and learning and the challenges of using traditional games in the mathematics classroom.

2.2 Theoretical frameworks

Teachers' application of research based mathematics instruction requires a solid understanding of the foundational theories that drive teaching. These include theories on learners learning, what they should learn and how teachers can facilitate learners`s effective learning. Theorists reflected on in this study of primary school learners include Piaget, Brunner, and Maria Montessori.

2.2.1 Piaget's Theory of cognitive development

Piaget (1936)'s theory of cognitive development explains how a child constructs and develops a mental model of the world and its mathematics. According to Piaget (1936) cognitive development is a process which occurs due to biological maturation and interaction with the environment. Piaget (1936) asserts that children learn best through doing. Active exploring of their environment is seen as a central ingredient to the transformation of the primary school curriculum. Plowden (1967) added the need for flexibility in curriculum where the centrality of play in children's learning is a key activity. The environment is the main source of learning by discovery. Such a view calls for a localized application of traditional games. Piaget outlined four main stages of cognitive development. The four stages according to Hayes, (1984) are sensory-motor (0-2 years), pre-operational (2-7) concrete operation (7-11) and formal operations (11+). In Zimbabwe, primary school learners are mainly on the concrete to formal operation. Learning of mathematics concepts is effective using concrete objects like stones which are commonly used for traditional games like tsoro. Learners must carry out experiments through manipulating objects. In this instance the role of the teacher is to facilitate learning by drawing learners' attention to the mathematics within the game rather than lecturing them on abstract mathematics.

2.2.2 Bruner's Theory of Instruction

Mwamwenda (1996) itemized four aspects of instruction within Bruner's theory, namely: motivation, structure, sequence and reinforcement. Siann and Ugwuegbu (1985) explain that, learners are intrinsically motivated to learn. They have inborn need to master the world around them by becoming competent at manipulating things generating curiosity and interest them. Consequently, teachers are expected to exploit children's motivation by using games to teach mathematics. Traditional games became ideal since they are available and free from language restrictions.

Rudhumbu (2014) applauses Bruner for the famous statement that anything can be taught to any learner provided it is presented in a form simple enough for any particular learner to understand in a recognizable form. Emphasis is on the structure of knowledge, which can be characterized in three ways. Firstly, what content is presented and how the method is presented are critical aspects. Be it talk and chalk demonstration or discovery method. This study advocates for games to enhance free play and learning. Mwamwenda (1996) recommended sequencing content from enactive, through to the iconic and finally the symbolic levels.

Immediate feedback is critical in any teaching and learning process. It helps the learner develop self -confidence, self- esteem, as well as provide the much needed motivation to go ahead and discover more on the concept in question. Traditional games have both intrinsic and extrinsic motivation as feedback. According to Mwamwenda, (1996) young learners in the infant school learn more effectively when concrete objects, actions, materials and examples are used. That calls for teachers in the infant department to be quite resourceful. They should collect and prepare adequate teaching and learning media that is age appropriate and relevant to a mathematics topic or concept being developed. For example as they play tsoro, learners count stones.

2.2.3 Maria Montessori's views

Maria Montessori was one of the proponents of the use of play in child learning processes, and her findings have been adopted in the education sector through the use of games, which however is not included in the Zimbabwe infant mathematics syllabus (2024-2030). According to Montessori in Taylor (2017) play is the work of the child. She states that play activities are essential to the health development for the children. Research by Montessori according to Taylor (2017) show that 75 % of brain development occurs after birth and the activities engaged in by children both stimulate and influence the pattern of the connections made between the nerve cells. This process influences the development of fine and gross motor skills, language, socialization, personal awareness, emotional well-being, creativity, problem solving and learning ability. Play helps children to be active, which is a very important role in the child's

total development. Children can make choices and practice actions to mastery. They get experiences with a wide variety of content in art, music, language, science, social relations and mathematics because each is important for the development of complex and integrated brain functions. Thus games such as tsoro, which links sensorimotor, cognitive, social, and emotional experiences provides an ideal setting for the child's brain development.

According to Montessori (Taylor 2017: 36) the essential dimensions of games are:

- Creativity, experimental, using problem-solving skills and physical skills.
- Helps in discovery and expansion of known or new ideas.

Thus, if play is the work of every learners then toys, counters, a notebook and a pencil are the tools. Through traditional games and concrete objects children learn about their world, themselves and others. The stones that children use when playing tsoro are concrete objects that can be used as counters.

2.3 Mathematical pedagogical characteristics embedded in traditional games

Simple mathematical concepts can be taught using traditional games, making mathematics learning more interesting and culturally appropriate. Mosimege (2016) highlighted the importance of traditional games in regaining African pride in mathematics lessons. The use of traditional games during the lessons of mathematics in the classroom provides learners with an opportunity to utilise their background and experiences gathered outside the school facility. Moloi (2015) posits that learners are highly motivated to play and develop essential concepts in mathematics and other important domains by using in traditional games. According to Nxumalo and Mncube (2019), the use of traditional games promote problem-solving skills in rural learning ecologies. Aside from traditional games, researchers have considered the role and use of indigenous materials and practices in the lessons of school mathematics.

Pelay (2016) indicated that through the process of games, learners can acquire intellectual skills such as attentiveness and improved intellectual pros. It is generally agreed that these acquired skills will eventually improve the results in mathematics. In the literature on knowledge, there seems to be general agreement that the transfer of knowledge occurs when a set of skills learnt in a domain can be generalised to other domains. Goldman (2018) stressed the importance of knowledge consisting of procedures and concepts, which implies that learning is either guided by rules or formed under categories such as fractions, ratio and angles. Moreover, Shulman (2018) explained that curriculum knowledge is a conjunction of horizontal and vertical curricula. He indicated that knowledge of a subject for providing lessons requires more than

facts and concepts. In mathematics, concepts such as area, ratio, proportions, geometric figures and numerical patterns, similarity assist in developing the following skills such as logic, reasoning, construction, accuracy in calculations, interpretation and identifications (Shulman, 2018). Through traditional games and concrete objects learners learn about their world, themselves and others.Traditional Shona games such as Pada , Tsoro , Nhodo and Fishi-fishi ,Chihwande-hwande ,Raka-raka, culturally grounded opportunities for teaching mathematical concepts at Primary School Level in Zimbabwe.These games integrate numeracy skills with social interaction , concentration and problem-solving , aligning with the principles of ethnomathematics , which emphasises the use of cultural practices in learning mathematics(Senziwe Makoni 2022).

Pada, shown in Figure 2.1, is one of the traditional games used in the teaching of mathematics.

Figure 2.1 Pada (Traditional game)

Nyanhongo (2015) posits that Pada is a balancing game where a player balances on one foot while moving a stone across a series of drawn squares.. It can be utilised in the teaching of mathematical concepts such as counting and number sequences (Nyanhongo, 2015).Players count the number of squares and steps , reinforcing number order.Pada teaches spatial awareness.Pupils will understand positions and movements within a defined space.Pada also teaches balance and coordination which are physical skills that enhance focus and body control(Micheal ,M Van Wyk(2014).According to Shumirai Nyota and Jacob Mapara(2008) through Pada pupils navigate the game's layout enhances understanding of shapes , sizes and spatial relationships.Pupils benefit geometry concepts where learners learn about geometric shapes and properties through the game's design.Through Pada pupils also benefit probability and strategy concepts where decision in the game introduces basic probability and strategic planning.According to Micheal,M Van Wyk , teaching mathematics using Pada educators gain

conceptual teaching.Pada provides a practical context for teaching geometry and probability concepts.The game's competitive element fosters a desire to learn and succeed in mathematics. While playing pada, as indicated in figure 2.1 player gain points by balancing with one foot without using the other foot. Learners push the stone across the squares drawn on the ground. In order to balance on one foot, one has to strategically position oneself. Nyanhongo (2015) argues that using Pada game in the learning mathematics learners also learn to calculate while counting in the process because they have to think of the scores and from which box it will start. Thus, the traditional game can be used in the lessons of the concepts of balancing and counting. According to the picture below in figure 2.2 at Rukariro Primary School in UMP Pada helps learners grasp concepts of balancing ,mass,and weight as well as observation and concentration skills.

Nyanhongo (2015) also identified Tsoro as one of the traditional games that can be used by mathematics teachers to help learners understand the mathematics concept at primary school level.According to Senziwe Makoni (2022) ,Tsoro is a traditional two-player strategy game involving pits and seeds or stones.Players distribute seeds across pits , aiming to capture opponents' seeds. The stones that learners use when playing tsoro, shown in Figure 2.2 below, are concrete objects that can be used as counters.

Figure 2.2 (Tsoro traditional game)

According to Nyanhongo (2015) tsoro is an ancient two player mathematical strategy board game that has been played for over a thousand years. Tsoro is one of the games that influence the way players behave and associates with people. Both analytical and social skill are developed during play. Tsoro is played by two people using an array of small holes (usually

16-24) holes. The holes are divided equally between players in a symmetrical manner for example, 2 by 4 to make it 8 holes for each player or 2 by 5 for 10 holes for each player. Next, the players populate each hole with equal number of stones usually 5 in each hole. That is mathematics base five or sets of five. A player chooses a hole and distributes his stones into other holes in an orderly and repetitive manner. That is one-to-one sharing to a target. The aim of the moves is to choose a hole that each player can use as a bank to store all the stones in his other holes. The first player to fill his bank hole wins the game. As indicated by Nyanhongo (2015), Tsoro teaches counting to infant learners. In mathematics, learner will count the stones every time they will be playing. According to Senziwe Makoni , 2022 , Tsoro game develops counting and arithmetic in learners ,addition and subtraction is done through seed distribution.Pupils will develop logical reasoning where they will develop strategic planning and prediction of outcomes.They will also have an understanding of sets and subsets through pit and seed organisation.The game improves children`s pronunciation of number names as they repeatedly say the number of stones in each hole throughout their play.

Similarly, according to Moyo and Chinamasa (2022) Tsoro game enable learners to participate, hence they understand better, what they do. The game help learners to have practical experience and concretize mathematics concepts introduced. Learners can release tension generated from learning other subjects' content, they enjoy and improve in mathematics language usage. The social context of tsoro helps to develop learners' self-esteem, social skills and respect for others. Tsoro enhances concentration , hand-eye coordination , and numeracy skills making it effective for teaching whole number concepts.According to Chinamasa Emmanuel ,Tsoro provides a tangible method to teach abstract mathematical concepts.It benefits educators in curriculum integration , the game's elements align with topics like number operations and set theory.

Using a traditional game like Nhodo as a teaching aid assists in the teaching of addition and subtraction (Mosimege, 2014). A new code of learning and teaching using Nhodo as shown in figure 2.4 as a teaching tool becomes exciting as it makes learning conducive, which enables different methods of mathematics lessons in the classroom.

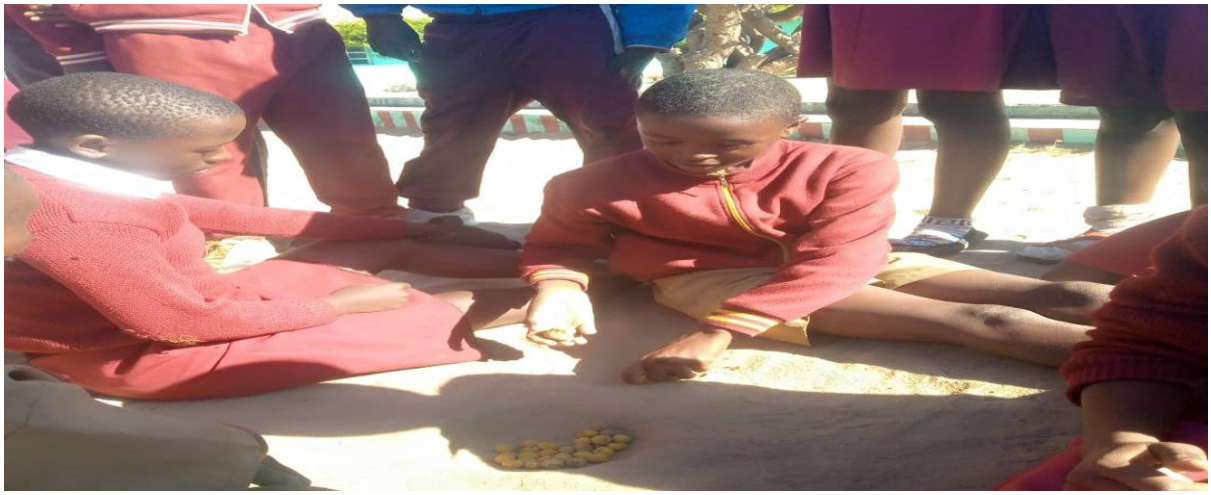

Figure 2.4 Nhodo (Traditional game)

Nhodo is a popular game in Zimbabwe where players toss a stone (mudodo) into a hole and pick up other stones without letting the tossed stone fall.It teaches counting and number operations , players count stones picked up in sequences (one by one ,two by two etc).It also teaches addition and subtraction ,managing and calculating the number of stones.Nhodo enhances dexterity and coordination.Studies highlight that Nhodo aids in developing numeracy ,problem-solving , and social skills , fostering emotional regulation and conflict resolution(Traditional games and Promotion of Social Cohesion ,2017).

Educators can nhodo as an assessment tool where educators can observe learners' counting abilities and understanding of number sequences in a natural setting.Educators benefits,engagement,the games interactive nature increases student participation and enthusiasm for mathematics(Senziwe Makoni,2022).

Moloi (2015) argued that learners can learn multiple functions from playing indigenous games such as fishi-fishi as shown in figure 2.5, which can also be referred also to a skipping rope.

Figure 2.4 Fishi-fishi (traditional game)

Fishi-fishi is a game involving a group of children forming a circle ,with one child in a center who attempts to catch another. Learners can also be divided into two teams; however, only two people from each team are permitted to hold the skipping rope. Moloi (2015) further indicated that through the game, learners can identify geometric shapes with the aim of interpreting, converting and integrating them into mathematics word problems.According to Fortunate Madondo and Joseph Tsikira (2021) ,this game promotes counting and grouping ,spatial awareness ,teamwork and cooperation.Through collaborative play it enhances social interaction. The movement of fishi-fishi refers to the way the rope changes shape when it moves, for example, when it swings down for the first time and touches the ground to form a loop that faces upwards, and when it swings up for the first time and weaves in the air to form another loop facing downwards.

A research by Moyo and Chinamasa (2022) in the Makonde district revealed that games such as Tsoro are effective in teaching fundamental mathematical concepts like counting, sets, addition, and subtraction through the use of concrete objects. These games provide learners with hands-on experiences that deepen their understanding of numeracy.

Connecting classroom mathematics to learners' everyday experiences is another significant benefit of traditional games. Madondo and Tsikira (2022) emphasize that games like Tsoro and pada are deeply embedded in Zimbabwean rural communities and serve as culturally familiar tools for teaching foundational numeracy skills. By using these games, teachers enable learners to relate mathematical ideas such as counting, number recognition, and matching to their own lived environments, fostering meaningful learning.

Beyond basic numeracy, traditional games also promote problem-solving and critical thinking skills. Studies report that participation in these games sharpens learners' observation skills, strategic thinking, and social norms such as turn taking and respect for others. Such cognitive and social skills are integral to mathematical problem solving and reasoning (Madondo & Tsikira, 2022).

The cultural relevance of traditional games is repeatedly noted as a key factor in their effectiveness as teaching tools. Because these games originate from the communities where learners live, they provide an authentic cultural context that makes mathematics instruction more relatable and engaging. This connection supports the view that grounding mathematics

teaching in cultural heritage enhances learners' conceptual understanding and motivation (Madondo & Tsikira, 2022).

Although explicit research on motivation is limited, evidence suggests that learners show greater participation and enthusiasm when mathematics lessons incorporate traditional games. The familiarity and enjoyment associated with these games encourage active engagement and willingness to learn, which is critical for effective education in numeracy (Madondo & Tsikira, 2022).

Teachers have also reported using the inherent rules and strategies of games such as Nhodo to illustrate mathematical procedures like addition and subtraction. By embedding mathematical operations into game rules, educators create a natural and intuitive learning environment where concepts are experienced through play, enhancing understanding and retention (Madondo & Tsikira, 2022).

In addition to mathematical skills, traditional games help learners develop a range of broader competencies. Psychomotor skills like hand–eye coordination, communication, concentration, and social interaction are cultivated during gameplay. These skills support mathematics learning by fostering the mental and social abilities required to engage with mathematical tasks effectively (Moyo & Chinamasa, 2022; Madondo & Tsikira, 2022).

Despite their benefits, challenges limit the widespread use of traditional games in Zimbabwean classrooms. Studies reveal that many teachers prefer Western-style games or teaching methods, often due to limited familiarity with indigenous games and a lack of professional training on how to integrate them pedagogically. This knowledge gap, coupled with insufficient instructional resources, restricts the effective incorporation of traditional games in mathematics education (Moyo & Chinamasa, 2022; Madondo & Tsikira, 2022).

2.4 Experience and perspective of primary schools teachers in the use of traditional games

Russo et al. (2023), Syahrial et al. (2020), and Avdiu (2020) focused on the teachers' perspectives on how to integrate traditional games and the implications for effective integration. Participants from all three studies agreed that the students' enjoyment was an important characteristic in determining traditional game integration in mathematics (Russo et al., 2023; Syahrial et al., 2020; Avdiu, 2020).

A study done by Bustamante et al., (2022), established that most teachers have the view that traditional games that were motivating and modifiable were important to integrating a traditional game because the teacher could better align the games to meet student's academic needs. Bustamante et al. (2022) illustrated modifiability by changing game rules and completing two experiments. By adjusting the game rules to include more mini-games, students were provided more opportunities to practice fractions and decimals, thus meeting more learning objectives that were not met in the pilot experiment (Bustamante et al., 2022).

Booker (2018) advocates the use of traditional games for developing mathematical concepts as they lay the foundations for processes and thinking strategies that will be formalized later as well as consolidate existing thinking.

A study by Rice (2018) established that, teachers believe that traditional games provide visual, auditory, and kinaesthetic experiences for the construction of mathematical knowledge. Thus, in play learners learn to think about strategies, to explore new interests by applying their experiences, to experience the fun of the game, to listen and cooperate with each other, and to learn by doing. In this role, traditional games integrate the social, affective and cognitive aspects of learning (Rice, 2018). Therefore, traditional games put the learner in a web of learning opportunities that aid mathematical development provided the teacher recognizes this value and is clear with the circumstances under which such learning opportunities can be maximized.

According to the study by Gates (2020) teachers have a view that games serve as a bridge between formal and informal methods of learning and provide an excellent way to teach mathematics. Games have built-in learning principles in their design (Russo et al. 2023). Researchers (Boluk and LeMieux, 2017, Grace, 2019, Heath, 2017, Williams 2017, Podsakoff, MacKenzie & Podsakoff 2016) provided contemporary evidence to demonstrate that the use of traditional games in teaching mathematics provides alternative instruction strategies in which students interact with each other and with adults. Thus, the interactive aspects of traditional games through which individuals construct knowledge, share knowledge and make meaning of the knowledge as critical behaviours in learning mathematics.

Hasana and Alifiani, (2019) noted that because of the interactions that occur between participants, traditional games provide for discussion among students and between students

and their teacher. Outlining the factors that can maximize learning opportunities with traditional games, Hasana and Alifiani,(2019) noted that the social context reinforces individual thinking, allows others to follow the reasoning pattern, and reduces the drudgery associated with learning alone. The interactive pattern shapes the thinking process and one may think that the interactions help children link informal to formal mathematics. The acquired strategies in play promote and sustain learners' interest and mathematical experiences.

The motivational value of games in learning and in active engagement is well documented (Boluk and LeMieux, 2017, Grace, 2019, Heath, 2017, Williams, 2017, Podsakoff, MacKenzie & Podsakoff, 2016). According to Boluk and LeMieux (2017), through traditional games, a learner may develop the power of concentration and acquire a love of learning. Grace (2019), noted that learners become strongly motivated, they immerse themselves in the activity, and over a period should enhance their attitude towards the subject. The motivation generates excitement and involvement in mathematical activity. Williams (2017) study shows that when a traditional game is modelled to meet real situations and used continuously with tutoring and counselling, it can lead to positive attitudinal change through its motivational power.

A study by Podsakoff, et al., (2016) established that teachers have a view that, using traditional games provide opportunities for developing learners' problem solving capacities and for exploring novel situations. Thus, learners can learn mathematical concepts and skills from traditional games. Based on these studies, the value of what is mathematical is likely to be shaped by one's personal disposition or by the curriculum lens.

According to Caroux, Isbister, Le Bigot and Vibert (2015), teachers believe that traditional games can help learners to develop mathematical skills and can be incorporated into mathematics lessons to make the lessons interesting for learners. This means that teachers can use traditional games to enhance mathematical lessons. This incorporation will motivate learners in the class. In playing traditional games, participants have to follow the rules of the games. For example, each player aims to win the game, while adhering to the rules and having the same interpretation of the rules as the opponent. This is consistent with solving mathematical problems, as certain rules have to be followed to solve a mathematical problem.

Hew, Huang, Chu and Chiu (2016) suggested that using traditional games in class can stimulate a learner's intelligence and participation. In all traditional games, player strategizes the next move, while keeping all the rules in mind. The player ponders over what the opponent's next move will be, the bases of the move and whether the rules are being followed. Visualisation is usually part of the game when going to make the next move. These traditional games are akin to solving mathematical problems to arrive at a solution according to proven rules.

Jackson, et al., (2015) asserts that the use of traditional games in mathematics lessons enable learners to learn the language and vocabulary of mathematics, develop analytical skills, develop the skills of mental mathematics, and develop problem-solving skills and the ability to generate mathematical concepts at different levels. Traditional games also contribute to stimulating data analysis skills in mathematics (Jackson et al., 2015). Studies that showed the use of games in solving problems have been documented (Katsila and Matsoukas, 2018). One important relation between games and solving problems is a central aspect of learning mathematics. Using traditional games also leads to discovery of patterns in decision-making, logical reasoning and analytical skills (Liao et al., 2016).

The findings of Westera (2019) established that teachers believe that games teach a number of mathematical problem-solving skills, including forming and evaluating hypotheses, devising methods, and organising data. Thus, introducing games help learners to gain good mental interaction, concentration, memory, and the capacity to understand and apply mathematical analytic thinking. It also creates an environment in which learners can discuss their views with their classmates. Learners practice mathematical concepts, ideas, and information implicitly through the varied traditional games they play in each culture. Any traditional game that individuals play generates language, vocabulary, mathematical prowess, and a range of mathematical tasks (Hwa, 2018). This implies that introducing traditional games in the classroom help learners to improve mathematics performance.

Studies such as those by Moyo and Chinamasa (2022) reveal that learners generally respond positively when traditional games are incorporated into mathematics lessons. The familiarity of these games encourages active participation and enjoyment, making mathematics more accessible and less intimidating. Learners are often more willing to engage, as the games resonate with their cultural background and daily experiences, thus creating a comfortable and motivating learning environment.

Teachers consider several factors before integrating traditional games in their teaching. According to Madondo and Tsikira (2022), these include the relevance of the game to specific mathematical concepts, the availability of necessary materials, the size and physical space of the classroom, and learners' cultural backgrounds. Moreover, the alignment of the game's mechanics with curriculum objectives plays a crucial role in the decision-making process.

Educators have also adapted traditional games to better suit their teaching goals. For instance, in Moyo and Chinamasa's (2022) study, teachers modified games like Tsoro by altering the number of stones used or adjusting rules to emphasize particular mathematical operations such as addition or subtraction. Such modifications help tailor the games to meet specific lesson objectives and accommodate learners' varying skill levels.

Traditional games significantly boost motivation and engagement. Madondo and Tsikira (2022) note that learners exhibit increased enthusiasm and sustained attention during lessons involving traditional play, compared to conventional teaching methods. The interactive nature and cultural familiarity of the games foster a sense of belonging and enjoyment, which supports sustained interest in mathematics learning.

Zimbabwean research identifies counting, number recognition, addition, subtraction, and understanding of sets as some of the mathematical skills most effectively developed through traditional games (Moyo & Chinamasa, 2022). Games like Pada and Nhodo provide hands-on experiences that enhance learners' grasp of these foundational concepts, reinforcing classroom instruction through concrete manipulation.

Traditional games encourage learners to develop problem-solving and critical thinking abilities. Madondo and Tsikira (2022) highlight that gameplay requires learners to strategize, anticipate opponents' moves, and apply logical reasoning—skills directly transferable to mathematical problem-solving. The social dynamics of these games also stimulate reflective thinking and collaborative problem-solving.

The social and interactive elements of traditional games are fundamental to their educational value. Interaction among learners during gameplay fosters communication, negotiation, and teamwork, which enrich mathematical learning (Madondo & Tsikira, 2022). These social

engagements also help learners articulate their reasoning and internalize mathematical concepts through peer discussion and shared experiences.

Despite their benefits, teachers face challenges in using traditional games, such as limited resources, large class sizes, and insufficient training on how to integrate games effectively (Moyo & Chinamasa, 2022). To address these, some teachers have creatively modified games to fit classroom constraints, sought support from colleagues, and advocated for professional development opportunities focused on culturally responsive pedagogies.

2.5 Teachers' awareness and knowledge of traditional games for mathematics teaching and learning.

Westera (2019), indicated that all teachers in the study have experienced a wide variety of traditional games as part of cultural life in their communities in the past and present. These traditional games were either experienced by observation and/or through participation. The degree of experience seems to be a function of the community where the teacher was raised as a child and where the teacher currently teaches. Further, the study by Westera (2019) established that teachers raised in rural communities tend to have wider range of experiences with cultural games in their communities during both childhood and adulthood than their urban counterparts. However, the traditional games experienced by both groups are similar to what one observes and experiences in contemporary Zimbabwean communities.

According to the study by Boluk and LeMieux (2017), several teachers spoke of their own experiences learning mathematics through playing traditional games with other members of the community as part of their cultural life. Teachers come to know various aspects of mathematics through their experiences playing the traditional games. Teachers' use of traditional games in the classroom reflects their familiarity with community games and their knowledge of the relevant mathematics within the games (Boluk & LeMieux, 2017). The personal past experiences teachers have playing or observing games as children and as adults, and their interpretation of the purposes of these games within the community, shape the teachers' knowledge and, hence, shape decisions they make with regards to playing traditional games in the mathematics classroom. In addition to personal experiences teachers may have with

traditional games in their communities, they also have opportunities to experience the use of traditional games in their education as children and later as part of their teacher education.

The survey done by Grace (2019) revealed that the teachers who reported experiencing traditional games as children seemed more likely to use traditional games as teachers. Although this relationship cannot be described as causal, it raises the question as to the importance of teachers experiencing traditional games as part of their educational experiences.

A study done by Heath (2017) also found that no teacher in the study indicated ever experiencing traditional games in mathematics in their pre-service or in-service development. The possible connection between the value of indigenous mathematics emphasized in the present curriculum and the use of traditional games generally does not appear to have been made by the teachers of pre-service and in-service teachers. With few or no opportunities to experience traditional games in a professional development setting, teachers do not have an opportunity to further reflect on and transform their knowledge to consider the potential value of traditional games in a mathematics classroom.

Similarly, the study by Williams (2017) found that many teachers commented on the obvious lack of education they received in both their pre-service and in-service experiences. Williams (2017) expressed the need for teacher education to explicitly incorporate traditional games in the teacher education curriculum and to use them to popularize their importance in mathematics education. Thus, there is need for in-service training to provide experiences that enhance teachers' capacity to use games for teaching mathematics.

Moyo and Chinamasa (2022) asserts that even though the use of traditional games is an expectation in the current Zimbabwean mathematics curriculum, less than half of the teachers in their study, reported using them in their practice. Although the curricular intent was to link culture and mathematics, most teachers do not appear to have made the connection (Moyo & Chinamasa, 2022). Thus, without appropriate educative and practical experiences, it is not surprising that there is minimal use of traditional games in mathematics teaching.

Research by Moyo and Chinamasa (2022) indicates that many teachers recall a variety of traditional games from their childhood and community life. Commonly mentioned games include Tsoro, Pada, Nhodo, and Fishi-fishi, which are widely known in rural and urban

settings across Zimbabwe. Teachers typically learned about these games both through active participation as children and by observing others within their communities, highlighting the role of cultural transmission in sustaining indigenous play activities.

However, despite these personal experiences, the extent to which traditional games were integrated into formal mathematics learning during teachers' own schooling appears limited. Heath (2017) and Williams (2017) found that most Zimbabwean teachers did not experience the use of traditional games in their pre-service or in-service training. This lack of formal exposure translates into a gap between teachers' cultural knowledge of games and their pedagogical application in mathematics classrooms.

Confidence in identifying mathematical concepts within traditional games varies among teachers. Madondo and Tsikira (2022) suggest that while many teachers recognize basic numeracy concepts such as counting and balancing in games like Tsoro and Pada, they often lack deeper pedagogical knowledge to effectively link these games with broader curriculum goals. This uncertainty affects their willingness to incorporate traditional games regularly in lessons.

Personal experiences with traditional games strongly influence teachers' decisions about their use in teaching. Moyo and Chinamasa (2022) report that teachers who actively engaged with traditional games during childhood are more inclined to integrate them into their instruction, valuing the cultural relevance and learner engagement these games foster. Conversely, those less familiar tend to rely on conventional teaching methods.

Regarding alignment with the Zimbabwean mathematics curriculum, research shows mixed awareness among teachers. While the curriculum encourages culturally responsive teaching, including the use of indigenous games, many educators have limited understanding of how to operationalize this guidance in practice (Madondo & Tsikira, 2022; Moyo & Chinamasa, 2022). This gap highlights a need for clearer curricular frameworks and instructional support.

Teachers express a need for specific knowledge and skills to use traditional games effectively in mathematics teaching. This includes training on selecting appropriate games, modifying game rules to meet learning objectives, classroom management during game activities, and linking game experiences explicitly to mathematical concepts (Williams, 2017; Heath, 2017).

Professional development opportunities focusing on culturally responsive pedagogy and practical strategies are thus crucial to empower teachers.

In summary, recent Zimbabwean literature points to a strong cultural foundation of traditional games among teachers but underscores challenges related to professional training, curriculum integration, and pedagogical confidence. Addressing these through targeted teacher education and curriculum support can enhance the effective use of traditional games in mathematics classrooms.

2.6 Challenges of using traditional games in the mathematics classrooms

Using traditional games in mathematics classrooms can offer engaging and culturally relevant learning experiences. However, several challenges can hinder their effective integration. Podsakoff, et al., (2016) argues that traditional games are merely mentioned in the mathematics curriculum without elaboration. There is no information available to teachers as to what constitutes a traditional game, how and when to use traditional games. There is also no information on what traditional games to use for specific topics (Podsakoff, et al., 2016). Many teachers lack the training or confidence to use traditional games effectively. This includes both an understanding of the cultural context of the games and the pedagogical knowledge to extract mathematical meaning from gameplay (Podsakoff, et al., 2016). As a result, games may be used superficially, without achieving deeper learning.

Moyo and Chinamasa (2022) argues that teachers often experience difficulties in clearly understanding what qualifies as a traditional game suitable for mathematics instruction. Moyo and Chinamasa (2022) observed that many educators lack a standardized definition or criteria, leading to uncertainty about which games can effectively support mathematical learning. This ambiguity is compounded by varied interpretations of traditional games across different communities, making it harder for teachers to select appropriate games confidently.

The study by Avdiu, (2020) revealed that teachers have varied and at times contradictory conceptions and interpretations of what a game is and what cultural activity constitutes a traditional game. Thus, this difficulty raises questions as to how teachers might determine which traditional games are appropriate for inclusion in the mathematics classroom. One major challenge is aligning traditional games with the formal mathematics curriculum and specific learning objectives. Teachers may struggle to clearly map game mechanics to measurable

outcomes in areas such as algebra, geometry, or statistics (Avdiu, 2020). This misalignment can lead to reduced instructional efficiency and difficulties in assessment.

Madondo and Tsikira (2022) found that teachers struggle to map game activities to particular mathematical concepts such as fractions, geometry, or number patterns. The curriculum's general references to cultural activities often lack detailed guidance, leaving educators to independently bridge this gap, which can be a complex and time-consuming process.

Similarly, a study done by Syahrial et al., (2020) established that curriculum does not seem to motivate teachers to include cultural games in the mathematics curriculum implementation and teachers do not seem to have support for making informed decisions on the use of cultural games. The use of traditional games in teaching mathematics required substantially more instructional time than was available. Syahrial et al., (2020) argues that as opposed to directly teaching curriculum concepts, use of games required the integration of different activities, such as modelling how to play, allowing sufficient time to play, and making links between the mathematics in the traditional games and school mathematics.

According to Moyo and Chinamasa (2022), preparing, explaining, and facilitating gameplay requires more instructional time than traditional teaching methods. Teachers express concern that the lengthy process of setting up games, demonstrating rules, and allowing sufficient playtime is difficult to accommodate within tight lesson schedules, especially in exam-focused environments. Çelik, (2019) asserts that traditional games often require extended time for explanation, play, and debriefing. In tightly packed curricula, especially in exam-focused systems, there may not be enough time to incorporate such activities meaningfully (Çelik, 2019). This issue is exacerbated in high-stakes environments where teachers are pressured to cover content quickly. This implies that traditional games required more instructional time than was scheduled in the timetable. Çelik, (2019) argues that in addition to the extra instructional time required, the practice of using games requires more time for pre-lesson and post-lesson organizational activities especially in their large classes. Thus, more time is needed to prepare lessons, set up the traditional games, and organize learners into groups.

Bustamante et al. (2022) indicated that most classrooms hold more learners than expected and far more than the recommended class size. Under the conditions where classrooms are packed

with learners and with virtually no space for free movement and/or practical activities, teachers tend to avoid the use of games as using them under such conditions was viewed as a struggle. Part of the struggle was the rise in management problems, particularly for games and activities with high levels of interaction among students. Thus, the numbers of learners in their classroom and limited space make games impossible or ineffective. Bustamante et al. (2022) also asserts that some traditional games by their nature either require extensive space for play or cannot be played inside a classroom at all. Bustamante et al. (2022) note that overcrowded classrooms restrict movement and make organizing interactive game sessions challenging. Limited physical space often prevents the implementation of games that require room for active participation, causing teachers to avoid using them or to modify games in ways that may reduce their educational effectiveness.

According to Russo et al. (2023), many traditional game materials are not suitable for use in the classroom because of the nature of the games. For example, some traditional games require digging holes in the dirt, throwing stones, or jumping and kicking activities. Obtaining materials and equipment needed for traditional games poses additional challenges. Russo et al. (2023) highlight that some traditional games require specific items, such as stones, sticks, or drawn playing areas, which are not always readily available in under-resourced schools. This scarcity forces teachers to improvise with unsuitable materials or to exclude these games altogether from their teaching repertoire.

Thus, there is a need to have access to the materials and the classroom space. Satisfying all these conditions as criteria for implementation appears problematic among teachers (Russo et al. 2023). Some traditional games require specific materials or space that may not be available in all school settings. Especially in under-resourced schools, acquiring the necessary tools to implement these games can be a logistical challenge (Russo et al. 2023).

Traditional games usually involve informal learning, making it challenging to assess student progress objectively. Standardized tests rarely capture the collaborative, process-based skills that games foster, such as problem-solving, reasoning, and strategic thinking (Çelik, 2019). This discrepancy can discourage their use in classrooms focused on quantifiable assessment.

While traditional games can reflect local heritage, not all traditional games are culturally inclusive or appropriate in diverse classrooms. Some games may unintentionally marginalize

students from different backgrounds or may involve themes that are outdated or offensive in contemporary settings (Avdiu, 2020).

Classroom management during interactive traditional games is another concern. Large, energetic groups playing games can lead to distractions and disciplinary issues, as reported by Moyo and Chinamasa (2022). Teachers often find it difficult to maintain order and ensure that all learners remain focused on the mathematical objectives of the activity, necessitating strong classroom control skills.

Assessing students' mathematical learning through traditional games remains problematic. Çelik (2019) and Madondo and Tsikira (2022) discuss the challenge of capturing learners' progress and understanding when learning is embedded in informal play. Standardized assessments do not easily reflect skills developed through games, such as strategic thinking and collaboration, making it hard for teachers to measure and report student outcomes effectively.

Lastly, cultural and inclusivity concerns arise in selecting traditional games. Avdiu (2020) and local Zimbabwean researchers note that some traditional games may not be culturally neutral or appropriate for diverse classrooms. Certain games might unintentionally exclude or alienate learners from different ethnic or social backgrounds, or involve gender roles that limit participation. Therefore, teachers must carefully consider the cultural context and inclusivity when choosing games to ensure equitable learning opportunities for all students.

In summary, Zimbabwean studies reveal that while traditional games have rich educational potential, teachers face multifaceted challenges ranging from conceptual clarity and curriculum alignment to practical issues of resources, classroom management, assessment, and cultural inclusivity. Addressing these challenges requires systemic support through professional development, resource provision, and curriculum enhancement. While traditional games offer rich opportunities to make mathematics more meaningful and enjoyable, several challenges limit their classroom use. These include curriculum alignment, time and resource constraints, assessment issues, and a lack of teacher preparation. To address these challenges, targeted teacher training, curriculum development, and culturally responsive pedagogy are essential.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1. Introduction

This section highlights the research paradigm, research methodology, research design, population and sample as well as instruments for data collection and analysis. The issues of validity, reliability and ethical considerations are also covered in this chapter.

3.2 Research Paradigm

The study is based on a constructivist-interpretive paradigm (Denzin & Lincoln, 1994). This paradigm focuses on the social construction of knowledge and relies on subjective constructions of multi-realities. People come to participate in social practices from an individual set of sociocultural experiences but knowledge emerges as a collection of multiple subjectivities. Constructivist researchers hold the view that knowledge and its acceptance as knowledge can be explained using sociological tools. Lincoln and Guba, (2000) present constructivism as an inquiry method that adopts a relativist's ontology, a transactional and subjectivist epistemology and a dialectical methodology. It stresses a socially constructed nature of reality and recognizes the existence of multiple realities or coexistence of multiple knowledge's and understandings (Guba & Lincoln, 1994).

Traditional game practices are bound to exist as individual teachers uniquely construct pedagogical content knowledge. This knowledge, understood as mental constructions, is experientially based, local and specific (Lincoln & Guba, 2000). Mathematical knowledge on traditional games is symbolically constructed with understanding based on the rules of the traditional game, the materials and actions involved. Thus, a mathematical concept defined by a traditional game is what is agreed as a mathematical idea and does not become clarified by any one person's construction. The constructivist view of knowledge construction allows the socially constructed nature of mathematics and building traditional games activities into mathematics lessons. However, the knowledge required to realize these benefits is an individual construction in social interactions in the process of meaning making.

Since the study is on the exploration of traditional Zimbabwean games for teaching mathematical concepts at primary school level, using a constructivist-interpretive paradigm has merit. Interpretive inquiry produces outcomes that explain or create generalizations, develop new concepts, elaborate existing concepts, provide insights, clarify complexity, and develop theory (Dawidi et al., 2021). Interpretive research, as Pandey and Pandey (2021) noted, regards education as a process and understanding the meaning of this process constitutes knowledge. Interpretations do not only engender new concepts but also elaborate existing ones.

3.3 Research methodology

In order to adequately answer the research questions of this study, a qualitative research approach was employed. Dawidi et al.(2021) defines qualitative research as an investigation of the expressions of individuals' understandings of themselves and that of their environment. The research is qualitative because data gathered often come in more detail. The goal of qualitative research is to obtain an understanding from individuals about the world around them (Denzin & Lincoln, 2011). Frost (2021) describes qualitative research as aiming at gathering expressive data in its context.

Since qualitative research emphasizes processes and meanings (Denzin & Lincoln, 1994), qualitative methodology was used in this study to explore the use of traditional Zimbabwean games for teaching mathematical concepts at primary school. Doing a qualitative study directs attention to interpretations of the participants under investigation. A qualitative approach to research provides a methodological flexibility towards understanding teachers' experiences and understandings of traditional games in their natural settings. Furthermore, this approach enable the researcher to capture teachers' holistic experiences and perspectives within a constructivist framework or paradigm.

The use of qualitative research within the constructivist-interpretive research paradigm is highly justified, especially for studies exploring complex human experiences, meanings, and social interactions, such as teachers' perspectives and practices in using traditional games in mathematics teaching.

According to Frost (2021), the constructivist-interpretive paradigm assumes that reality is socially constructed and subjective, shaped by individuals' experiences, beliefs, and cultural contexts. It emphasizes understanding the meanings people assign to their experiences rather

than seeking objective, measurable truths. Qualitative research methods, such as interviews is ideally suited to this paradigm because it allows for in-depth exploration of participants' lived experiences, interpretations, and the contexts that influence them.

In this paradigm, knowledge is co-constructed between the researcher and participants through dialogue, which helps uncover the nuances, complexities, and multiple realities inherent in educational settings (Frost, 2021). Qualitative research enables the researcher to capture rich, detailed data that reflect the participants' voices, providing insight into how teachers interpret traditional games and integrate them into mathematics teaching within their specific cultural and institutional environments.

Furthermore, Dawidi et al.(2021) argues that the flexible and open-ended nature of qualitative inquiry allows the researcher to adapt questions, probe emerging themes, and explore unexpected insights, which aligns with the constructivist emphasis on understanding evolving meanings rather than testing predetermined hypotheses.

Therefore, employing qualitative research within the constructivist-interpretive paradigm is justified as it provides the tools and epistemological stance necessary to deeply understand teachers' subjective experiences, social realities, and the culturally embedded practices surrounding the use of traditional games in mathematics education.

3.4 Research Design

The case study design helped the researcher in laying and carrying out the research in a manner that ensured valid findings (Creswell & Plano Clark, 2015). The thrust of a case study is to understand people in their social setting by interpreting their actions and relationships. Yin (2014) defines a case study as a deep analysis of a single entity, which could be a person or institution. Fellow and Liu (2021) views a case study as an investigation of participants where relationships may appear to be unclear. Frost (2021) argues that a case study is a deep and thorough investigation from many perspectives of the intricacy and distinctiveness of a phenomenon in actual situations. The researcher adopted a case study design to get in-depth insights into the exploration of traditional Zimbabwean games for teaching mathematical concepts at primary school. The nature of the research question allowed the case study design to be the most suitable because it provided a proper way to collect and report findings giving an opportunity to better appreciate a problem in a broader context. Since the research was intended to use verbatim expressions that sought to answer research questions, it was hoped,

would best be captured through a case study research. It was intended that the case study research would bring new knowledge and stimulate other researchers.

3.5 Population

Decisions about the population are crucial in any research. Kawulich, (2014) defines a research population as people from which a sample can be chosen. The study involved primary teachers from a 54 primary schools in a particular district of Zimbabwe. 10 primary schools from a total of 53 primary schools within the district were purposively selected. The decision for selecting 10 schools was a deliberate to balance the need for rich, detailed data with practical considerations such as time, resources, and manageability. In qualitative research, especially studies involving interviews, the focus is on depth and quality of information rather than large-scale generalizability. By concentrating on a smaller number of schools, the researcher could engage more thoroughly with participants, allowing for a deeper understanding of teachers' experiences, perceptions, and challenges related to the use of traditional games in mathematics teaching.

The researcher considered factors such as the geographic location of the schools, the size of the school, the level of resources available and the extent to which traditional games are already being used in teaching. This purposive approach ensures that the sample captures a diverse range of contexts and perspectives within the district, thereby enriching the findings.

In summary, selecting 10 schools through purposive and stratified sampling methods allowed the researcher to gather rich, contextually varied data within manageable logistical limits. This careful selection process ultimately contributed to a comprehensive understanding of teachers' experiences with traditional games in mathematics classrooms across the district.

3.6 Sample and Sampling procedure

Wang, Hu, Xia, Wen and Ding (2014) indicated that sampling is the selection from a large population by applying certain criteria. In qualitative research, Pandey and Pandey (2021) recommends a non-probability sampling strategy and suggests developing sampling criteria to guide participant selection. The possible sample size of participating teachers from the 10 selected schools consisted of 10 teachers. For qualitative research that aims to explore in-depth experiences and perspectives, selecting about one teachers per school was generally

manageable and sufficient. This size allowed for rich, detailed data collection while keeping the study practical and focused.

The selection of the 10 participating teachers was purposive, targeting those who are most relevant to the research topic. Cohen, *et al*. (2014) argue that purposive sampling is suitable for qualitative research. Wagner, *et al*. (2016) state that in purposive sampling, the researcher handpicks certain groups or individuals to include in the sample based on their relevance to the problem under study. In this case, priority was given to mathematics teachers who have experience using traditional games in their teaching practice. This ensures that the participants can provide informed and meaningful insights about the integration of traditional games in mathematics lessons.

3.7 Data Collection Instruments

Interviews with the ten selected teachers was used to solicit information on:

(a)Mathematics pedagogical characteristics embedded in Zimbabwe's traditional game

(b) Experiences and perspectives of primary school teachers in the use of traditional games in the mathematics classroom.

(c) Teachers' awareness and knowledge of traditional games for mathematics teaching and learning.

(d) Challenges of using traditional games in the mathematics classroom.

Thus, the use of interview permits participants to create their own responses and to voice their experiences unconstrained (Creswell, 2019). An interview is a verbal interchange, often face-to-face (although the telephone may be used) in which an interviewer tries to elicit information, beliefs or opinions from the person. Doody & Noonan (2019) view an interview as a data gathering experience in which the interviewer asks a respondent some questions. In other words, an interview is an interface between a researcher as an interviewer and a respondent as an interviewee. Englander (2017) posits that the purpose of interviewing is to find out what is on someone's mind and to review respondents' views and experiences about a phenomenon under review.

The researcher used an interview schedule to elicit information from respondents (Ritchie & Lewis 2018). Interview questions covered all the four research questions (questions 1-4). All interviewees were asked similar questions to ensure responses from the same questions in order to facilitate theming and coding. Semi-structured interviews were preferred for the following reasons: To begin with, semi-structured interviews allowed teachers freedom to express their

views and understanding of their role and experiences with exploring traditional Zimbabwean games for teaching mathematical concepts at primary school level, thus, they allowed an opportunity to understand the world from their perspective (Creswell, 2019). Secondly, semi-structured interviews allow the researcher to probe issues that required clarifications (Pandey and Pandey, 2021). Thirdly, semi-structured interviews encouraged a two-way communication (Pandey and Pandey, 2021). Interviewees had an opportunity to ask the researcher where they felt it unclear to them, thus making interview reliable, and evolve to reality.

3.8 Data Analysis

This phase involved thematic analysis, which applied to all qualitative data derived from responses of the research questions on the exploration of traditional Zimbabwean games for teaching mathematical concepts at primary school. Thematic analysis refers to putting codes from a single or more transcriptions to represent the findings in a logical and systematic way (Guest, Namey & Mitchell, 2017). Thematic analysis allows the researcher to present data from interviews using citations from the individual transcripts to illustrate the source of the researchers' interpretation. Thus, the analytic process was guided by themes and constructs related to the principles of using traditional games in teaching mathematics. In addition, the objectives of the study informed the analysis of this study.

3.9 Trustworthiness

The proposed criteria to achieve data trustworthiness include credibility, dependability, and transferability that parallel internal validity, reliability, and external validity respectively (Guba & Lincoln, 1994). These criteria stress the situated, relational, and textual structures of qualitative experience. Credibility, which pertains to the constructivist paradigm, tests the correspondence between the research participants' social constructs and the way the researchers interpret their viewpoints. Credibility was achieved by providing clear and meaningful links between questions, data, analysis, and conclusions throughout the research process, and situate the report in its context. In the constructivist paradigm, dependability, according to Guba and Lincoln, (1994) is used to describe the stability of data over time. Thus, dependability measures the degree to which the interpretations and concepts have mutual meanings between participants and researcher. Transferability is the extent to which results can be generalized to other situations. Transferability is identified as the qualitative analogue to external validity (Guba & Lincoln, 1994).

3.10 Ethical Considerations

Gaining access involves receiving official permission and laying the groundwork for acceptance at the research site. This gives the researcher freedom to investigate and a greater access to a wider range of settings. Consequently, letters were written to seek permission from the Heads of Primary Schools and participating teachers. Before conducting interviews, the researcher explained to participants the purpose of the study, its nature and what would be done with the findings. Participating teachers were made to sign consent forms that indicated their willingness to participate and their rights to opt out anytime during the research without hindrance. All participants were assured of anonymity. The researcher used pseudonyms names of the participating teachers in fulfilment of the ethical agreement. Since in qualitative research, the researcher-participant relationship is important, only volunteers were considered for this study.

3.11 Summary of the chapter

Chapter Three presented the research methodology that was employed in this qualitative case study. The study used interviews as data gathering instrument. The whole idea was to get deep insights into the exploration of traditional Zimbabwean games for teaching mathematical concepts at primary school. The chapter also focused on the research approach, research design and purposive sampling. Ethical considerations, which included informed consent; anonymity and confidentiality, were explained.

CHAPTER 4. RESEARCH FINDINGS

4.1 Introduction

Chapter 3 described the research design and methodology used in the study. A qualitative research approach, in the form of a case study, was employed towards the study of the exploration of traditional Zimbabwean games for teaching mathematical concepts at primary school. The present Chapter presents the research findings of the study. The study was guided by the following research objectives:

(a) To establish mathematics pedagogical characteristics embedded in Zimbabwe's traditional game

(b) To establish experiences and perspectives of primary school teachers in the use of traditional games in the mathematics classroom.

(c) To establish the teachers' awareness and knowledge of traditional games for mathematics teaching and learning.

(d) To establish the challenges of using traditional games in the mathematics classroom.

4.2 BIOGRAPHIC FACTORS

The table 4.1 below shows biographical information of ten teachers who were interviewed.

Table 4: Demographic data for participating teachers.

Teacher (Pseudonyms)	Sex	Experience (years)	Grade taught
T1	F	17	2
T2	F	20	2
T3	F	30	3
T4	M	14	5
T5	F	15	5
T6	M	6	1
T7	F	21	4

T8	F	5	3
T9	M	13	2
T10	M	19	3

Of the participants that were interviewed, their teaching experience ranged from five years to thirty years and they were currently teaching grade 1, 2, 3,4 and 5 at particular schools. The table 4 show that all the participating teachers were senior teachers according to the Zimbabwean standard, which was good for this study.

4.3 Mathematics pedagogical characteristics embedded in Zimbabwe's traditional game

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

Theme: Mathematics Pedagogical Characteristics Embedded in Zimbabwe's Traditional Games

Introduction to the theme

Traditional games in Zimbabwe, such as *Tsoro, Pada*, *Nhodo,* and *Fishi-fishi*, carry rich mathematical pedagogical value. They embed core mathematical concepts in culturally relevant, engaging, and interactive ways, thereby linking classroom learning with learners' lived experiences. The use of these games not only promotes conceptual understanding but also nurtures problem-solving, critical thinking, and positive learner attitudes toward mathematics. Through teachers' perspectives, several pedagogical characteristics emerge, demonstrating how mathematics instruction can be contextualized, meaningful, and culturally sustaining.

Sub- themes

Mathematical concepts embedded in traditional games.

When participating teachers were asked which specific mathematical concepts, they think are best taught through traditional games, some of the non-verbatim responses from the participating teachers of the sub questions asked are given below.

T1 noted that games like Tsoro help with counting, grouping, and understanding base systems.

T3 asserts that Pada supports balancing and coordination alongside number sense. T10 believed that Nhodo work well for addition and subtraction.

T08 suggested that Fishi-fishi is linked to geometric shapes, patterns, and timing.

Both T6 and T4 concurred that fractions, ratios, and measurement concepts can also be embedded in game activities.

Connection between classroom mathematics and everyday experiences

The participating teachers were also asked how traditional games such as Pada, Tsoro, Nhodo, or Fishi-fishi help learners connect classroom mathematics to their everyday experiences and their non-verbatim responses are below.

T5 felt that learners could easily relate the counting of stones in Tsoro or Nhodo to counting objects at home.

Similarly, T8 explained that the familiar outdoor play settings and cultural relevance make the concepts less abstract, and children often recognise the same shapes or patterns they see during the games in other parts of their lives.

Enhancement of problem solving and critical thinking.

When asked on how traditional games enhance learners' problem-solving and critical thinking skills in mathematics, their non-verbatim responses were as follows.

T7 described how learners develop strategies during play, such as deciding which hole to start from in Tsoro to maximise their score, or predicting rope movements in Fishi-fishi.

T10 pointed out that the need to plan moves, anticipate outcomes, and adapt to opponents' actions mirrors mathematical reasoning processes.

Cultural relevance as a pedagogical tool.

Another sub question was on the role cultural relevance play when teaching mathematics through traditional games and the non-verbatim responses from the participating are below.

T2 emphasised that when learners see familiar cultural practices in the classroom, they gain pride and confidence.

T4 said it creates a bridge between home and school knowledge, making maths feel like "ours" rather than something foreign.

T9 also felt it preserved cultural heritage while delivering academic content.

Learner motivation and engagement in mathematics.

When asked how learners respond (in terms of motivation and participation) when mathematics lessons include traditional games, some of their non-verbatim responses are below.

T3 observed higher levels of excitement, eagerness, and voluntary participation.

T9 argues that learners often requested to repeat activities and were more willing to engage in tasks they might normally find difficult.

T5 noted reduced anxiety and more collaboration during game-based sessions.

Integration of game rules and strategies into mathematics instruction.

The participating teachers were asked to describe how to integrate rules and strategies of traditional games into teaching mathematical procedures or concepts and their non-verbatim responses were as follows.

T1and T7 concurred that they map game rules directly onto the concept being taught, for example, relating the one-to-one distribution in Tsoro to division or sharing problems.

T10 suggested the use of Pada's movement rules to explain sequences and counting patterns.

T2 suggested modify the scoring systems to align with targeted maths topics, such as multiples or subtraction.

Development of non-mathematical skills that support mathematics learning.

When asked what skills beyond mathematics do learners acquire through these games, and how do these skills support mathematics learning, the non-verbatim responses from participating teachers are below.

T3 mentioned teamwork, patience, communication, and respect for others' turns.

T5 also highlighted improved concentration, fine motor skills, and resilience when learners lose and try again.

Both T3 and T5 felt that these behaviours, help learners stay focused, follow instructions, and persist in solving challenging problems.

Challenges and limitations in using traditional games.

When participating teachers were asked what challenges or limitations they face when using traditional games as a tool for teaching mathematics, some of their non-verbatim responses are below.

T10, T6, T2 and T7 reported constraints such as lack of time in the syllabus, large class sizes, and insufficient space for outdoor play.

T1 also mentioned that some games require materials that are not always available.

T9 suggested that few learners might be unfamiliar with certain traditional games, requiring extra time to teach the rules before linking them to mathematics concepts.

4.4 Experiences and perspectives of primary school teachers in the use of traditional games in the mathematics classroom.

Non-verbatim responses from participating teachers for the themes and sub-themes offered some experiences and perspectives of primary school teachers in the use of traditional games in the mathematics classroom.

Theme: Experiences and Perspectives of Primary School Teachers in the Use of Traditional Games in the Mathematics Classroom

Introduction to the themes.

The integration of traditional games into mathematics lessons presents both opportunities and challenges for teachers. Their experiences reveal that traditional games can enhance learner motivation, engagement, and conceptual understanding by connecting mathematical ideas with cultural practices and playful contexts. Teachers' perspectives show that while games are effective in promoting problem-solving, critical thinking, and social interaction, they must be carefully adapted to align with lesson objectives, learner levels, and classroom realities. The following sub-themes highlight the ways teachers experience and perceive the use of traditional games as a pedagogical approach in mathematics teaching.

Sub-themes

Learner Responses to Traditional Games in Mathematics Lesson.

When the participating teachers were asked how learners generally respond when traditional games are used in mathematics lessons, some of the non-verbatim responses of the interviewed included the following.

T4 observed that learners become more excited and actively participate when traditional games are introduced.

T10 said learners often look forward to the sessions, show more energy, and even request to repeat the activities.

T6 mentioned that the games reduce anxiety and make the classroom more relaxed, encouraging even shy learners to take part.

Factors Considered in Selecting Traditional Games

When participating teachers were asked, on which factors considered when deciding whether to integrate a particular traditional game into your mathematics teaching, some of their non-verbatim responses are below.

T7, T4 and T3 explained that they consider the relevance of the game to the topic being taught, the age and ability of the learners, the availability of space and materials, and the time constraints of the lesson.

T9 also noted that they choose games that can be adapted to cover multiple mathematics concepts.

Modification of Traditional Games for Mathematical Objectives.

Teachers were asked to describe any examples where they modified the rules of a traditional game to better meet mathematics-teaching objectives and some of the non-verbatim responses are below.

T5 reported modifying scoring systems to focus on certain concepts such as fractions or decimals.

T9 suggested adding mini-challenges during play, for example, requiring learners to solve a quick sum before making their move.

T1 suggested simplifying complex games for younger learners to focus on basic counting or shape recognition.

Influence on learner motivation and engagement.

When asked how traditional games influence learners' motivation and engagement in mathematics learning, their non-verbatim responses are below.

T2 highlighted that games create a fun and competitive environment that keeps learners motivated.

T7 noted that learners often become so absorbed in play that they do not even realise they're practising mathematical skills.

T6 also mentioned that games break monotony, making mathematics lessons more lively and memorable.

Development of mathematical skills and concepts.

The participating teachers were also asked what kinds of mathematical skills or concepts learners develop most effectively through traditional games and their non-verbatim responses are below.

T5 pointed to counting, addition, subtraction, multiplication, fractions, and problem-solving strategies.

T3 mentioned spatial awareness, recognising patterns, measuring distances, and understanding geometric shapes.

T9 agreed that games provide a practical context for these concepts.

Promotion of problem solving and critical thinking.

When participating teachers were asked how traditional games contribute to learners' problem solving and critical thinking abilities in mathematics, some of their non-verbatim responses are below.

T1 said games require learners to plan, anticipate opponents' moves, and adjust strategies.

T4 observed that learners practise logical reasoning, quick decision-making, and mental calculations.

T8 also mentioned that learners often discuss and justify their moves, which strengthens analytical thinking.

Social and interactive dimensions of learning.

Another sub question was on what role do the social and interactive aspects of traditional games play in mathematics learning and some of the non-verbatim responses from the participating teachers are below.

T10 agreed that traditional games encourage teamwork, communication, and peer learning.

T7 noted that learners often explain rules and strategies to each other, which deepens understanding.

T9 also observed that the social element builds confidence and fosters a sense of community in the classroom.

Challenges and strategies to overcome them.

When teachers were asked on challenges, they faced in using traditional games to teach mathematics, and how they addressed them, some of the non-verbatim responses are below.

T3 cited challenges such as limited time in the syllabus, lack of suitable space, and large class sizes.

T1 mentioned that certain learners were unfamiliar with the games, requiring extra time to teach the rules.

T8 suggested addressing these challenges by selecting simpler games, using improvised materials, or incorporating short game segments into lessons.

4.5 Teachers' awareness and knowledge of traditional games for mathematics teaching and learning.

This research question was guided by theme and sub-themes to facilitate the interview of participating teachers on teachers' awareness and knowledge of traditional games for mathematics teaching and learning.

Theme: Teachers' Awareness and Knowledge of Traditional Games for Mathematics Teaching and Learning

Introduction to the themes.

Teachers' awareness and knowledge of traditional games are central to their effective integration into mathematics teaching and learning. The extent to which teachers are familiar with the games, understand their cultural roots, and can identify their mathematical potential determines how confidently and meaningfully they use them in the classroom. Findings reveal that while most teachers have rich personal experiences with traditional games from childhood, their professional training has not adequately equipped them to transform this cultural resource into a pedagogical tool. Teachers' confidence, curriculum alignment, and recognition of necessary professional skills all shape their perspectives on using traditional games in mathematics lessons.

Sub-themes.

Familiarity with traditional games from childhood and community life.

When teachers were asked on what traditional games are were they familiar with from their own childhood or community experiences, some of their non –verbatim responses are below.

T6, T9,T2, T5 and T3 mentioned games such as Tsoro, Nhodo, Pada, and Fishi-fishi.

T7and T1 noted that these games were a normal part of daily play in their communities, especially in rural settings.

Learning pathways into traditional games.

When asked on how did they first learn about these traditional games (e.g., participation, observation, or both), their non-verbatim responses were as follows.

T10, T8, T4 and T7 reported learning the games through active participation with friends and family during childhood.

T9 and T6 are among others who added that they also learned by watching older children or community members play before joining in themselves.

Experiences of traditional games in formal schooling.

The participating teachers were asked what extent did they experience traditional games being used for learning mathematics during your own schooling and some of their non-verbatim responses were as follows.

Many teachers, like T3, T6, T10 and T8 are among the participating teachers who said they never encountered traditional games in formal mathematics lessons while at school.

A few participating teachers such as T2 and T7 recalled informal counting or sharing activities linked to games, but these were not explicitly presented as mathematics learning tools.

Teacher training and professional preparation.

When teachers were asked if they have received any training, either in pre-service or in-service teacher education, on how to integrate traditional games into mathematics lessons, some of their non-verbal responses were as follows.

Most of the Teachers, T1, T4, T5, T9 and T10 generally reported receiving little to no training in this area.

T2, T3, T6 and T7 noted that traditional games were briefly mentioned in teacher education courses, but without practical demonstrations or guidance on classroom application.

Confidence in identifying mathematical concepts in traditional games.

Teachers were also asked on how confident they feel in identifying mathematical concepts that can be taught using traditional games. The following were some of their non-verbatim responses.

T1, T2, T6 and T10 felt confident about linking them to concepts like counting, patterns, and shapes.

T3, T7, T8, T9, T4 and T5 admitted they struggled to see the direct mathematical connections without more guidance.

Influence of personal experiences on classroom practice.

Another sub question was on how teachers' personal experiences with traditional games influence their decision to use (or not use) them in their mathematics teaching. Some of their non-verbatim responses are below.

T5, T9, T2 who played traditional games often as children felt more motivated to introduce them in lessons, believing they make learning relatable.

T1,T3, and T10 suggested that they tended to use them less since they have limited childhood exposure, citing uncertainty about their educational value.

Understanding of curriculum alignment.

When the participating teachers were asked on their understanding of how traditional games align with the current mathematics curriculum in Zimbabwe, some of their non –verbatim responses were as follows.

T4, T5, T7 acknowledged that the curriculum encourages the use of culturally relevant materials, including traditional games.

T1, T2, T6 and T10 admitted they were unclear on exactly where and how these games fit into specific learning objectives.

Knowledge and skills needed for effective use of games.

Another sub question was on what knowledge or skills do teachers need in order to effectively use traditional games for teaching mathematics and some of their non-verbatim responses were as follows.

T3, T8 and T9 suggested the need for practical training, clear examples of lesson plans, and demonstrations of how to adapt game rules to suit different mathematics topics.

T6 and T10 also emphasised the importance of understanding both the cultural context of the games and their mathematical content.

4.6 Challenges of using traditional games in the mathematics classroom.

Non-verbatim responses from participating teachers for the themes and sub-themes offered a number of challenges of using traditional games in the mathematics classroom.

Theme: Challenges of using traditional games in the mathematics classroom.

Introduction to the themes.

While traditional games carry significant potential for enriching mathematics teaching and learning, teachers encounter a range of challenges when attempting to integrate them into classroom practice. These challenges stem from conceptual uncertainties, curriculum alignment issues, logistical barriers, and pedagogical constraints. Teachers' experiences highlight how difficulties in identifying appropriate games, limited resources, large class sizes, and assessment concerns hinder the effective use of traditional games as pedagogical tools. Additionally, cultural inclusivity and behaviour management present further complexities. The following sub-themes summarise the key challenges identified by teachers.

Sub-themes

Uncertainty in identifying suitable traditional games.

When teachers were asked about difficulties, they have faced in understanding what counts as a traditional game suitable for teaching mathematics, among some of their non-verbatim responses were as following:

T1, T6, and T10 argued that at times, it is unclear which games are actually considered traditional for maths teaching, as there has not been clear guidance.

T3 and T8 asserted that while they recall certain cultural games from their own upbringing, they feel uncertain about whether those games can be applied in maths instruction.

Difficulty in aligning games with the mathematics curriculum.

When asked how easy or challenging it is to connect traditional games with the mathematics curriculum and its learning goals, some of the teachers non-verbatim responses were as follows:

T2 argued that it could be difficult to link the games precisely to the syllabus, especially with exams focusing heavily on written problem solving.

T5 and T9 believed that aligning the games with curriculum requirements without creating extra workload is a struggle.

Time constraints in lesson planning and implementation.

In response to questions about time constraints for preparing, explaining, and playing traditional games during lessons, some of their non-verbatim responses are given below.

T8, T1 and T3 believed that explaining the rules and getting students started could take up too much time, leaving less room for the planned lesson content.

T7 argued that by the time the game is set up and played, there is very little time remaining for discussion or consolidation.

Impact of large class sizes and limited classroom space.

When asked about the impact of large class sizes or limited classroom space, some teachers ‘non-verbatim responses are mentioned below.

T5, T4, T9 and T10 believed that overcrowded classrooms make movement-based games almost impossible to run.

T8, T3 and T7 argued that the lack of adequate space hinders proper setup, and the resulting noise levels become hard to manage.

Shortage of materials and resourses.

Regarding challenges in acquiring materials or equipment for traditional games, some of the teachers' non-verbatim response are given below.

T10 and T6 asserted that some games require special items, such as stones or boards that are not available at school.

T1, T2 and T5 argues that gathering all necessary resources is difficult, particularly in under-resourced teaching environments.

Classroom management and behavioural challenge.

The participating teachers were asked on how they manage classroom control or learner behaviour when using highly interactive traditional games, some of their non-verbatim responses are given below.

T6 and T4 asserted that learners could become overly excited, making it hard to keep the activity maths-focused.

T7, T9 and T10 suggested that competitive behaviour sometimes leads to arguments, disrupting the lesson flow.

Difficulties in assessing mathematical learning through games.

When asked on what challenges have they experienced in assessing students' mathematical learning when using traditional games, some their non-verbatim responses are given below.

T3 argued that it is challenging to gauge exactly what students have learned without using written assessments.

T8 suggested that while games encourage thinking, it is not always possible to demonstrate measurable progress in a format recognised by the school system.

Cultural and inclusivity concerns.

Another sub question was if there was any cultural or inclusivity concerns that arise when selecting traditional games for mathematics lessons and some of their non-verbatim responses were as follows.

T2 felt that some games are familiar only to certain cultural groups, which may leave other students feeling excluded.

T5, T9 and T1 suggested that certain games contain themes that may not align well with the modern classroom setting.

4.7 Summary

The findings reveal that teachers generally view traditional games such as *Tsoro*, *Nhodo*, *Pada*, and *Fishi-fishi* as valuable pedagogical tools for mathematics teaching and learning. These games were recalled by most teachers as a regular feature of their childhood play, especially in rural communities, often learned through participation with peers and family or through observation of older children. However, teachers reported that traditional games were rarely used in their own formal schooling, with only occasional informal links to counting or sharing activities. In their professional training, little to no practical guidance was given on how to integrate these games into mathematics teaching, leaving many teachers with uneven levels of confidence in identifying their mathematical potential. Those with strong personal exposure to the games felt more able and motivated to use them in their classrooms, while others expressed uncertainty and hesitation.

Teachers identified a wide range of mathematical concepts that can be taught effectively through traditional games, including counting, grouping, base systems, addition, subtraction, multiplication, fractions, ratios, measurement, geometry, spatial awareness, and pattern recognition. The games were described as bridging classroom mathematics with learners' everyday experiences, making abstract concepts more concrete and relatable. For instance, counting stones in *Tsoro* or *Nhodo* mirrors home-based counting activities, while the shapes and patterns in *Fishi-fishi* connect to environmental contexts familiar to learners. Teachers also

noted that the cultural relevance of these games fosters learner pride, confidence, and a sense of ownership over mathematics, while simultaneously preserving heritage.

Beyond content knowledge, teachers highlighted how traditional games promote problem-solving, logical reasoning, and critical thinking. Learners are required to plan moves, anticipate outcomes, adjust strategies, perform mental calculations, and justify their decisions, as seen in optimising moves in *Tsoro* or predicting rope movements in *Fishi-fishi.* The social and interactive aspects of games were also recognised as valuable, encouraging teamwork, peer explanations, communication, and collaboration, which deepen understanding and build classroom community. Furthermore, teachers observed that learners respond with high levels of motivation and participation when games are included in lessons. Games reduce anxiety, create a lively and memorable learning environment, and even engage shy learners, with many students eagerly requesting to repeat the activities.

Teachers reported adapting game rules to suit mathematics objectives, such as using one-to-one distribution in *Tsoro* to explain division, modifying scoring systems to emphasise fractions or decimals, or simplifying rules for younger learners to focus on counting and shapes. These adaptations were seen as essential to aligning games with specific mathematical procedures and curriculum needs. Teachers also valued the development of transferable skills such as concentration, patience, resilience, and respect for others which support mathematics learning by improving focus, persistence, and cooperation.

Despite these benefits, teachers identified significant challenges in using traditional games in mathematics classrooms. Some expressed uncertainty about what qualifies as a suitable traditional game for instruction, citing a lack of clear guidelines. Others struggled with aligning games to curriculum demands, particularly within exam-oriented systems that emphasise written assessments. Time constraints posed a major barrier, as explaining rules, organising play, and managing discussions often consumed much of the lesson. Large class sizes, overcrowded classrooms, and limited space further restricted the feasibility of movement-based activities, while noise and excitement during play sometimes led to classroom management issues. Material shortages, particularly in under-resourced schools, made it difficult to provide the items required for certain games. Teachers also noted challenges in assessing learners' mathematical progress through games, as such activities do not always yield outcomes measurable by conventional assessment standards.

Cultural and inclusivity concerns were also highlighted, as some games were only familiar to certain cultural groups, risking exclusion of others, while a few contained themes considered less appropriate for contemporary classrooms. These findings underscore that while traditional games hold strong pedagogical and cultural value, their effective integration requires clearer curriculum alignment, adequate resources, manageable class conditions, and professional training that equips teachers with practical strategies for adapting and implementing games in mathematics teaching.

4.8 Discussion

4.8.1 Mathematics pedagogical characteristics embedded in Zimbabwe's traditional game

The findings reveal that teachers view traditional games such as Tsoro, Pada, Nhodo, and Fishi-fishi as valuable tools for teaching a wide range of mathematical concepts, including counting, grouping, base systems, addition, subtraction, geometric patterns, fractions, ratios, and measurement. This is consistent with the results from the past studies. A research by Moyo and Chinamasa (2022) in the Makonde district revealed that games such as Tsoro are effective in teaching fundamental mathematical concepts like counting, sets, addition, and subtraction with concrete objects. These games provide learners with hands-on experiences that deepen their understanding of numeracy.

The results of the study showed that teachers noted that these games bridge the gap between classroom mathematics and everyday life by situating abstract concepts in familiar cultural contexts. For example, counting stones in Tsoro or Nhodo mirrors everyday counting activities at home, while the shapes and patterns in Fishi-fishi reflect those learners encounter in their environments. This is in agreement with the results from the previous studies. A study by Madondo and Tsikira (2022) emphasize that games like Tsoro and pada, are deeply embedded in Zimbabwean rural communities and serve as culturally familiar tools for teaching foundational numeracy skills. By using these games, teachers enable learners to relate mathematical ideas such as counting, number recognition, and matching to their own lived environments, fostering meaningful learning.

The results of the study also revealed that beyond content knowledge, the games were said to enhance problem-solving and critical thinking by encouraging strategic planning, anticipation of outcomes, and adaptability, as seen in decisions like choosing the optimal starting hole in Tsoro or predicting rope movements in Fishi-fishi. This is in line with previous results of the past studies. A study by Nxumalo and Mncube (2019) found that the use of traditional games promote problem-solving skills in the lessons of school mathematics. A similar study by Madondo and Tsikira (2022) reported that participation in these games sharpens learners' observation skills, strategic thinking, and social norms such as turn taking and respect for others. Such cognitive and social skills are integral to mathematical problem solving and reasoning (Madondo & Tsikira, 2022).

The findings from the teachers' interview showed that cultural relevance of these games was described as fostering learner pride, confidence, and a sense of ownership over mathematics, while also preserving heritage. This is agreement with the results from the past studies. According to Moyo and Chinamasa (2022), the cultural relevance of traditional games is repeatedly noted as a key factor in their effectiveness as teaching tools. Because these games originate from the communities where learners live, they provide an authentic cultural context that makes mathematics instruction more relatable and engaging (Moyo & Chinamasa, 2022). This connection supports the view that grounding mathematics teaching in cultural heritage enhances learners' conceptual understanding and motivation (Madondo & Tsikira, 2022).

The findings of the study also revealed that teachers observed that integrating traditional games into lessons increased motivation, participation, and collaboration, with learners showing eagerness to engage and reduced anxiety toward difficult tasks. This is consistent with the results from the past studies. Mosimege (2020) argues that although explicit research on motivation is limited, evidence suggests that learners show greater participation and enthusiasm when mathematics lessons incorporate traditional games. The familiarity and enjoyment associated with these games encourage active engagement and willingness to learn, which is critical for effective education in numeracy (Madondo & Tsikira, 2022).

The findings of the study also revealed that rules and strategies of the games were often adapted to reinforce specific mathematical procedures, such as using one-to-one distribution in Tsoro to explain division or Pada's sequences to illustrate counting patterns. This is in line with the studies from the past. A study by Moloi et al (2021) showed that teachers have also reported

using the inherent rules and strategies of games such as Nhodo to illustrate mathematical procedures like addition and subtraction. By embedding mathematical operations into game rules, teachers create a natural and intuitive learning environment where concepts are experienced through play, enhancing understanding and retention (Madondo & Tsikira, 2022).

The results of the study revealed that the games developed transferable skills such as teamwork, patience, communication, concentration, and resilience, which support mathematics learning by improving focus, instruction following, and perseverance. This is consistent with the results from the previous studies. According to a study by Nyanhongo (2015), traditional games help learners develop a range of broader competencies such as psychomotor skills like hand–eye coordination, communication, concentration, and social interaction. These skills support mathematics learning by fostering the mental and social abilities required to engage with mathematical tasks effectively (Moyo & Chinamasa, 2022; Madondo & Tsikira, 2022).

The findings of the study also revealed that challenges include limited syllabus time, large class sizes, restricted outdoor space, lack of necessary materials, and the need to teach unfamiliar games to some learners before applying them to mathematics. This is in line with the results from the previous studies. Studies Nyanhongo (20150 and Moloi et al (2021) revealed that many teachers prefer Western-style games or teaching methods, often due to limited familiarity with indigenous games and a lack of professional training on how to integrate them pedagogically. This knowledge gap, coupled with insufficient instructional resources, restricts the effective incorporation of traditional games in mathematics education (Moyo & Chinamasa, 2022; Madondo & Tsikira, 2022).

4.8.2 Experiences and perspectives of primary school teachers in the use of traditional games in the mathematics classroom.

Teachers reported that learners generally respond with high enthusiasm and active participation when traditional games are incorporated into mathematics lessons. Such activities spark excitement, reduce anxiety, and create a relaxed learning atmosphere that encourages even shy learners to engage. Learners often look forward to these sessions, request repeats, and display increased energy and willingness to participate. This is in line with the findings from past studies. Studies such as those by Moyo and Chinamasa (2022) reveal that learners generally respond positively when traditional games are incorporated into mathematics lessons. The familiarity of these games encourages active participation and enjoyment, making mathematics more accessible and less intimidating. Learners are often more willing to engage, as the games

resonate with their cultural background and daily experiences, thus creating a comfortable and motivating learning environment.

Similarly, the study done by Bustamante et al., (2022), established that most teachers have the view that traditional games that were motivating and modifiable were important to integrating a traditional game because the teacher could better align the games to meet student's academic needs. Similarly, a study by Grace (2019), noted that learners become strongly motivated, they immerse themselves in the activity allowed for by traditional game, and over a period should enhance their attitude towards the subject. Thus, the motivation generates excitement and involvement in mathematical activity.

The results of the study also revealed that when selecting games, teachers consider factors such as the game's relevance to the mathematics topic, the age and ability levels of the learners, the availability of space and materials, and the time available within the lesson. This is in agreement with the results from the previous studies. According to Madondo and Tsikira (2022), teachers consider several factors before integrating traditional games in their teaching and these include the relevance of the game to specific mathematical concepts, the availability of necessary materials, the size and physical space of the classroom, and learners' cultural backgrounds. Moreover, the alignment of the game's mechanics with curriculum objectives plays a crucial role in the decision-making process.

The findings of the study showed that modifications of games are common when teaching mathematics using traditional games to better suit their teaching goals; for instance, some teachers adjust scoring systems to focus on fractions or decimals, add quick problem-solving challenges before a move, or simplify rules for younger learners to emphasise basic counting or shape recognition. This is in agreement with the results from the previous studies. A study by Moyo and Chinamasa (2022) showed that teachers modified games like Tsoro by altering the number of stones used or adjusting rules to emphasize particular mathematical operations such as addition or subtraction. Such modifications help tailor the games to meet specific lesson objectives and accommodate learners' varying skill levels.

The findings of the study showed that traditional games were seen to boost motivation and engagement by introducing fun, competition, and novelty into lessons. Learners often become so immersed in play that they practise mathematics without consciously realising it, and the lively, memorable environment helps maintain attention. This is in agreement with the results

from the previous studies. Madondo and Tsikira (2022) note that learners exhibit increased enthusiasm and sustained attention during lessons involving traditional play, compared to conventional teaching methods. The interactive nature and cultural familiarity of the games foster a sense of belonging and enjoyment, which supports sustained interest in mathematics learning.

The results of the study also showed that traditional games most effectively reinforce skills such as counting, addition, subtraction, multiplication, fractions, spatial awareness, pattern recognition, measurement, and geometry. This is in line with results from the past studies. Zimbabwean research identifies counting, number recognition, addition, subtraction, and understanding of sets as some of the mathematical skills most effectively developed through traditional games (Moyo & Chinamasa, 2022). Games like Pada and Nhodo provide hands-on experiences that enhance learners' grasp of these foundational concepts, reinforcing classroom instruction through concrete manipulation.

The findings of the study also highlighted the role of teachers in strengthening problem-solving and critical thinking. Games require learners to plan moves, anticipate opponents' actions, adjust strategies, and perform mental calculations. Discussions about moves encourage logical reasoning, quick decision-making, and analytical thinking. This is in agreement with the results from the past studies. Madondo and Tsikira (2022) highlight that gameplay requires learners to strategize, anticipate opponents' moves, and apply logical reasoning skills directly transferable to mathematical problem solving. The social dynamics of these games also stimulate reflective thinking and collaborative problem solving (Rice, 2018).

The result of the study also showed that the social and interactive elements that affect the teaching of mathematics using traditional games include teamwork, communication, peer explanation, and shared strategies and were seen as valuable for deepening understanding, building confidence, and fostering a sense of classroom community. This is in line with the results from the past studies. The study by Grace (2019) established that social and interactive elements of traditional games are fundamental to their educational value. Interaction among learners during gameplay fosters communication, negotiation, and teamwork, which enrich mathematical learning (Madondo & Tsikira, 2022). These social engagements also help learners articulate their reasoning and internalize mathematical concepts through peer discussion and shared experiences (Hasana & Alifiani, 2019).

The findings of the study also revealed that challenges include limited instructional time; inadequate space, large class sizes, and some learners' unfamiliarity with certain games have been addressed by choosing simpler games, using improvised materials, and integrating short, focused game segments into their lessons. This is in line with the result from the previous studies. Despite the benefits of teaching mathematics using traditional games, teachers face challenges in using traditional games, such as limited resources, large class sizes, and insufficient training on how to integrate games effectively (Moyo & Chinamasa, 2022). According to the study by Moyo and Chinamasa (2022),to address these, some teachers have creatively modified games to fit classroom constraints, sought support from colleagues, and advocated for professional development opportunities focused on culturally responsive pedagogies.

4.8.3 Teachers' awareness and knowledge of traditional games for mathematics teaching and learning.

The findings from the study showed that teachers recalled being familiar with traditional games such as Tsoro, Nhodo, Pada, and Fishi-fishi, often alongside local variations unique to their home communities. This is consistent with the results from the past studies. Research by Moyo and Chinamasa (2022) indicates that many teachers recall a variety of traditional games from their childhood and community life. Commonly mentioned games include Tsoro, Pada, Nhodo, and Fishi-fishi, which are widely known in rural and urban settings across Zimbabwe.

The findings of the study revealed that teachers typically learned about these games both through active participation as children and by observing others within their communities, highlighting the role of cultural transmission in sustaining indigenous play activities. This is in agreement with the results from the previous studies. The study by Boluk and LeMieux (2017) established that these games were a regular part of childhood play, particularly in rural settings, and were usually learned through active participation with friends and family, sometimes supplemented by observation of older children or community members before joining in.

The results of the study indicated that most teachers reported that during their own schooling, traditional games were rarely, if ever, used in formal mathematics lessons. While a few remembered informal counting or sharing activities linked to games, these were not explicitly framed as mathematics learning tools. This is in agreement with the study from the past. According to the study by Boluk and LeMieux (2017), several teachers spoke of their own

experiences learning mathematics through playing traditional games with other members of the community as part of their cultural life but not in their formal mathematics lessons.

The results of the study showed that teachers did not receive little to no instruction on integrating traditional games into mathematics teaching during their professional training. This is consistent with the findings from the past studies. Heath (2017) and Williams (2017) found that most Zimbabwean teachers did not experience the use of traditional games in their pre-service or in-service training. This lack of formal exposure translates into a gap between teachers' cultural knowledge of games and their pedagogical application in mathematics classrooms.

The results from the study also established that confidence of teachers in identifying mathematical concepts within traditional games varied. The result of the study revealed that teachers with extensive personal experience of these games felt able to link them to concepts such as counting, patterns, and shapes, while others struggled to make clear connections without further guidance. This is in line with the findings from the previous studies. Madondo and Tsikira (2022) suggest that while many teachers recognize basic numeracy concepts such as counting and balancing in games like Tsoro and Pada, they often lack deeper pedagogical knowledge to effectively link these games with broader curriculum goals. This uncertainty affects their willingness to incorporate traditional games regularly in lessons.

The findings of the study also showed that personal experiences of teachers also influenced teaching practices such as those who had played traditional games frequently as children were more inclined to use them, seeing their potential to make mathematics relatable, whereas those with limited exposure tended to use them less due to uncertainty about their educational value. This is in agreement with results from the past studies. The study by Moyo and Chinamasa (2022) report that teachers who actively engaged with traditional games during childhood are more inclined to integrate them into their instruction, valuing the cultural relevance and learner engagement these games foster. Conversely, those less familiar tend to rely on conventional teaching methods.

The findings of the study revealed that while many teachers acknowledged that the Zimbabwean mathematics curriculum promotes the use of culturally relevant resources, including traditional games, they admitted a lack of clarity on where these games fit into specific learning objectives. This is consistent with the findings from the previous studies.

While the curriculum encourages culturally responsive teaching, including the use of indigenous games, many teachers have limited understanding of how to operationalize this guidance in practice (Madondo & Tsikira, 2022; Moyo & Chinamasa, 2022). This gap highlights a need for clearer curricular frameworks and instructional support.

The results of the study also showed that teachers agreed that effective integration of the use traditional games in the teaching and learning mathematics requires practical training, concrete lesson examples, and demonstrations on adapting game rules to different mathematics topics. The results of the study also stressed the importance of understanding both the cultural significance of the games and their underlying mathematical concepts. This is in line with the results from the previous studies. Studies by Williams (2017) and Heath (2017) reported that teachers express a need for specific knowledge and skills to use traditional games effectively in mathematics teaching. This includes training on selecting appropriate games, modifying game rules to meet learning objectives, classroom management during game activities, and linking game experiences explicitly to mathematical concepts (Williams, 2017; Heath, 2017).

4.8.4 Challenges of using traditional games in the mathematics classroom.

The results of the study showed that teachers reported several challenges in using traditional games for mathematics teaching. The result of the study showed that teachers was uncertainty over what qualifies as a traditional game suitable for classroom use, with many saying they lacked clear guidelines and felt unsure about adapting cultural games from their own childhood for mathematics lessons. This is consistent with the results from previous studies. Moyo and Chinamasa (2022) observed that many teachers lack a standardized definition or criteria, leading to uncertainty about which games can effectively support mathematical learning. This ambiguity is compounded by varied interpretations of traditional games across different communities, making it harder for teachers to select appropriate games confidently.

The result of the study also showed that aligning games with the formal curriculum and specific learning objectives was also seen by participating teachers as challenging, particularly given the exam-oriented focus on written problem-solving. The result of the study also show that some teachers felt that integrating games risked becoming extra work rather than directly supporting syllabus content. This is in line with the results from the previous studies. Madondo and Tsikira (2022) found that teachers struggle to map game activities to particular mathematical concepts such as fractions, geometry, or number patterns. The curriculum's general references to cultural activities often lack detailed guidance, leaving teachers to

independently bridge this gap, which can be a complex and time-consuming process. Teachers may struggle to clearly map game mechanics to measurable outcomes in areas such as algebra, geometry, or statistics (Avdiu, 2020). This misalignment can lead to reduced instructional efficiency and difficulties in assessment.

The findings from the study revealed that time management emerged as another barrier, as preparing, explaining, and playing the games often consumed much of the lesson, leaving limited time for discussion or follow-up activities. This is in agreement with the results from the past studies. According to Moyo and Chinamasa (2022), preparing, explaining, and facilitating gameplay requires more instructional time than traditional teaching methods. This implies that the lengthy process of setting up games, demonstrating rules, and allowing sufficient playtime is difficult to accommodate within tight lesson schedules, especially in exam-focused environments.

A similarly study by Çelik, (2019) found that traditional games often require extended time for explanation, play, and debriefing. In tightly packed curricula, especially in exam-focused systems, there may not be enough time to incorporate such activities meaningfully (Çelik, 2019).. This implies that traditional games required more instructional time than was scheduled in the timetable. Çelik, (2019) argues that in addition to the extra instructional time required, the practice of using games requires more time for pre-lesson and post-lesson organizational activities especially in their large classes. Thus, more time is needed to prepare lessons, set up the traditional games, and organize learners into groups.

The findings of the study showed that large class sizes and limited space made organising movement-based games impractical, while noise levels during play could become disruptive. This is in line with the results from the past studies. Bustamante et al. (2022) note that overcrowded classrooms restrict movement and make organizing interactive game sessions challenging. Limited physical space often prevents the implementation of games that require room for active participation, causing teachers to avoid using them or to modify games in ways that may reduce their educational effectiveness (Bustamante et. 2022).

The results of the study showed that material shortages also posed a problem, especially for games requiring specific items like stones, boards, or ropes, which were not always available in under resourced schools. This is consistent with the results from the previous studies. Russo et al. (2023) highlight that some traditional games require specific items, such as stones, sticks,

or drawn playing areas, which are not always readily available in under-resourced schools. This scarcity forces teachers either to improvise with unsuitable materials or to exclude these games altogether from their teaching repertoire.

Furthermore, the results of the study revealed that maintaining classroom control during teaching mathematics using games was described by participating teachers as difficult, with excitement sometimes leading to loss of focus or competitive arguments among learners. This is in agreement with the results from the previous studies. Large, energetic groups playing games can lead to distractions and disciplinary issues, as reported by Moyo and Chinamasa (2022). Teachers often find it difficult to maintain order and ensure that all learners remain focused on the mathematical objectives of the activity, necessitating strong classroom control skills.

The findings of the study showed that assessing mathematical learning through games presented further challenges, as teachers found it hard to measure progress without traditional written assessments recognised by the school system. This is in line with the results from the previous studies. Studies by Çelik (2019) and Madondo and Tsikira (2022) found that standardized assessments do not easily reflect skills developed through games, such as strategic thinking and collaboration, making it hard for teachers to measure and report student outcomes effectively.

Lastly, the result of the study showed that some games were familiar only to certain cultural groups, potentially excluding others, and a few contained themes considered unsuitable for modern classroom contexts. This is consistent with results of previous studies. The study by Avdiu (2020) note that some traditional games may not be culturally neutral or appropriate for diverse classrooms. A study by Podsakoff, et al., (2016) established certain games might unintentionally exclude or alienate learners from different ethnic or social backgrounds, or involve gender roles that limit participation. Therefore, teachers must carefully consider the cultural context and inclusivity when choosing games to ensure equitable learning opportunities for all students.

CHAPTER 5 : SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of research study, conclusions and recommendations based on the findings of the study.

5.2 Summary.

5.2.1 Mathematics pedagogical characteristics embedded in Zimbabwe's traditional game.

The study found that teachers regard traditional Zimbabwean games such as *Tsoro*, *Pada*, *Nhodo*, and *Fishi-fishi* as valuable tools for teaching a broad range of mathematical concepts, including counting, grouping, base systems, addition, subtraction, geometric patterns, fractions, ratios, and measurement. These games offer hands-on experiences that help learners connect abstract mathematical ideas to familiar cultural contexts, thereby bridging the gap between classroom learning and everyday life.

Consistent with prior research (e.g., Moyo & Chinamasa, 2022; Madondo & Tsikira, 2022), the games' cultural relevance fosters learner pride, confidence, and ownership over mathematics while preserving heritage. For example, counting stones in *Tsoro* or *Nhodo* mirrors home activities, while patterns in *Fishi-fishi* reflect environmental shapes. Teachers reported that these games enhance motivation, participation, and collaboration, reducing anxiety toward challenging tasks. The enjoyment and familiarity associated with play encourage active engagement.

Beyond mathematical content, traditional games promote cognitive and social skills integral to problem solving, such as strategic thinking, anticipation, adaptability, observation, turn taking, and respect for others. Teachers also adapt the games' rules and strategies to illustrate specific

mathematical procedures, such as division in *Tsoro* or counting patterns in *Pada*, creating intuitive and memorable learning experiences.

The games further develop transferable skills such teamwork, patience, communication, concentration, and resilience that support mathematical learning by improving focus and persistence. These findings echo earlier studies (e.g., Nxumalo & Mncube, 2019; Nyanhongo, 2015) that highlight the broader competencies gained from traditional games.

However, challenges remain. Teachers cited limited syllabus time, large class sizes, restricted space, lack of materials, and the need to teach unfamiliar games before linking them to mathematics. Additionally, some educators prefer Western teaching methods, often due to unfamiliarity with indigenous games or lack of professional training in integrating them effectively. This knowledge gap and shortage of instructional resources limit the full potential of traditional games in mathematics education.

5.2.2 Experiences and perspectives of primary school teachers in the use of traditional games in the mathematics classroom.

The study revealed that integrating traditional games into mathematics lessons generates high enthusiasm, active participation, and a relaxed learning atmosphere that encourages even shy learners to engage. Learners often look forward to such sessions, request repeats, and display increased motivation and willingness to participate. This positive response aligns with earlier studies (Moyo & Chinamasa, 2022; Grace, 2019) which note that cultural familiarity and enjoyment make mathematics more accessible, reduce anxiety, and sustain interest.

When selecting games, teachers consider factors such as their relevance to the mathematics topic, learner age and ability, available space and materials, and lesson time. They also assess how well the game's mechanics align with curriculum objectives. Modifications are common to tailor games to specific teaching goals such as adjusting scoring systems for fractions, simplifying rules for younger learners, or altering equipment to emphasise addition, subtraction, or shape recognition (Moyo & Chinamasa, 2022).

Traditional games were found to enhance motivation and engagement by introducing fun, competition, and novelty. Learners often practise mathematics subconsciously while immersed in play, and the interactive, memorable environment helps maintain attention (Madondo &

Tsikira, 2022). These games most effectively reinforce skills such as counting, number recognition, addition, subtraction, multiplication, fractions, spatial awareness, pattern recognition, measurement, and geometry, with hands-on activities like *Pada* and *Nhodo* providing concrete experiences that strengthen conceptual understanding.

Teachers reported that traditional games also develop problem solving and critical thinking skills. Gameplay requires planning, anticipating opponents' actions, adjusting strategies, and performing mental calculations, which foster logical reasoning and decision-making. Social and interactive elements such as teamwork, peer explanation, and shared strategies, deepen understanding, build confidence, and promote a sense of classroom community (Grace, 2019; Hasana & Alifiani, 2019).

Despite these benefits, challenges include limited instructional time, large class sizes, inadequate space, and some learners' unfamiliarity with certain games. Teachers address these constraints by choosing simpler games, improvising materials, shortening game segments, and collaborating with colleagues. However, insufficient training in integrating traditional games remains a barrier, prompting calls for professional development in culturally responsive pedagogies (Moyo & Chinamasa, 2022).

5.2.3 Teachers' awareness and knowledge of traditional games for mathematics teaching and learning.

The study found that teachers were generally familiar with traditional games such as *Tsoro*, *Nhodo*, *Pada*, and *Fishi-fishi*, often alongside local variations unique to their communities. This familiarity was acquired mainly through active participation and observation during childhood, reflecting the role of cultural transmission in preserving indigenous play. While many teachers had personal experience with these games, most reported that they were rarely used in formal mathematics lessons during their own schooling, and few had encountered them in teacher training programmes.

A significant gap emerged between teachers' cultural knowledge of games and their pedagogical application in mathematics. Confidence in linking games to mathematical concepts varied: teachers with extensive personal experience could identify connections to skills such as counting, patterns, and shapes, whereas others struggled without additional guidance. Personal history influenced teaching practice such that those who played the games

frequently as children were more inclined to integrate them into lessons, while those with limited exposure relied more on conventional teaching methods.

Although the Zimbabwean mathematics curriculum promotes culturally relevant resources, including traditional games, many teachers lacked clarity on how these fit into specific learning objectives. This uncertainty, combined with limited formal training, hindered effective integration. Teachers stressed the need for practical support, including targeted professional development, concrete lesson examples, and demonstrations on adapting game rules to mathematics topics. Effective use, they agreed, requires understanding both the cultural significance and the underlying mathematical concepts of the games, as well as skills in classroom management and curriculum alignment.

5.2.4 Challenges of using traditional games in the mathematics classroom.

The study identified several challenges teachers face when using traditional games for mathematics instruction. A key difficulty was uncertainty over which games qualify as appropriate for classroom use, stemming from the absence of clear guidelines and varying definitions across communities. This lack of standardisation made it harder for teachers to select games confidently and adapt them for mathematical learning.

Teachers also struggled to align games with formal curriculum requirements and specific learning objectives, particularly within exam-oriented systems. The limited guidance in the curriculum on linking cultural activities to measurable mathematical outcomes left educators to make these connections themselves, often-making integration time-consuming and potentially inefficient.

Time management emerged as another major barrier, as preparing, explaining, and facilitating gameplay consumed significant lesson time, leaving little space for follow-up activities. Large class sizes, restricted physical space, and noise levels further complicated the organisation of movement-based games. Material shortages, particularly in under-resourced schools, also forced teachers to improvise or avoid certain games.

Classroom management was reported as challenging, with learner excitement sometimes leading to loss of focus, arguments, or disruptions. Assessing learning outcomes through games

was another difficulty, as the skills developed, such as strategic thinking and collaboration, were not easily captured by standard written assessments.

Lastly, cultural inclusivity posed challenges. Some games were familiar only to certain cultural groups or contained themes considered inappropriate for contemporary classrooms, raising concerns about equity and inclusivity in diverse learning environments.

5.3 Conclusions.

The study demonstrated that traditional games such as *Tsoro*, *Pada*, *Nhodo*, and *Fishi-fishi* hold significant potential as culturally relevant tools for enhancing mathematics teaching and learning. Teachers reported that these games effectively support the development of diverse mathematical concepts, including counting, operations, patterns, geometry, fractions, and measurement, while fostering problem-solving, critical thinking, and transferable social skills such as teamwork, communication, and resilience. Learners generally respond with high enthusiasm, showing increased participation, motivation, and reduced anxiety when games are incorporated into lessons. This engagement stems from the games' cultural familiarity, interactive nature, and capacity to bridge the gap between abstract mathematics and everyday life.

However, the findings also reveal notable challenges that limit the consistent and effective use of traditional games. These include uncertainty over which games are suitable for classroom use, difficulty-aligning games with curriculum objectives, time constraints, large class sizes, inadequate space, shortages of materials, and the need for strong classroom management during gameplay. Assessing mathematical learning through games is complicated by the mismatch between the skills developed and the demands of standardised written assessments. Additionally, issues of cultural inclusivity arise when certain games are familiar only to specific groups or contain themes deemed inappropriate for modern classrooms.

Teachers' personal experiences and familiarity with traditional games strongly influence their willingness and confidence to integrate them into mathematics lessons. While the national curriculum encourages culturally responsive teaching, many educators lack the training, practical guidance, and clear curricular frameworks needed to link games effectively to learning outcomes. Addressing these gaps through targeted professional development, provision of resources, and structured lesson models could enable teachers to harness the full

educational value of traditional games, thereby enriching mathematics instruction with culturally grounded, engaging, and conceptually meaningful learning experiences.

5.4 Recommendations

Based on the findings, it is recommended that deliberate efforts be made to integrate traditional games into mathematics teaching as culturally relevant and pedagogically valuable resources. Teacher training programmes, both pre-service and in-service, should include practical modules on identifying suitable traditional games, aligning them with curriculum objectives, and adapting their rules to teach specific mathematical concepts. Such training should provide clear guidelines, concrete lesson examples, and demonstrations that illustrate how games can reinforce skills such as counting, operations, geometry, fractions, and problem-solving, while also developing social competencies like teamwork and communication.

The Ministry of Education and curriculum developers should offer explicit guidance within the mathematics syllabus on the use of traditional games, including suggested activities for different topics and strategies for assessing learning outcomes that go beyond standard written tests. Schools should be encouraged to create supportive environments for game-based learning by allocating adequate lesson time, providing necessary materials, and utilising available spaces effectively.

To address challenges of large class sizes, limited space, and diverse cultural backgrounds, teachers should be supported with strategies for modifying games to suit different contexts and for ensuring inclusivity so that all learners can participate meaningfully. Collaboration among teachers through professional learning communities could facilitate the sharing of resources, culturally diverse games, and classroom management strategies.

Finally, ongoing research and documentation of effective practices should be encouraged to build a robust body of evidence on the role of traditional games in mathematics education, ensuring that future policy and practice are informed by tested, and culturally responsive pedagogies.

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Appendix

INTERVIEW SCHEDULE

Research Question 1: What mathematics pedagogical characteristics are embedded in Zimbabwe's traditional games?

Sub Questions

1. Which specific mathematical concepts (e.g., counting, ratios, and geometry, balancing) do you think are best taught through traditional games?
2. How do traditional games such as Pada, Tsoro, Nhodo, or Fishi-fishi help learners connect classroom mathematics to their everyday experiences?
3. In your experience, how do traditional games enhance learners' problem-solving and critical thinking skills in mathematics?
4. What role does cultural relevance play when teaching mathematics through traditional games?
5. How do learners respond (in terms of motivation and participation) when mathematics lessons include traditional games?
6. Can you describe how you integrate rules and strategies of traditional games into teaching mathematical procedures or concepts?
7. What skills beyond mathematics (e.g., social skills, reasoning, and coordination) do learners acquire through these games, and how do these skills support mathematics learning?
8. What challenges or limitations do you face when using traditional games as a tool for teaching mathematics?

Research Question 2: What are the experiences and perspectives of primary school teachers in the use of traditional games in the mathematics classroom?
Sub Questions.

1. From your experience, how do learners generally respond when traditional games are used in mathematics lessons?

2. Which factors do you consider when deciding whether to integrate a particular traditional game into your mathematics teaching?

3. Can you describe any examples where you modified the rules of a traditional game to better meet your mathematics teaching objectives?

4. In your view, how do traditional games influence learners' motivation and engagement in mathematics learning?

5. Based on your experience, what kinds of mathematical skills or concepts do learners develop most effectively through traditional games?

6. How do traditional games contribute to learners' problem-solving and critical thinking abilities in mathematics?

7. In your opinion, what role do the social and interactive aspects of traditional games play in mathematics learning?

8. What challenges have you faced in using traditional games to teach mathematics, and how have you addressed them?

Research Question 3: What are the teachers' awareness and knowledge of traditional games for mathematics teaching and learning?
Sub Questions.

1. What traditional games are you familiar with from your own childhood or community experiences?

2. How did you first learn about these traditional games (e.g., participation, observation, or both)?

3. To what extent did you experience traditional games being used for learning mathematics during your own schooling?

4. Have you received any training, either in pre-service or in-service teacher education, on how to integrate traditional games into mathematics lessons?

5. How confident do you feel in identifying mathematical concepts that can be taught using traditional games?

6. How do your personal experiences with traditional games influence your decision to use (or not use) them in your mathematics teaching?

7. What is your understanding of how traditional games align with the current mathematics curriculum in Zimbabwe?

8. In your view, what knowledge or skills do teachers need in order to effectively use traditional games for teaching mathematics?

Research Question 4: What are the challenges of using traditional games in the mathematics classroom?

Sub Questions.

1. What difficulties, if any, have you experienced in understanding what qualifies as a traditional game for mathematics teaching?

2. How easy or difficult do you find it to align traditional games with the mathematics curriculum and specific learning objectives?

3. Have you faced challenges related to the time required to prepare, explain, and play traditional games during lessons? If so, how?

4. How do large class sizes or limited classroom space affect your ability to use traditional games in teaching mathematics?

5. What issues, if any, have you encountered with obtaining the materials or equipment needed for traditional games?

6. How do you manage classroom control or learner behaviour when using highly interactive traditional games?

7. What challenges have you experienced in assessing students' mathematical learning when using traditional games?

8. In your experience, are there any cultural or inclusivity concerns that arise when selecting traditional games for your mathematics lessons?

SAMED

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BINDURA UNIVERSITY OF SCIENCE EDUCATION

Date: 26 June 2025

TO WHOM IT MAY CONCERN

NAME: MUDURU NIKITA REGISTRATION NUMBER: B2268600

PROGRAMME: BSc Edmt PART: 2.2

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

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

Exploring Traditional Zimbabwean games for Teaching mathematical concepts at primary school level.

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

Your co-operation and assistance is greatly appreciated.

Thank you

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BINDURA

Ndamo (Dr.)
CHAIRPERSON - SAMED

THE SCHOOLS INSPECTOR
27 JUN 2025