International Journal of Education Humanities and Social Science

ISSN: 2582-0745
Vol. 5, No. 04; 2022

MATHEMATICS PEDAGOGICAL CHARACTERISTICS OF TRADITIONAL GAMES: CASE OF TSORO IN PRIMARY SCHOOLS IN ZIMBABWE

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https://doi.org/10.54922/IJEHSS.2022.0412

ABSTRACT

This study explored mathematics pedagogical characteristics of traditional games for primary school mathematics instruction. It was motivated by observing that, play is every child's serious business and traditional games were unpopular for mathematics instruction. The study was guided by the pragmatism philosophy which aims to establish what works under the prevailing social circumstances. Pragmatism enhanced field data collection by mixing qualitative and quantitative approaches. Data was collected from purposive samples of 56 teachers and 126 pupils from 8 primary schools in Makonde district of Mashonaland West Province in Zimbabwe. Questionnaires followed by focus group discussions gathered teachers' individual and group perceptions on the use of games for primary school mathematics instruction. Data collection on the types of games children played was done by observing them play during lunch hour. Interviews with both children and teachers enhanced deduction of pedagogical insights and activity interpretation. A hypothesis test revealed an association between games and gender. This study settled for tsoro variation of holes and stones which is most popular in Chitomborwizi cluster. The study found that, traditional games free children from language restrictions and are good children socialization activities, hence appropriate for lower primary school whose main purpose is the development of socialization and literacy. Observations showed that, games develop children's psychomotor skills, communication, concentration and hand to eye coordination. During games, children are active, make choices and practice numeracy computational skill to mastery level. Mathematical concepts embedded in tsoro include sets, counting, addition and subtraction of whole numbers. Its use of concrete objects improves pupil`s understanding of whole number concepts. Teachers' have limited knowledge of traditional game-based pedagogical instruction. Consequently, the study recommends teachers' staff development workshops for awareness, creative skills application of traditional tsoro for primary school mathematics instruction and traditional games book authoring.

Key Words: Mathematics teaching, Traditional games, Tsoro, primary school.

1. INTRODUCTION

According to Fenske (2016) play is every child`s serious business. Play is a spontaneous activity effectively communicated through children's local languages. In fact, Zimbabweans have a rhetoric greeting, "*wariseyi vana*? How are the children?" The rhetoric response is, "*vanotamba hawo*." Meaning that, they are *well and playful*. Play specifically mathematics games using local languages, must be the conduit for every serious primary school subject instruction.

ISSN: 2582-0745
Vol. 5, No. 04; 2022

Oldfield (1991:383) provides characteristic functions of pedagogical mathematics games as a pedagogical child activity that:

- has specific mathematical cognitive objectives. This is a teacher's role.
- [requires] students to use mathematical knowledge to achieve content-specific goals and outcomes in order to win the game. In tsoro, counting, sharing and one-to-one matching is promoted.
- has enjoyable inherent activities with potential students' self- engagement.
- 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. This is a socialization motivating function.
- includes elements of mathematics knowledge, skills, strategy, and luck.
- has a specific objective and a distinct finishing point.

Logically then, Zimbabwe's indigenous Shona traditional games are rich sources of mathematics instructional activities at primary school level. They are available, freed from language restrictions and played in and out of school. Educationists like Froebel and Montessori (1948) in Machingambi (1994:23) have stated loudly and clearly that children learn best through play and fun. Due to this fact, primary school teachers are expected to use play in their teaching of mathematics. Children too are expected to be keen to play and learn simultaneously.

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 children can learn through play. This is a call to shift mathematics instruction to an engaging activity where children become active participants in the learning process. Hence the current study analyses pedagogical mathematics characteristics embedded in tsoro game which can be applied in the teaching and learning of mathematics at primary school. Games are played on a voluntary basis as a pass time activity.

Zimbabwe's Ministry of Primary and Secondary Education infant syllabus (2015:4) suggested the following learner centered teaching methods: discovery through involvement and experience, experimentation through trial and error or trial and success, group work or in pairs. These are easy to achieve if mathematics is taught through games. Unfortunately, the infant mathematics syllabus in Zimbabwe is euro-centric. It does not include traditional games like tsoro as a vital teaching method. Fenske (2016) laments teachers' treatment of child play as an afterthought method for mathematics instruction, when it is actually every child`s serious business.

In Zimbabwe, Nziramasanga's (1999) commission into education recommended the implementation of a competence-based curriculum which emphasizes active learning. One of the curriculum`s major goals is that; teachers learn together with learners through activity based instruction. Consequently, the complementary use of traditional games for mathematics instruction at primary school may be ideal for teachers and children to discover remedial activities to assist them understand mathematics concepts.

ISSN: 2582-0745
Vol. 5, No. 04; 2022

Curriculum Council (2014: 22) specifies the following goals of the Infant school module, which can be achieved by mathematics instruction through traditional games:

- acquisition of foundational skills for learning in the cognitive, psychomotor and affective domains.
- establishment of building blocks for socialisation.
- development of an initial appreciation of national heritage and identity.
- development of physical, psychomotor and social competencies.
- demonstration of early signs towards lifelong learning and problem-solving aptitudes.
- acquisition of basic literacy and numeracy skills, including basic practical competences necessary for life and work.

According to Dockett and Perry (2010:02), play has long been regarded as a critical element of early childhood curriculum and pedagogy. Although the authors have cited games as a critical element, they did not mention the Shona traditional games as an essential element of infant pedagogy in Zimbabwe. Play, in the teaching of infant mathematics was recognized by Wood (2008) in Dockett and Perry (2010:02) as a vehicle for learning. In addition play was considered as a context in which young children demonstrate their own learning and at the same time help scaffold the learning of others. The idea supports the thrust of the competence based curriculum that teachers are grappling to implement through games.

A child centered view from Matiure and Matiure (2013) emphasizes that, children are their own educators. Most of their learning is spontaneous from the games that they voluntarily participate in every time. The games which they play include those that are handed over to them by their adults through their culture (cultural heritage) like tsoro. Those games they compose themselves and those that are borrowed from other cultures. Game based learning was described by Pinder (2016:03) as possessing three elements: competition, engagement and immediate inherent personal and group rewards. Children get into a competition that involves child versus child, child versus teacher or child trying to be the best player. Naturally learners get engaged in games to satisfy curiosity, socialization and imagination. The mathematics learning aspect such as counting, sets, sharing and approximation is gained unnoticed. For instructional purposes, both the teacher and the child ought to be aware of what concepts were learnt in a particular game. Both players must be aware of successes to provide feedback and acknowledge correct answers while they pursue the game.

Puentedura (2010:07) regards a game as, “a system in which players engage in an artificial conflict defined by rules that result in a quantifiable outcome.” To that end, a game creates an artificial antagonistic situation between any participating individuals or groups playing against each other. During mathematics educational game planning, the mathematics content must be placed at the point of antagonism. The game rules can clarify the mathematical logic in the game, either as a strategy to win or as an indicator for a win. In any game there is a winner and a loser or they all win when they obtain equal points. Winners can be encouraged to explain the mathematics which placed them at a vantage in the game for shared learning.

Although Pinder (2016) notes that in West Indies game based learning has become a way of teaching, in Zimbabwe play is rarely used as a teaching method. Teachers use it at the beginning

ISSN: 2582-0745
Vol. 5, No. 04; 2022

or end of lessons. Sometimes games are used as interludes between lessons. In this regard Matiure and Matiure (2013) encourage teachers to use games as the main teaching and learning platform on which children learn and gain skills, concepts and knowledge. Consequently children play as they learn and learn as they play (vice-versa). Thereby according its' place as children's serious business.

Theoretical Values of games

Butler, (2008:01) suggests that, young children cannot distinguish play and learning. In fact, play is a priority in early childhood Zimbabwean education system. Children can play for enjoyment, pass time or in this case as a teaching learning activity. Wood (2008) in Dockett et al (2010:02) added that, play is a context in which children demonstrate their own learning and help scaffold the learning of others.

According to Nyota and Mapara (2008:192) games also provide children with opportunities for mastery of play. They continue with it, gain self-confidence and self-esteem. To that Ernest in Phong (1996:172) pointed out that games can be used to teach mathematics effectively by providing reinforcement and practice of skills, motivation, helping in the acquisition and development of concepts and by developing problem solving strategies.

Cognitive theories also support the view that play facilitates children`s intellectual development, and critical thinking. Fein (1987) and Russ (1993) concur on the fact that, children`s intellectual cognitive skills such as measurement, comparison for equivalency, balance, spatial concepts, conservation and logical classification are enhanced during play. In addition, play is thought to afford children the opportunity for creative expression and divergent thinking.

Kuyayama (2015:107) suggest that, through play children develop knowledge, social and motor skills. Rud and Beck (2000) concluded that children`s play unlocks their creativity and imagination thereby developing their problem solving skills. Active involvement in play activities stimulates and develops intellectual, social, emotional, physical and language development. Teachers can use games to develop mathematics language.

Play is important for a healthy brain development. The games they play create meaningful situations for applied mathematics at primary school. Games allow children to operate at different levels of thinking and to learn from each other. The rules of the game and the children`s motivation usually keep them on the task. Children`s thinking becomes apparent through the actions and decisions they make during the game.

Statement of the Research Problem

Although theory emphasizes the use of games in mathematics, it has limited information on the pedagogical characteristics 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 examines the pedagogical characteristics of traditional games for instructional insights.

Research Question

ISSN: 2582-0745
Vol. 5, No. 04; 2022

The study sought answers to the pertinent question: *What mathematics pedagogical characteristics are embedded in Zimbabwe's Shona traditional game of tsoro?*

Research Objective

The purpose of this study is to identify pedagogical characteristics embedded in Zimbabwe's Shona traditional game of tsoro.

Hypothesis:

H_0: There is no Association between gender and traditional game preference.

H_1: There is an Association between gender and traditional game preference.

Mathematics pedagogical Theories

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

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 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.

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, children 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

ISSN: 2582-0745
Vol. 5, No. 04; 2022

a recognizable form. Emphasis is on the structure of knowledge which can be characterized in three ways. Firstly, what (content) is presented then, how (the method) it 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, children count stones.

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 (2015-2022). According to Montessori in Taylor (2017: 25) 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 and 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:

- Voluntary, enjoyable, purposeful and spontaneous.
- Creativity, experimental, using problem-solving skills and physical skills.
- Helps in discovery and expansion of known or new ideas.
- Helps the child to adapt socially.
- Helps to thwart emotional problems.

Thus if play is the work of every child then toys, counters, a notebook and a pencil are the tools. Through traditional games and concrete objects children learn about their world, themselves and

ISSN: 2582-0745
Vol. 5, No. 04; 2022

others. The stones that children use when playing tsoro are concrete objects that can be used as counters.

Oldfield (1991: 383 to 384) 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.

Advantages of Using Games in Mathematics

According to Davies (1995) 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.
- Motivation: Children freely choose to participate and enjoy playing the games.
- 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: Children's 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: Children can work independently of the teacher. The rules of the game and the children's motivation usually keep them on task.

Therefore if well planned, games are a form of entertainment and most pupils 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.

Teachers` views on using games to teach mathematics.

Kuhudzai (1995:15) proposes that, interactive learning accepts that children 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 children to different situations provided by traditional games in teaching.

ISSN: 2582-0745
Vol. 5, No. 04; 2022

Lloyd's (1995:17) study reports 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 children 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 center stage in their learning and teaching activity.

Barker (1988:01)`s view is that there are two extremes to educational spectrum in terms of the way teachers set about their tasks. The teacher centered approach is the one in which children are treated like empty bottles into which facts simply have to be poured. That is what Paulo Freire (1972) in Barker (ibid) 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 children who sit and listen in passive and stony silence. Children are not provided with the opportunity to be active or creative, or to discover things for themselves. The other extreme is the child centered approach where children 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.

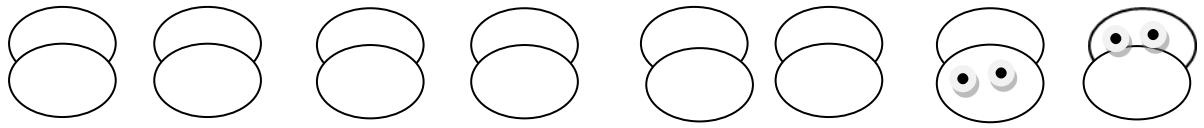
Tsoro Game

According to Nyanhongo (2015) tsoro is an ancient two player mathematical strategy board game that has been played for over a thousand years. Tsoro game has its roots in Zimbabwe and was first described in literature by Matthews in 1964 (Wikipedia). 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. In the ancient times tsoro was played by warriors to improve their rival capturing and raiding strategies in war situations. It was also used to teach young boys and girls how to count, chiefs and kings often settled disputes mathematically by playing tsoro. Today the game is only played during leisure times and sometimes competitively. The game of tsoro has many varieties, however this study concentrates on the one played on dug holes.

Tsoro is played by two people who dig 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.

Players sit face to face and each player occupies the two rows nearest to them. For example, an eight-hole tsoro with two seeds in each hole at the beginning of a game.

ISSN: 2582-0745
Vol. 5, No. 04; 2022



The game tsoro is enjoyable and it requires strategic skills which are almost related to games like chess and checkers. The game is a uniting force between children. It promotes friendship with classmates. Tsoro teaches counting to infant learners. In mathematics, learner will count the stones every time they will be playing. The game improves children`s pronunciation of number names as they repeatedly say the number of stones in each hole throughout their play.

Rules of the game

- According to Matthews (1964 Wikipedia), the starting player chooses any hole from his/her set of holes and collects all the seeds in that hole and distributes them one per hole in the succeeding holes, going in one direction (either clockwise or anti-clockwise). The direction is maintained throughout the game.
- If the last seed falls in a non-empty hole in the outer row, the player collects all the seeds in that hole and redistributes them into the succeeding holes.
- If the last seed falls into a hole in the inner row, the player captures all the seeds in his or her opponent`s two holes in the same column as his or her hole and distributes them as before.
- A player`s turn ends when the last seed being distributed lands, either in an empty hole in the inner row which is in the same column with an empty hole in the opponent`s inner row.
- The game ends when one of the two players has captured all the holes of the other player.
- The winner is the player with all the seeds.

Hints for successful use of games

Oldfield (1991) requires games to be fun mathematics lessons. When choosing a game, teachers must have a specific mathematics objective for the game. Games should be used for specific learning purposes, not just time fillers. The number of players should be kept from two to four so that turns come around quickly. The game competition should be kept short. Children should be familiar with the rules of the game. Teachers must vary the mathematics rather than the rules. Teachers can also invite children to create their own board games or variations of known games.

2.STUDY METHODOLOGY

Philosophy and Design

The study was guided by the pragmatist research philosophy. The pragmatist philosophy facilitated the triangulation of qualitative and quantitative methods for study validation. Qualitative methods guided sampling and observations. Quantitative methods were ideal for reporting findings from surveys. A case study of Makonde district is an appropriate delimitation to account for Ministerial restrictions. In this study a linear research design of documentary analysis, surveys, observation and interviews collected empirical evidence

ISSN: 2582-0745
Vol. 5, No. 04; 2022

Population and Sampling

The population of this study was composed of 150 primary school teachers and 642 learners from Chitomborwizi cluster of Makonde district. A purposive sample of 56 teachers and 126 learners participated in the study. Their non-probability sampling inclusion criterion was being rich sources (have knowledge of tsoro), available and willing to participate in the study. This population was a valid source of information because they are the actual teachers and learners in the cluster. Purposive sampling is encouraged for qualitative studies whose purposes are to understand. Specifically, learners were observed playing voluntarily. That allowed data to be collected from its natural environment.

Instruments

The qualitative aspects of pragmatist philosophy allowed researchers to be key instrument of data collection as advised by (Lincoln and Guba 1985, Borman 1986, Miles and Hurberman 1994, Chisaka 2001 and Nyawaranda 2003) in Chinamasa (2014:03). We structured and administered a five open-ended item questionnaire seeking teachers` and learners` views on use of Shona traditional games like tsoro for mathematics instruction. The questionnaire facilitated the collection of data from this literate population simultaneously. Responses to this instrument provided leads and insights for interviews and document analysis.

We relied on observations, interviews and document analysis in the collection of data for this study. The other instruments were the interview and observation guides. The interview guide captured information from teachers and learners. Interviews allowed learners to explain the rules of the games in their own languages. The explanations enriched the researchers` in-depth understanding as required by (White, 2005). The observation guide identified how teachers taught and how children learnt mathematics at primary school level using tsoro. They were crucial instruments for inferring the actual levels of teachers` skills.

Data collection

Data collection was commenced by seeking for permission from the Ministry of Primary and Secondary Education through Makonde District Education Office which is in charge of schools in the district. Permission seeking is an ethical strategy which also facilitated human resources mobilization for the study. This is an important administration stage for field work and a critical ethical observation in research. Permission was also sought from school Heads who happen to be the immediate supervisors of teachers who were the main subject of the research.

When permission has been granted researchers distributed questionnaires to schools through the school heads at a meeting who distributed them to teachers at their respective schools. This was done to save time and costs of moving from school to school. The school heads were asked to assist by returning the questionnaires at the district offices where the researchers collected them for analysis.

Desk research was initiated by document analysis including pedagogical textbooks for the theory of mathematics teaching using games. These were critical for the bench marking and theories supporting the use of games as a teaching method. Field document analysis focused teachers'

ISSN: 2582-0745
Vol. 5, No. 04; 2022

schemes to find how they factored games in their mathematics lessons. Learners` exercise books were rich sources of the actual curriculum.

Researchers visited the targeted schools on the appointment dates and sought for permission from the interviewees to record the interview sessions on the interview schedule guides and two fully-charged smart-phones. Researchers observed and carried out one-on-one interviews with 29 teachers and 31 pupils found playing tsoro. The interviews also helped us to benefit from the different facial expressions and body language gestures exhibited by the interviewees. In addition we were able to seek for clarity on some issues raised in the questionnaires as well.

Researchers observed teachers using tsoro to teach sets and recorded on observation guide or checklist. Researcher also recorded immediate observation when children were playing tsoro in maths-science lessons. Wragg (1994) stated that observation is where by the observer joined in the activities and talked to other people involved. The researchers paid attention to the game being played, the mathematical objective, the number of players in the game, the rules of the game, time allocation of the game and how the game was addressed to different classes. According to Nachmias and Nachmias (1998) the major advantage of observation lies in its directedness. Researchers obtained data directly from the scene. Observations also captured data from unwilling participants.

3.FINDINGS

We checked all collected questionnaires for completeness and answering of key questions. Responses were then coded to research question themes to guide in collating of responses from our research instruments. We also identified common factors and deviant cases were identified as emerging themes. Frequency tables and graphs were generated for discussion.

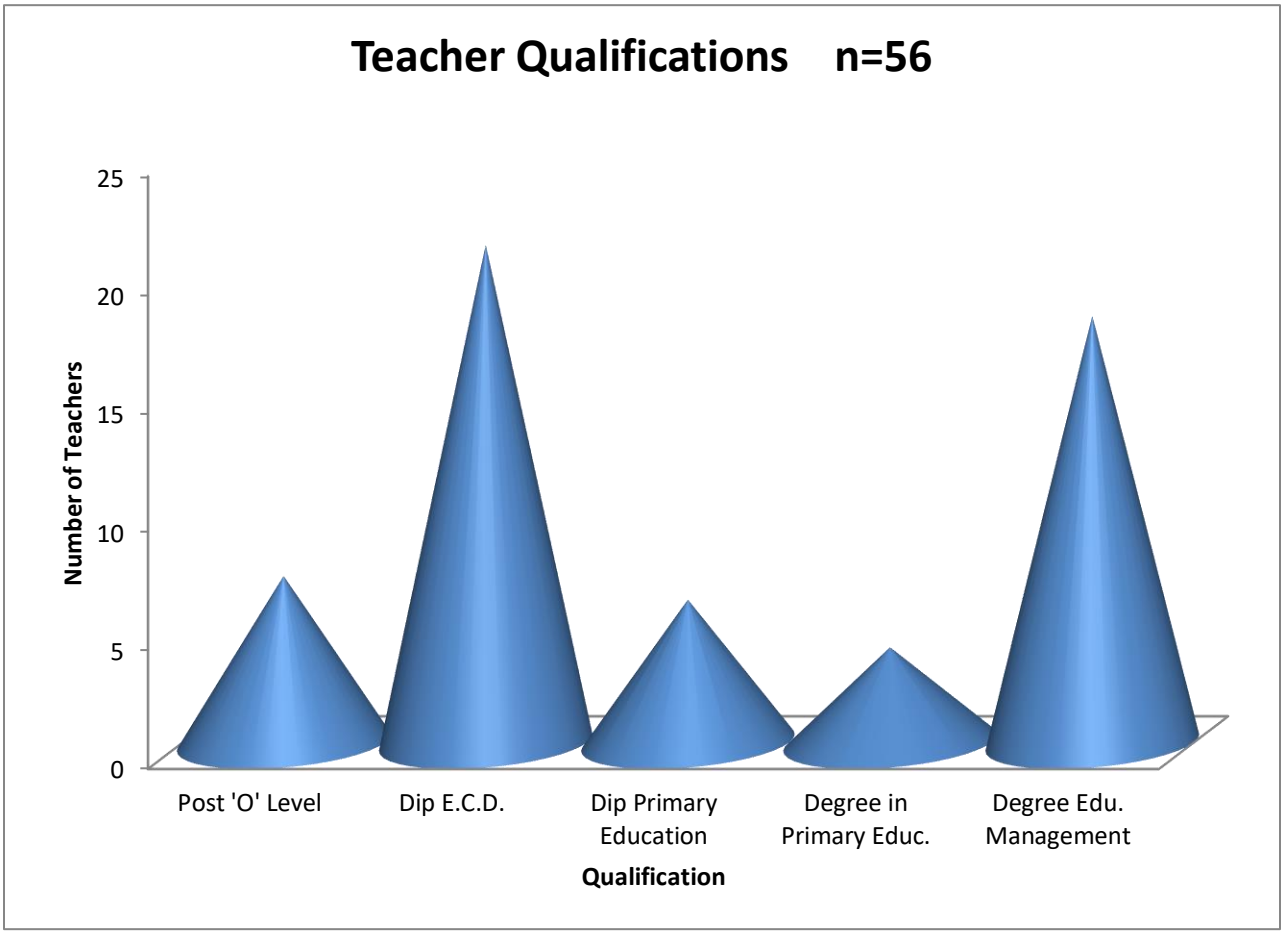
Teacher participant distribution by Gender and Age N= 56

	Teachers' Age group				
Gender	20-30	31-40	41-50	51-60	Total
Male	2	7	9	3	21 (37.5%)
Female	5	8	14	8	35 (62.5%)
Total	7 (12.5%)	15(26.8%)	23 (41.1%)	11(19.6%)	56

All participants are adults (above 20years) whose responses are reliable. The majority of respondents (62.5%) are female. The distribution tallies with the natural teacher distribution by gender in Zimbabwe. Findings (teachers` views on the use of games to teach mathematics) will be dominated by female perceptions. The retirement age for teachers in Zimbabwe is 55 years. Respondents' distribution reveals that, the district should be planning to replace 19.6% of the

ISSN: 2582-0745
Vol. 5, No. 04; 2022

teachers. Teachers above 40 years may not be keen to learn. This implies that, in this cluster the majority (60.7%) need serious training in the use of traditional games in mathematics. Their age (40 plus years) makes them rich sources of traditional games. The cluster then, has potential to apply traditional games to teach mathematics.

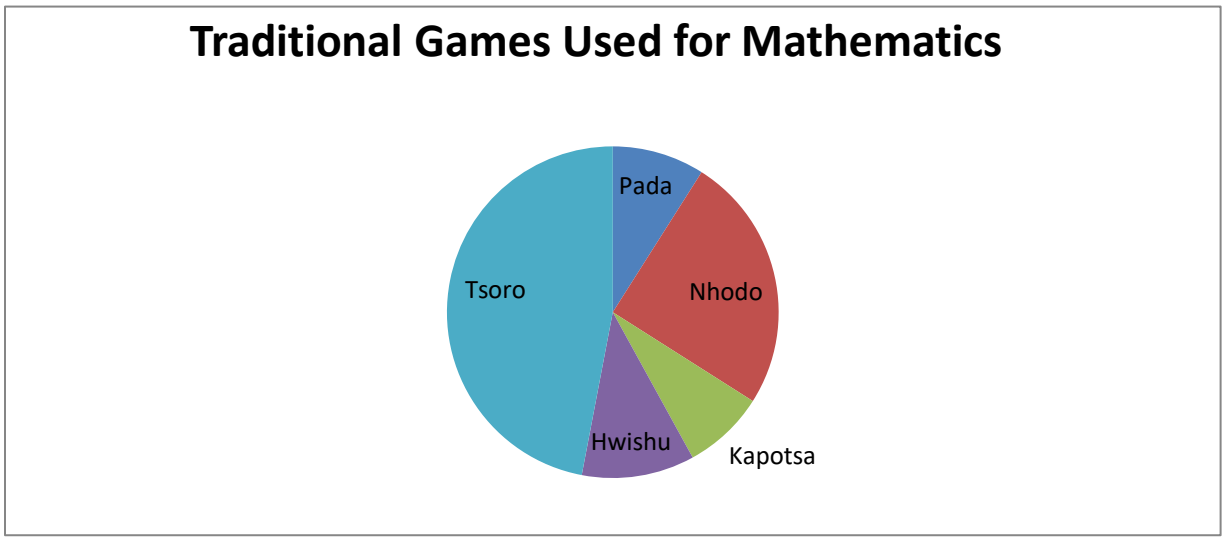


The majority of teachers (92.9%) are qualified primary school professionals holding Diplomas in Early Childhood Development (ECD) and primary education. There are limited degree holders in primary education emphasizing primary school mathematics pedagogics. Those with degrees in educational administration specialization had less emphasis on pedagogical skills development. The majority of respondents are capable of making well informed decisions on choice of teaching methods hence they can understand the importance of games in teaching. This could raise the standards of education in Zimbabwe.

Traditional games used by mathematics teachers are presented in the pie-chart on the next page. The chart shows that, the majority of participants (teachers and learners) reported playing and using tsoro as a game for teaching and learning mathematics. This was followed by nhodo. Of interest is the fact that, both games involve the use of ground holes and small stones. The games can be played indoors or outdoors. The mathematics of sets and counting is common also. This

ISSN: 2582-0745
Vol. 5, No. 04; 2022

Teachers may not be well versed in how hwishu and kapotsa which were mainly named by learners and can be used for mathematics learning.



Teachers reported that infant classes (ECD-grade 2) benefit most from traditional games like tsoro. The finding suggests that, young children benefit more from learning through play. The finding contradicts Kuhudzai (1995:23) who argues that games and warm-ups are important for everyone not only younger and shy pupils.

Contingent Table for Hypothesis Test for Association n= 182

	Teachers' and pupils' traditional game preference					
Gender	Tsoro	Pada	Nhodo	Hwishu	Kapotsa	Total
Male (21 Teachers +44 pupils)	21(16.4)	9 (8.9)	17(20.7)	10 (10.7)	8 (8.2)	65
Female (35Teachers +82 pupils)	25(29.6)	16(16.1)	41(37.3)	20 (19.3)	15 (14.8)	117
Totals	46	25	58	30	23	182

At 5% level of significance, with 4 Degrees of Freedom, Critical value for χ^2 = 9.50 while the Calculated χ^2 = 3.10. Since χ^2 = 3.10 < χ^2 = 9.50, We do not reject H_0 at 5% level of significance and conclude that, there is an association between Gender and participants' traditional game preference. When teachers are selecting traditional games to use for mathematics instruction, they can consider gender preferences. For example, Nhodo is preferred by more girls than boys. Tsoro and Pada can be played by both.

ISSN: 2582-0745
Vol. 5, No. 04; 2022

Purpose of tsoro game in teaching mathematics. **N** =56

Purpose	Frequency/%
A, To pass knowledge in a natural way.	1 (1%)
B, to stimulate interest or drive the desire to learn.	30(54%)
C, To enhance the counting skill and number pronunciation.	5 (9%)
D, To encourage pupils to think and reinforce concepts.	6 (11%)
E, To make learning fun.	9 (15%)
F, To encourage participatory learning.	5 (9%)

Most teachers (54%) use tsoro to stimulate interest or drive the desire to learn in children. Lesson observations did not support the claim. The variations in finding suggest that, teachers have the theoretical application from understanding of theories of motivation but limited practical knowhow to stimulate interest. This can be a training need for the cluster. Only 2% use tsoro game to pass knowledge in a natural way which might be an indication that the game is not used as a teaching method or to improve the learning process. Kuhudzai (1995:10) however highlights that, "Playing games is not the opposite of learning but can be part of it." Games are not a waste of time.

Benefits from tsoro game

Teacher respondents suggested that, tsoro game enable children to participate, hence they understand better what they do. The game help children to have practical experience and concretize mathematics concepts introduced. Children can release tension generated from learning other subjects' content, they enjoy and improve in mathematics language usage. One teacher said, "Children learn in a natural way. Through play children`s number concept is developed, personality and confidence are developed as well." The social context of tsoro helps to develop children's self-esteem, social skills and respect for others. These findings suggest that teachers are aware of the benefits of tsoro game though they might not be using the game regularly to teach mathematics.

Main challenges reported as reducing teacher application of games as a teaching methods include a lack of knowledge of how to use them. In addition, limited time allocated to the teaching of mathematics lesson. Teachers reported the challenge of controlling learners during games that they enjoy as a constraint in the application of games. Another (29%) highlighted lack of knowledge of how to incorporate tsoro in the actual teaching of mathematic.

ISSN: 2582-0745
Vol. 5, No. 04; 2022

4.CONCLUSIONS

The findings in the research study were that teachers are aware of the importance of games in teaching. Teachers perceive games as most suitable to infants (ECD-grade two). Most teachers use games as introductory activities and conclusions of lessons and not in lesson development. There was an acute shortage of resources in schools like books and other materials to use on games hence use of traditional games is important. Lastly, teachers need training on how to use games like tsoro on actual lesson delivery.

Ndlovu (1996:5) asserts that, "children are going to play whether adults and teachers want them to or not. Nature, a much great force than a human being has dictated this." Therefore if play can be utilized to help develop pupils into the types of adults the world needs, then two birds can be killed with one stone. That is when children are satisfying an inborn drive, play, real education will be taking place at the same time.

Participants observed that, tsoro game requires constant practice with its use. Training through workshops, staff development sessions, in-service training and facilitating of demonstration lessons was also required. This would help teachers acquire methods of teaching and learning mathematics using games. Improvisation on the part of teachers was suggested by teachers as the environment itself can provide resources.

5.RECOMMENDATIONS

On the basis of the major conclusions made, the following recommendations are suggested:

- Cluster Heads in should consider staff development and in-service training for teachers so that they acquire knowledge on traditional games for mathematics instruction. Heads, deputy heads and TICs can encourage the incorporation of games in scheme-cum plans.
- Demonstration lessons on use of traditional games should be held for teachers to learn from one another.
- Use of games benefit all grade levels, therefore they should not be limited to infants only.
- Shortage of resources call for innovations and creativity on the part of teachers, hence they can author traditional mathematics games for primary schools. Teachers can use the environment to provide aids for use in games.
- Use of traditional games should not be limited to mathematics only but applied in all subjects for the primary school curriculum since they motivate children to learn.

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