MAKERERE UNIVERSITY

EXPLORING ETHNOMATHEMATICS AS A TEACHING APPROACH IN LEARNING SECONDARY SCHOOL MATHEMATICS USING OMWESO GAME IN ZESUI SUB COUNTY IN SIRONKO DISTRICT

ROGERS MUSIKA

2022/HD04/22334U

A DISSERTATION SUBMITTED TO THE DIRECTORATE OF GRADUATE TRAINING IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER OF EDUCATION (SCIENCE EDUCATION) OF MAKERERE UNIVERSITY

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DECLARATION

I, Musika Rogers of registration number 2022/HD04/22334U, hereby declare that this research report is my original work and has never been submitted to any University or Higher Institution of learning for an academic award.

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DEDICATION

This research report is dedicated to my family most especially my wife Nafuna Jastine, my father Mubida Kanzimini, my sisters and brothers and all my children for their emotional, spiritual and financial support they have rendered to me. May the almighty God bless you abundantly.

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LIST OF ABBREVIATIONS

UNEB	:	Uganda National Examinations Board
NAPE	:	National Assessment Progressive Education
SCT	:	Socio-Cultural Theory
ZPD	:	Zone of Proximal Development
DSTVE	:	Department of Science and Technical Vocational Education
CEES	:	College of Education and External Studies
NCDC	:	National Curriculum Development Center
NGO	:	Non-Governmental Organization
IKS	:	Indigenous Knowledge System
MOES	:	Ministry of Education and Sports
UNESCO	:	United Nations Educational Scientific and Cultural Organization
2D	:	Two Dimensional
TIMSS	:	Trends in International Mathematics and Science Study
UNICEF	:	United Nations International Children’s Emergency Fund

ABSTRACT

This study dealt with exploring ethnomathematics as a teaching approach in learning secondary school mathematics using Omweso game in Zesui Sub County in Sironko District. Omweso game is used a teaching tool in learning mathematical concepts namely counting, patterns, and logical thinking. The study was guided by the following objectives; to identify the mathematics concepts found in Omweso game, to find out how the mathematical concepts can be taught using Omweso game and to establish the challenges teachers would face while teaching mathematics using Omweso game. The sample size used was 12 secondary school mathematics teachers from the selected secondary schools in exploring ethnomathematics as a teaching approach in learning school mathematics using Omweso game. The study employed a multi case study design that involved examining responses got teachers from the sampled schools in depth and then comparing responses to identify patterns, differences, and shared meanings on issues concerning exploring ethnomathematics as a teaching approach in learning school mathematics using Omweso game. In-depth interviews, and focus group discussion guides were used as tools to collect qualitative data from the participants. The results were analyzed using thematic analysis based on the themes and codes gathered from the data collected.

The study findings revealed that the Omweso game embodies a wide range of mathematical concepts such as counting, addition, subtraction, multiplication, division, probability, spatial reasoning, circle geometry, line symmetry, reflections, transformations, and modular arithmetic, making it a valuable assessment, learning, and pedagogical tool in secondary mathematics. Teachers used the game to engage learners interactively, though challenges such as limited teacher expertise, classroom management issues, unequal participation, and difficulties in adapting the game to diverse learning styles were noted. In conclusion, Omweso provides a culturally relevant and practical approach for strengthening mathematical understanding, but its effectiveness depends on teacher mediation, structured reflection, and proper integration into the curriculum. The study recommended the need to include mapping Omweso game’s concepts to curriculum standards, training teachers through continuous professional development, designing lessons that integrate multiple mathematical concepts, enhancing classroom management strategies, tailoring the game to different learner abilities, and ensuring support from the Ministry of Education through provision of resources and textbooks that contextualize mathematics using cultural games like Omweso game.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This Chapter presents the introduction to the study, the background to the study, the statement of the problem, the purpose, objectives, research questions, significance, the scope of the study and the justification of the study.

1.1 Background of the Study

This Chapter introduces the study by examining the historical, contextual, theoretical, and conceptual foundations underpinning the integration of ethnomathematics into school mathematics. Historically, formal education in Uganda was by colonialists who merged cultural practices with mathematics, laying the groundwork for ethnomathematics (Gilsdorf, 2012; D'Ambrosio, 1985). Contextually, the traditional East African Omweso game reflects embedded mathematical and strategic skills, yet current pedagogical practices often neglect such culturally relevant tools, contributing to poor numeracy outcomes (UWEZO, 2019; NAPE, 2014). Theoretically, the study is grounded in D'Ambrosio's ethnomathematics framework, which emphasizes mathematics as a culturally situated practice. Conceptually, it explores how incorporating indigenous games like Omweso game into classroom instruction can enhance learner engagement and mathematical understanding. The Chapter further presents the background, problem statement, purpose, objectives, questions, significance, scope, and justification of the study.

1.1.1 Historical Perspective

Globally, indigenous communities developed rich mathematical, scientific, and technological traditions, intricately woven into their daily practices from astronomy and agriculture to navigation and games. However, the introduction of Western education by colonial powers often devalued these knowledge forms, creating a dichotomy between “modern” and “traditional” knowledge (Thaman, 2014). D’Ambrosio (1985) introduced the term "ethnomathematics" to advocate for recognizing and integrating culturally embedded mathematical knowledge into formal education. Rosa and Orey (2011) further emphasized the importance of contextualizing mathematics instruction by incorporating learners’ cultural experiences, arguing that mathematics is not a neutral, universal body of knowledge but one shaped by cultural interpretations and purposes.

In addition, mathematics achievement varies widely, with the Trends in International Mathematics and Science Study (TIMSS) 2019 center point at 500, while several Sub-Saharan African countries score around 400 or below, highlighting persistent learning gaps linked to poverty, class size, and instructional resources (Mullis et al., 2020). Regionally, fewer than 50% of secondary school learners in Sub-Saharan Africa achieve minimum proficiency in mathematics, and Uganda reflects this trend. The 2021 Uwezo assessment reports that only 42% of lower secondary learners (S1–S4) demonstrate basic proficiency in mathematics, with rural districts like Sironko performing below the national average due to limited access to textbooks, overcrowded classrooms, and minimal instructional materials (Uwezo Uganda, 2021; UNICEF Uganda, 2023; MoES, 2019). These statistics indicate that traditional teacher-centered, textbook-focused instruction was insufficient to meet curriculum goals in resource-constrained secondary schools.

Learners who are exposed to ethnomathematics approaches tend to demonstrate higher engagement, better conceptual understanding, and improved attitudes toward mathematics than peers taught via conventional methods (Batiibwe, 2024; Bonato, 2024). Games such as Omweso, Morabaraba (South Africa), Bao (East Africa), and other traditional counting or stone games, embody key secondary-level mathematical concepts including counting, distribution, sequencing, probability, and strategic reasoning linking directly to topics like operations, algebraic thinking, and problem solving (Kirumira, 2019; Matsekoleng, 2024). Classroom studies in Africa indicate that incorporating such games can increase learner participation by over **30%** and reduce mathematics anxiety, especially for students in culturally familiar environments (Matsekoleng, 2024).

In West Africa, efforts to integrate Indigenous Knowledge Systems (IKS) into educational systems have yielded mixed results. In Ghana, for example, curriculum developers have attempted to use cultural contexts such as basket weaving, local markets, and traditional architecture to teach mathematical concepts (Asiedu-Addo & Owusu, 2016). However, the dominant use of foreign textbooks, assessment pressures, and lack of teacher training have limited the success of ethnomathematics as a teaching approach. Even though ethnomathematics practices incorporated in the IKS are mathematically rich, they are often not formally acknowledged in classroom instruction. This highlights a persistent challenge embedding local cultural tools into formal education systems while ensuring that, they align with national curriculum standards.

The Tanzanian, Report of 1992 by the Nyerere emphasized grounding education in African realities, values, and knowledge systems, advocating for learning experiences that reflect learners' daily lives and environments. Despite this visionary stance, ethnomathematics remains largely absent in the Tanzanian curriculum, and most mathematical instruction continues to follow foreign models with limited relevance to learners' contexts, even though local languages are used as the medium of instruction in early and lower secondary education (Sanga & Mwakalonge, 2021; Batiibwe, 2024). This reflects a broader African trend, where indigenous knowledge is often celebrated rhetorically but rarely operationalized in curriculum or pedagogy. Consequently, learners are frequently exposed to abstract concepts that lack connection to their cultural experiences, illustrating the pressing need for research on culturally responsive approaches, such as integrating games like Omweso into secondary mathematics instruction, to enhance engagement, understanding, and performance.

In Ethiopia, studies on indigenous measurement systems, local counting practices, and traditional construction methods are widely used in communities but excluded from classrooms. For example, Habtamu (2018) notes that Ethiopian students are often unable to relate classroom mathematical knowledge to real-life practices, leading to low engagement and performance. The disconnection between indigenous epistemologies and formal education points to a critical research gap: how can ethnomathematical tools be meaningfully integrated into national curricula to bridge this divide?

In Uganda, the Omweso game embodies a culturally embedded system of logic, arithmetic, and strategy, involving mental calculations, sequencing, and problem-solving, yet it remains largely absent from formal education due to curriculum rigidity, limited pedagogical training, and examination-driven teaching (Musinguzi, 2024). Other ethnomathematics approaches, such as weaving and basketry patterns for teaching geometry and symmetry, indigenous counting systems, and locally framed word problems, similarly offer culturally relevant avenues for teaching mathematics. Research indicates that integrating these practices can enhance learners' engagement, understanding of number operations, pattern recognition, logical reasoning, and spatial skills (Batiibwe, 2024). Despite their potential, these culturally grounded methods remain underutilized and under-researched in Uganda's secondary school mathematics curriculum, highlighting the need for studies that explore their application, particularly in resource-constrained district of Sironko.

National assessments such as UWEZO (2019) and NAPE (2014) highlight the consequences of this disconnection, reporting consistently low numeracy performance among Ugandan learners. These outcomes are often attributed to rote learning and abstract teaching methods that do not connect with learners' cultural experiences. Gilsdorf (2012) argues that integrating games like Omweso game can revitalize mathematics instruction by grounding it in culturally relevant contexts. However, Uganda's policy documents and teacher training programs remain silent on such approaches, revealing a policy-practice gap in the recognition and application of indigenous tools in teaching.

D'Ambrosio and Orey support the use of culturally embedded tools like Omweso game as a foundation for mathematics education. Their work underscores that knowledge systems should not be viewed hierarchically, with Western knowledge at the top, but rather as diverse, equally valuable ways of knowing. Yet despite their global influence, their ideas remain underutilized in many African countries, including Uganda, where curriculum decisions are still largely shaped by colonial legacies and global testing standards (Rosa & Orey, 2011). The need to localize global theoretical frameworks into classroom practices in Uganda is therefore urgent. At the local level, particularly in Zesui Sub County in Sironko District, the use of Omweso game as a teaching tool remains virtually unexplored in formal schools. Yet anecdotal evidence suggests that learners are familiar with the game and often engage with it outside school settings. The disconnect between cultural familiarity and classroom instruction suggests a missed pedagogical opportunity.

1.1.2 Theoretical Perspective

This study is anchored in the Social Constructivist Theory (SCT) developed by Lev Vygotsky, which asserts that learning is an active, socially mediated process shaped by cultural and historical contexts. According to SCT, learners do not passively absorb information; instead, they construct knowledge through interactions with others using tools such as language, cultural symbols, and community practices. In mathematics education, this theory promotes teaching approaches that are contextual, engaging, and responsive to learners' backgrounds. The integration of indigenous knowledge systems specifically, the *Omweso* game into mathematics instruction aligns with SCT by utilizing learners' cultural experiences to foster cognitive development through authentic, practical engagement.

Vygotsky's concept of the Zone of Proximal Development (ZPD**)** highlights how learners progress more effectively when guided by knowledgeable peers or adults within familiar cultural settings. The traditional game *Omweso game*, deeply embedded in Ugandan community life, serves as a valuable educational scaffold that promotes critical thinking, sequencing, and strategic reasoning. Studies by Musinguzi (2024) and Batibwe (2024) reveal that learners who engage with *Omweso game* show enhanced mathematical reasoning and problem-solving abilities. These findings underscore SCT's claim that meaningful learning occurs when instructional content is connected to the learners' sociocultural environment, enabling them to relate new knowledge to existing experiences and understandings.

Complementing SCT is ethnomathematics theory, introduced by D'Ambrosio (1985), which argues that mathematical knowledge is culturally situated and arises from the unique problem-solving contexts of different societies. This perspective, further supported by Rosa and Orey (2011), emphasizes the importance of integrating culturally relevant tools into mathematics education to promote inclusivity and equity. The use of *Omweso game* in classrooms affirms cultural identity while reinforcing SCT principles like cultural mediation, scaffolding, collaborative learning, and contextual relevance. These constructs guided the study by framing how culturally grounded strategies like *Omweso game* support mathematics learning, turning abstract content into meaningful and accessible knowledge for learners.

1.1.3 Conceptual Perspective

The study was guided by concepts like Ethnomathematics, teaching approach and Omweso game Ethnomathematics, as conceptualized by D'Ambrosio (1985, 1995), refers to the study of mathematical practices embedded in distinct cultural contexts, reflecting how different communities count, measure, compare, and solve problems based on their own experiences. Rosa and Orey (2011) further emphasize that ethnomathematics involves connecting classroom mathematics with learners' cultural backgrounds, thereby fostering inclusive, critical, and reflective thinking. It integrates indigenous elements like language, artifacts, games, and customs into formal mathematical instruction. In this study, ethnomathematics is operationalized as the deliberate integration of culturally rooted practices specifically the *Omweso* game into teaching mathematical concepts such as probability, counting, and addition. Evidence of this integration was gathered through teacher interviews, lesson observations, and analysis of instructional materials to determine how cultural relevance is embedded in lesson delivery (Chikodzi & Nyota, 2010; Galawe, 2021).

A teaching approach is broadly defined as the method or strategy employed by educators to facilitate learning, structured according to learners' needs, content goals, and instructional contexts (Orlich et al., 2010). Within the ethnomathematics framework, the teaching approach must go beyond traditional transmission methods to embrace participatory, culturally responsive, and learner-centered strategies that allow for contextualized learning (Rosa & Orey, 2011). In this study, teaching approach is operationalized as the method used by teachers in Zesui sub-county secondary schools to introduce mathematical content particularly addition, probability, and counting through the use of cultural tools like *Omweso game*. Data were collected by conducting interviews with teachers to assess whether approaches reflected cultural responsiveness, hands-on engagement, and critical thinking opportunities as advocated by Nabie (2011).

The *Omweso* game is a traditional two-player strategy board game historically played by Bantu communities in Uganda. According to Nkuutu (2015), the game consists of two rows of eight pits per player, with each pit initially holding two seeds. The game involves complex reasoning, counting, sequencing, and strategic thinking all of which mirror core mathematical operations. Conceptually, within the ethnomathematics discourse, *Omweso game* functions as both a cultural artifact and a pedagogical tool that can mediate mathematical understanding through play and competition (D'Ambrosio, 1991; Rosa & Orey, 2011). In this study, *Omweso game* is operationalized as a culturally grounded instructional aid used to teach mathematical concepts in classroom settings. The extent of its usage was evaluated through teacher interviews to determine whether and how the game was adapted to introduce or reinforce mathematical ideas such as probability and addition.

1.1.4 Contextual Perspective

Zesui Sub County, located in Sironko District in Eastern Uganda, is predominantly rural with communities deeply rooted in indigenous cultural practices such as traditional games, including *Omweso game*, a board game that embodies mathematical thinking like counting, strategic planning, and spatial reasoning. Despite the rich ethnocultural environment, learners in this area continue to struggle with mathematics, often perceiving it as abstract and disconnected from their everyday experiences (Tumwesige, 2020). The teaching methods employed tend to emphasize rote memorization and standardized content delivery, which limits learners' engagement and problem-solving capabilities. Consequently, this has led to poor mathematics performance in national assessments, affecting learners' confidence and their progression in STEM subjects (Nabwire, 2021). The disconnection between curriculum content and learners' sociocultural realities contributes to reduced interest in mathematics learning.

While the Uganda National Curriculum Development Centre has made efforts to integrate local knowledge into the curriculum, these have not fully translated into classroom practice, particularly in rural schools like those in Zesui (Matagi, 2022). Limited teacher training on culturally responsive pedagogy and a lack of teaching resources related to indigenous practices such as *Omweso game* remain key barriers. Some Non-Governmental Organisations (NGOs) and educational research institutions have piloted community-based learning approaches, but these remain isolated and not widely scaled (Okello & Kintu, 2023). There is growing recognition that leveraging ethnomathematics can create more relatable and effective mathematics instruction, yet little empirical research has focused specifically on integrating traditional games in classroom settings. This study therefore seeks to bridge the gap by exploring how *Omweso game* can be used as a culturally grounded teaching tool to enhance mathematics learning outcomes in Zesui Sub County.

1.2 Statement of the Problem

Mathematics teaching and learning should be practical, relatable, and embedded in learners' cultural and daily experiences, enabling students to apply concepts meaningfully in real-life situations. However, in Zesui Sub County in Sironko District, mathematics teaching remains largely abstract and disconnected from learners' cultural realities (Ssempala & Mitana, 2021; Sironko District Education Report, 2022). Despite mathematics being inherently present in local practices such as basket weaving, farming, construction, and traditional games like Omweso game. These activities are rarely integrated into classroom instruction, leading to low learner engagement and persistent poor performance (MOES, 2015). Evidence from Sironko District shows that a significant number of secondary school learners fail to develop problem-solving and logical reasoning skills because mathematics is taught without reference to their lived experiences (Ssempala & Mitana, 2021).

Failure to address this problem risks continued low achievement, diminished learner confidence, and a widening gap between school mathematics and practical applications, which can ultimately affect students' further education and employment opportunities. While the government has provided policy frameworks encouraging competency-based curricula and teacher training programs, these efforts have largely failed to incorporate ethnomathematical approaches, leaving culturally responsive pedagogy underutilized (MOES, 2015; Sironko District Education Report, 2022). Guided by Social Constructivist Theory (SCT), which emphasizes learning through social interaction and contextualized experiences, this study investigates how Omweso game can used a teaching tool to construct and re-construct mathematical knowledge, making learning relevant, engaging, and functional for secondary school learners in Zesui. Addressing this gap is essential to enhance learners' mathematical understanding, motivation, and ability to apply concepts in meaningful ways.

1.3 Purpose of the Study

The purpose of the study was to explore ethnomathematics as a teaching approach in learning school mathematics using Omweso game in selected secondary schools in Zesui Subcounty in Sironko District.

1.4 Objectives of the Study

The study was guided by the following research objectives

i. To identify the mathematics concepts embedded within omweso game by secondary school mathematics teachers in Zesui Sub County, Sironko District.

ii. To find out how mathematical concepts can be used by teachers in a mathematics classroom in Zesui Sub County, Sironko District.

iii. To establish the challenges in developing mathematical concepts using omweso game-based teaching approach in Zesui Sub County, Sironko District.

1.5 Research Questions

The study was guided by three specific research questions

i. What are the mathematical concepts embedded within Omweso game?

ii. How can mathematical concepts be used by teachers in a mathematics classroom?

iii. What are the challenges in developing mathematical concepts using Omweso game-based teaching approach?

1.6 Significance of the Study

This study holds significant value for various educational stakeholders in Uganda. The findings will provide targeted insights that can inform policy, curriculum design, and pedagogical practices by focusing on the integration of traditional games like *Omweso game* in teaching mathematics through the Ethnomathematics approach. The implications for each body are as follows:

Ministry of Education and Sports (MoES): The study will show that learners exposed to Omweso-based activities are likely to demonstrate increased engagement and improved problem-solving and logical reasoning skills compared to those taught via conventional methods. This will help MoES identify gaps in current mathematics teaching approaches that overlook learners' cultural backgrounds and will guide the formulation of culturally responsive educational policies.

National Curriculum Development Center (NCDC): The study will reveal that contextualized learning using Omweso game can enhance learners' understanding of number operations, sequencing, and patterns. This in turn will inform curriculum review and development, prompting NCDC to embed ethnomathematical activities into mathematics syllabi, instructional materials, and teacher guides.

It will also strengthen the rationale for incorporating localized content in the Competency-Based Curriculum, ensuring that learners' everyday cultural experiences are reflected in classroom learning.

1.7 Scope of the Study

1.7.1 Geographical Scope

The study was conducted in Zesui Sub County, situated in Sironko District in Eastern Uganda, approximately six kilometers from Buweri Town Council along the Namagumba–Budadiri road. Zesui is predominantly rural, where learners are deeply rooted in cultural activities, including traditional games such as Omweso game, which is central to this investigation. The sub-county shares boundaries with Bugitimwa, Busulani, and Namaguli sub-counties, all of which exhibit similar socio-cultural and educational contexts characterized by limited access to localized teaching resources and persistent low achievement in mathematics (Ssempala & Mitana, 2021; Sironko District Education Report, 2022). These geographical and cultural features made Zesui a strategically appropriate site for exploring the potential of indigenous knowledge systems in formal education.

1.7.2 Content Scope

The study explored ethnomathematics as a teaching approach, using the Omweso game as a case to enrich the learning of mathematics in school settings. It addressed three key objectives: (i) To identify the mathematics concepts embedded within omweso game by secondary school mathematics teachers in Zesui Sub County, Sironko District. (ii) To find out how mathematical concepts can be used by teachers in a mathematics classroom in Zesui Sub County, Sironko District. (iii) To establish the challenges in developing mathematical concepts using omweso game-based teaching approach in Zesui Sub County, Sironko District. The research was guided by Social Constructivist Theory (SCT), which emphasizes contextualized, culturally informed learning experiences (Vygotsky, 1978; Ssempala & Mitana, 2021)

1.7.3 Time scope

The study was conducted between May and December 2024, coinciding with the school calendar, ensuring meaningful engagement with teachers. It aimed to bridge the gap between school mathematics and indigenous knowledge, providing practical insights into culturally responsive teaching methodologies to improve learner engagement, understanding, and performance in rural Ugandan classrooms.

1.8 Justification of the Study

The justification for this study lies in the urgent need to address the persistent disconnect between school mathematics and learners' cultural realities in Zesui Sub County, Sironko District. Despite the rich mathematical knowledge embedded in traditional practices such as the Omweso game, these culturally relevant tools remain underutilized in formal education, resulting in low learner engagement, poor performance, and limited problem-solving skills. The lack of culturally responsive pedagogies and contextualized learning materials has rendered mathematics abstract and inaccessible, particularly for learners in rural settings. Without timely intervention through studies like this, schools risk continuing with teaching methods that alienate learners, thus reinforcing educational inequalities and hindering the development of critical and applicable mathematical skills. This study provides a timely solution by exploring how indigenous games can bridge this gap, making mathematics more relatable, functional, and empowering for learners. Failing to conduct such a study would mean losing a valuable opportunity to revitalize mathematics instruction, preserve cultural heritage, and enhance educational outcomes through an approach grounded in learners' own lived experiences and environments.

1.9 Chapter Summary

This study explores how ethnomathematics can be integrated into school mathematics through the use of the traditional Omweso game in secondary schools in Zesui Sub County, Sironko District. It highlights how rich indigenous mathematical knowledge has been marginalized in Uganda's education system due to colonial legacies, rigid syllabi, and limited culturally responsive teacher training. Guided by Social Constructivist Theory and D'Ambrosio's ethnomathematics framework, the research presents Omweso game as a practical, culturally grounded tool for enhancing learner engagement and mathematical reasoning. The study investigates mathematical concepts embedded in the game, how teachers can incorporate them into instruction, and the challenges faced in doing so. Its findings aim to support education stakeholders in designing culturally inclusive curricula, assessments, and teaching policies. The research is timely and relevant for addressing the disconnect between abstract mathematics instruction and learners' cultural experiences in rural classrooms.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

Literature was reviewed and structured as follows, first was on conceptual framework, review of literature for each objective and a summary where a conclusion was drawn pertaining the whole chapter and some identified literature gaps.

2.1 Literature Review

This section entailed the literature on each objective of the study:

2.2 Mathematical Concepts embedded within Omweso Game

Teaching mathematics through ethnomathematics is not only interesting but also capable of presenting context and engagement (Rosa & Orey, 2011). When context and engagement appear in the learning process, students find it easier to understand the lesson and are more likely to bring experience into their daily lives (Meaney & Lange, 2012; Snounu, 2019). As a result, students are prepared to live in societies concerning cultural dignity, show critical reflexivity toward social justice, and can be aware of their duties of citizenship (Lafer & Tarman, 2018; Rosa & Orey, 2015; Solikhah & Budiharso, 2019). Akayuure (2016) synthesized a number of studies demonstrating that cultural games serve as effective media for developing foundational mathematical skills. His work emphasized how engagement in traditional play activities introduces learners to informal yet structured mathematical reasoning. He argued that these games often involve problem-solving, logical thinking, spatial awareness, and arithmetic operations, which are all relevant to formal mathematics instruction.

Nosis (2018) conducted a study exploring the mathematical experiences embedded in cultural games played by children during leisure time in their local communities. Although the specific title of the study and its geographical focus were not stated, the research revealed that children developed diverse mathematical concepts through culturally grounded activities. These included sorting, pattern recognition, measurement, and spatial reasoning. One of the cultural games examined was “Black Toti,” which was shown to support the development of counting, sorting, and logical sequencing—skills critical to early numeracy. Nosis highlighted that some cultures introduced spatial reasoning through hunting, while others nurtured measurement and construction skills through communal activities. These findings collectively underscore the formative role of cultural experiences in shaping mathematical understanding from an early age. Galawe (2021) examined the integration of indigenous games into formal classroom settings, particularly among Grade 4 learners in South Africa and Botswana. His study focused on the Morabaraba game and its application in teaching number sentences and geometric patterns. Conducted in the Motheo District of South Africa's Free State province, the study involved 45 participants across two schools and employed interviews and classroom observations analyzed through content analysis. Findings revealed that Morabaraba effectively supported learners in grasping abstract mathematical ideas by contextualizing them through culturally familiar activities. Importantly, Galawe suggested that similar integration of indigenous games into school curricula could greatly enhance performance, especially in resource-constrained settings. These findings resonate with the theoretical propositions of Social Constructivism, which advocate for meaningful, culturally relevant learning environments.

Moloi et al. (2021) explored how the indigenous game Kgati (skipping rope) could be used to teach mathematics, specifically word problems in Grade 4. The study was carried out at North-West University with second-year student teachers, using a participatory research approach. It revealed that students could extract mathematical knowledge such as the properties of circles and semicircles from the dynamics of the game. These geometric concepts were effectively translated into the solving of word problems, showing how cultural games provide a platform for interpreting, converting, and linking mathematical knowledge to real-life contexts. This reinforces the argument that indigenous games serve as vehicles for building conceptual understanding of mathematics, particularly geometry.

These studies collectively reveal a range of mathematical concepts including spatial reasoning, logical thinking, pattern recognition, arithmetic operations, and geometry that are embedded in traditional games across cultures. Although not all the reviewed scholars investigated the Omweso game specifically, the concepts identified in their studies are applicable to Omweso due to its mathematical structure and logic. For instance, Omweso game involves distributing seeds in sets of four across pits, a process grounded in basic counting, addition, and division (Smith, 2007). Players must plan moves ahead, anticipate opponents' strategies, and recognize patterns skills that are central to mathematical reasoning (Lee, 2010). The movement of seeds also supports spatial reasoning, which Gardner (2012) emphasizes as crucial for understanding geometry and number relationships. Thus, Omweso game not only aligns with core mathematical operations but also reflects deeper cognitive processes that underpin formal mathematical learning. Its use in classrooms could therefore bridge the gap between abstract mathematics and learners' cultural environments.

2.2.1 Ways in which Mathematical Concepts embedded in Omweso Game can be used by Mathematics teachers in a classroom situation.

In many mathematics classrooms, particularly at the primary and lower secondary levels, pedagogy tends to rely heavily on abstract content delivery, often through rote learning, textbook exercises, and teacher-centered instruction. Such approaches frequently disengage learners, especially when the content is detached from their lived experiences. To address this gap, cultural artifacts and traditional games can be harnessed as powerful pedagogical resources that foster contextualized and participatory learning. Ethnomathematics, as a culturally responsive approach, encourages the use of familiar cultural elements such as games, architecture, and crafts as instructional aids that enhance mathematical understanding by rooting it in learners' environments. In this light, past studies have demonstrated how educators can use ethnomathematical resources to make mathematics more meaningful and engaging.

For instance, Muhammad et al. (2020) applied the ethnomathematics approach in teaching geometry to elementary learners using the Borobudur temple in Indonesia. Their study allowed students to explore the architectural elements of the temple to identify basic geometric shapes like squares, rectangles, triangles, and circles. Through observation and guided instruction, learners were not only able to recognize these shapes in real structures but also to relate classroom concepts to tangible cultural heritage. Similarly, Fitrianawati et al. (2020) used the Prambanan temple—a UNESCO heritage site with intricate stone carvings and architectural designs—to teach geometry. Their research showed that integrating historical and cultural structures into mathematics teaching enhanced spatial reasoning and cultural appreciation among students. Both studies highlight how place-based, culturally meaningful instruction can transform passive learning into active, reflective exploration.

Another important contribution comes from Mauluah and Marsigit (2019), who emphasized the vast potential of Kraton Jogja, a historic royal palace in Yogyakarta, as a pedagogical resource for mathematics education. Their work outlined various learning opportunities embedded in the palace's cultural elements. For instance, measuring the height of Gunungan (a symbolic mountain in palace rituals), calculating the area within Batik motifs, interpreting Sultan Agung's traditional calendar, and drawing geometric representations of palace structures were all proposed as rich tasks. These activities not only incorporated mathematical concepts such as measurement, geometry, and arithmetic, but also strengthened students' cultural identity and historical awareness.

In another context, Supriadi (2019) implemented a didactical design research approach to teach flat rectangular shapes using Sundanese cultural board media in Banten. His study involved developing learning designs based on local culture and evaluating their impact on student comprehension. Results showed that using culturally embedded materials created a more stimulating learning environment, increased conceptual retention, and enhanced students' connection to mathematical ideas. The board media, reflecting traditional Sundanese designs, provided visual and tactile means of understanding area, length, and shape properties in a way that felt relevant and engaging to learners.

The integration of games into mathematics instruction has increasingly gained scholarly attention due to their potential to enrich both learner engagement and teacher pedagogy. In this context, Owusu (2023) conducted a study in Ghana focusing on how artistic and cultural games can be used to enhance mathematics teaching strategies in elementary schools. The study emphasized the development of mathematical concepts such as probability and pattern recognition through the use of culturally familiar games. Although the specific number of participants involved in the research was not stated, Owusu employed document analysis alongside content analysis to explore African traditional games and their embedded mathematical ideas. The key aim of this study was to equip basic school teachers with pedagogical tools that are culturally grounded and appropriate for improving both instructional quality and learner understanding. Owusu's work is particularly significant as it presents games not merely as supplementary materials but as core pedagogical strategies capable of transforming rigid instructional approaches.

Through document analysis, Owusu (2023) was able to trace and classify mathematics concepts that are naturally embedded within African games played by children and families in community settings. The findings revealed that traditional games, such as those involving chance, movement patterns, and object sorting, inherently teach probability and patterns even without formal mathematical instruction. Content analysis further revealed that these games provided opportunities for learners to internalize mathematical principles through experiential and playful interaction. By tapping into these traditional resources, Owusu suggested that teachers could better contextualize instruction, making abstract mathematical concepts more accessible and engaging for learners. This approach aligns with constructivist principles where learners build knowledge from real-life experiences, though Owusu's study did not explicitly state a guiding theoretical framework, which slightly limits its philosophical grounding.

Similarly, Gundogdu (2021) conducted a study to investigate how traditional games contribute to the development of early childhood mathematics skills. His research focused on mathematical domains such as numeracy, operation skills, measurement, estimation, spatial reasoning, geometric shapes, sorting, grouping, matching, comparing, and pattern creation. Like Owusu, Gundogdu employed document analysis as the main methodology, using a broad range of sources including textbooks, curriculum materials, and research articles to identify traditional games commonly played by children and the mathematics concepts embedded within them. The study utilized descriptive analysis to process and categorize the findings, allowing for a systematic understanding of how various mathematical concepts are naturally developed through play.

The results from Gundogdu's (2021) study confirmed that traditional games play a critical role in nurturing foundational mathematics skills in early learners. For example, games that require children to classify objects by shape, color, or size help foster sorting and grouping abilities, which are essential for set theory and logic. Other games involving the use of space, direction, or movement support the development of spatial reasoning and geometry, while counting-based games naturally enhance numeracy and arithmetic operations. Importantly, Gundogdu emphasized that these skills emerge not through formal instruction but through interactive, community-based play, suggesting a need to rethink how and where early mathematics education occurs. However, unlike Owusu, Gundogdu did not root his study in a specific learning theory, which presents a critical limitation. The absence of a clear theoretical framework reduces the explanatory power of the study in terms of how learning occurs and how teachers can scaffold these activities within structured curricula.

Despite lacking a guiding theory, Gundogdu's study indirectly resonates with Vygotsky's Social Constructivist Theory, which views learning as a socially mediated process where knowledge is constructed through cultural tools and interaction. Traditional games, in this case, serve as cultural tools through which children acquire mathematical understanding in familiar social contexts. Had the study explicitly adopted this theoretical lens, it could have provided richer insights into how teachers might support learners' transitions from informal, game-based understanding to more formal mathematical thinking. Nonetheless, the descriptive richness of the data and the variety of mathematical skills identified highlight the untapped educational potential of traditional games, particularly in culturally diverse settings.

Collectively, the works of Owusu (2023) and Gundogdu (2021) support the argument that traditional games are more than recreational tools they are fertile grounds for cultivating mathematical thinking from an early age. The use of document and content analysis in both studies underscores the value of qualitative evidence in educational research, especially when dealing with cultural artifacts and informal learning contexts. Owusu's emphasis on teacher pedagogy and instructional improvement through culturally grounded strategies provides a practical orientation for educators, while Gundogdu's comprehensive mapping of mathematical skills in games contributes a foundational understanding for curriculum designers and policymakers. Both studies advocate for integrating traditional knowledge systems into formal education, particularly to bridge the gap between learners' cultural realities and school-based mathematics instruction.

2.2.3 Challenges that Teachers face while developing Mathematical Concepts using Omweso Game based Teaching Approach.

Integrating indigenous games into the teaching of mathematics presents a promising yet complex pedagogical shift that requires adjustments at both systemic and classroom levels. While such games offer rich opportunities to contextualize mathematical concepts, educators often face multiple barriers in translating these opportunities into effective classroom practices. These challenges range from curriculum rigidity and insufficient teacher training to gender imbalances and resource limitations. In many educational settings, especially in rural and developing contexts, traditional teaching methods dominate, with limited space for experiential or culturally embedded instruction. The introduction of game-based approaches, such as using Omweso game in Uganda or Golla and Bibore in Ghana, often confronts deeply entrenched systemic norms that prioritize examination performance over conceptual understanding and contextual learning.

In a study conducted in Ghana by Tangkur (2023) at the Dombo University of Business and Integrated Development Studies, challenges related to the use of indigenous games in mathematics instruction were systematically investigated. The study involved 70 junior high school participants that included 65 males and only 5 females which also pointed to a significant gender disparity in both teacher participation and possibly in classroom engagement. Using an observation checklist**,** Tangkur documented classroom activities and analyzed the data (through thematic or content analysis, though the exact method was not stated). One key finding was that the existing mathematics curriculum often excludes indigenous games, making it difficult for teachers to incorporate them into formal lesson plans. This exclusion reflects a broader disconnect between curriculum developers and the cultural realities of learners, especially in basic schools and teacher training institutions. The lack of official curriculum space for such culturally responsive methods significantly undermines teachers' confidence and initiative to innovate.

Another significant challenge revealed by Tangkur's study was the lack of structured pedagogical training on how to integrate indigenous games into mathematics teaching. Although some children demonstrated high aptitude in mathematical reasoning when using games like Golla, Bibore, and Biloo/Bize, teachers lacked the methodological knowledge to scaffold these insights for broader classroom use. Instead of being trained to design tasks around these games, many teachers relied on demonstrations by capable students that often informally rather than embedding game mechanics into structured learning objectives. This gap highlights a need for targeted teacher development in culturally responsive pedagogy. Without such training, teachers struggle to bridge the gap between game play and formal mathematical concepts such as addition, probability, sequencing, and problem-solving that games like Omweso game naturally contain.

Tangkur (2023) carried out the study to find out the teachers' use of indigenous games in their classroom as well as the challenges they encounter in trying to integrate indigenous games in the teaching and learning of mathematics among students of Junior high schools in Ghana at Dombo University of Business and Integrated Development Studies Department of Foundational Education. He collected data from 70 participants of which 65 were males and 5 females, observation checklist was used to get data and after data analysis, the findings that emerged were that mathematics curriculum should include indigenous games particularly in basic schools and the teacher training colleges. It was also discovered that children who are good at mathematical related indigenous games can be called upon to demonstrate to their peers using practical examples of indigenous games such as Golla, bibore and biloo/bize.

Nabie (2015) investigated the perspectives of Ghanaian primary school teachers on integrating cultural games in mathematics teaching. Ten certificate teachers from the Upper West region, with 4 to 30 years of experience, were interviewed. Thematic analysis of the data highlighted diverse views on the value of games in cognitive, social, instructional, and cultural development. The study involved both users and non-users of games, including 8 males and 2 females, teaching in urban and rural areas. One-on-one informal conversational interviews were conducted to gather insights on the challenges and benefits of game integration.

Gullain (2023) investigated the use of deductive games in the teaching of mathematics and how such games could influence students' motivation and performance. The study was conducted among 52 teacher candidates enrolled in a Primary School Mathematics Teaching Program at a state university in the Central Anatolia Region of Turkey. Of these, 38 were female and 14 were male. This gender imbalance was common in many educational studies that raised concerns about representativeness and the applicability of findings across diverse groups

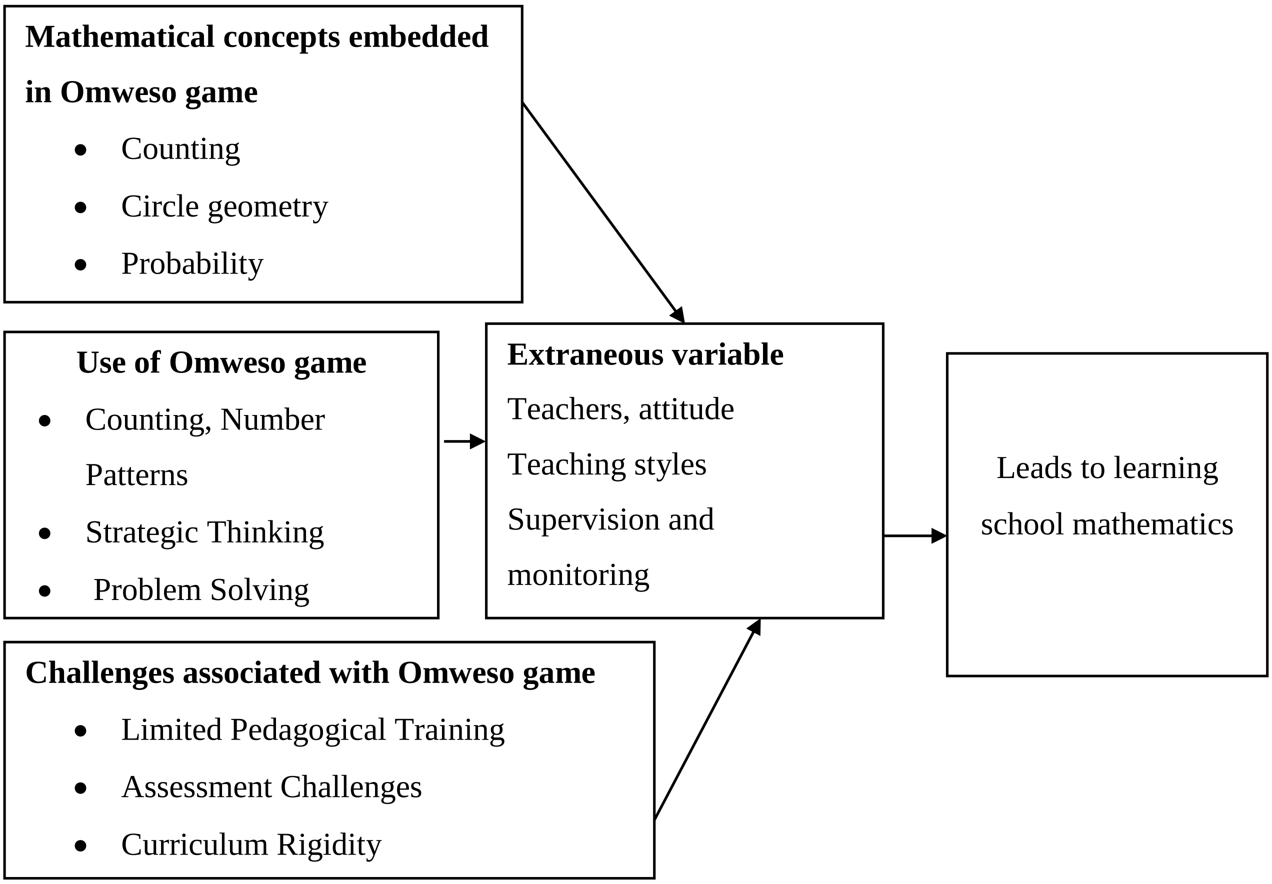
(Teddlie & Yu, 2007). The study sought to assess how deductive games, when incorporated into classroom instruction, could enrich learning outcomes. However, the context was limited to a single geographical and institutional setting, which constrains the external validity of the findings.

The study employed content analysis as its primary method for data interpretation. In this case, teacher candidates' open-ended responses were subjected to an open coding process to generate initial categories, followed by axial coding to organize related codes into broader themes, and finally selective coding to highlight the most salient issues particularly on the difficulty of designing curriculum-aligned games. However, the study does not explain whether this analysis was inductive or deductive, nor does it discuss the use of inter-coder reliability checks, peer debriefing, or member checks that was all crucial for ensuring trustworthiness and reducing subjectivity in qualitative analysis (Lincoln & Guba, 1985). The absence of these processes weakens the credibility of the conclusions drawn and suggests a lack of methodological rigor.

A critical finding from Gullain's (2023) study was that teacher candidates struggled to design games that were pedagogically appropriate for specific mathematical content. This gap reflects a deeper issue: the limited preparation and pedagogical training that teacher candidates receive in integrating innovative, game-based learning strategies into formal instruction. It also hints at a disconnect between theoretical coursework and practical application, a concern echoed by Akayuure and Nabie (2014), who argued that many teacher training programs fail to emphasize culturally responsive and creative teaching methods. Despite identifying this challenge, the study by Gullain does not sufficiently analyze why this problem exists whether due to lack of curriculum guidance, inadequate examples during training, or absence of relevant models in their context. More importantly, it omitted any linkage to a theoretical framework (e.g., constructivism or experiential learning), which would have added depth to the interpretation of these findings and facilitated their application in broader educational contexts.

In summary, several methodological and conceptual limitations are evident not only in Gullain's study but in related research in this area. Many of these studies, particularly in mathematics education and game-based learning, are not grounded in a specific theoretical framework (Saxe, 2012; D'Ambrosio, 1985), making their conclusions fragmented and lacking explanatory power. Most are situated in primary school environments and fail to extend their scope to teacher education programs where foundational pedagogical practices are shaped. Moreover, many such studies including Gullain's lack detailed explanation of data analysis techniques, with limited effort to ensure rigor or trustworthiness. Gender imbalance is a recurrent flaw, and a majority of studies are situated either in the Global North or isolated academic regions such as Central Anatolia, with very few conducted in African settings. These shortcomings informed the current researcher's decision to conduct this study in Zesui Sub-County, Uganda, focusing on the use of indigenous games like *Omweso* in mathematics teaching. This research aims to fill existing gaps by employing a theoretically grounded framework, robust qualitative analysis, and context-specific application of ethnomathematics, thereby offering both academic and practical value to mathematics education in under-researched contexts.

2.3 Conceptual Framework



Source: *Researcher (2024) based on the ideas of (D'Ambrosio, 2017, Barton, 2018, Gerdes, 2019 and Zaslavsky, 2017)*

Figure 1.1: Conceptual framework

Mathematical concepts embedded in Omweso game. This component explored how the rules, strategies, and patterns in the Omweso game were mapped to mathematical concepts such as counting, probability, and strategic thinking with the aim of leveraging the familiarity, and interest that students have in the Omweso game to introduce and reinforce mathematical ideas in a way that was culturally meaningful. Teachers who were engaged in the game would apply it in their understanding to solve mathematical problems derived from game situations.

Use of Omweso game. This focused on how teachers comprehended the rules and strategies of the Omweso game, which formed the basis for applying these concepts to mathematical problems with the sole purpose of thorough understanding of the game which is necessary for students to make meaningful connections between the game and mathematical concepts. Teachers facilitated the understanding by providing guidance and linking game mechanics to mathematical ideas while students worked on developing a deep understanding of Omweso game, which was essential for translating game strategies into mathematical reasoning based on the guidance from their teachers.

Challenges associated with Omweso game. This involved the process by which students learnt the Omweso game itself, including its rules, strategies, and cultural significance that served as the foundation for using Omweso as a tool for teaching mathematics. This stage was crucial as it built the students' confidence and familiarity with the game, making the transition to mathematical applications. Teachers provided instructions on the game, ensuring that all students participated and benefited from the ethnomathematical approach.

2.4 Chapter Summary

This chapter generally presented what other scholars revealed about how ethnomathematics can be used as a teaching approach in the learning of scholar mathematics. It showed how the previous researchers collected data, analysed data and interpreted it. This study explored the related literature on the use of games in the teaching of classroom mathematics and in particular use of omweso game as a teaching approach.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This Chapter presents a description of how the research was carried out. It gives organized steps and key areas that were followed in the study process. This consisted of: research approach, research design, study population, sample size and selection; data collection methods; data collection instruments; validity and reliability of data collection instruments; research procedure, intervention, data analysis, and ethical considerations.

3.1 Research Approach

The study adopted a qualitative research approach, which is appropriate for exploring meanings and culturally embedded practices within their natural contexts (Moser & Korstjens, 2018). This approach was particularly suitable because ethnomathematics focuses on understanding mathematical ideas as they emerge from indigenous knowledge systems and cultural activities. Through qualitative inquiry, the researcher was able to immerse in the learning environment and generate rich, descriptive data on how the *omweso* game functioned as a cultural resource for teaching and learning school mathematics. This immersion enabled an in-depth understanding of learners' mathematical reasoning, strategies, and cultural meanings embedded in the game, thereby illustrating how ethnomathematics bridges informal cultural knowledge with formal school mathematics (Creswell & Poth, 2018; D'Ambrosio, 2001).

3.2 Research Design

The study adopted a multi-case study design, which involves an in-depth investigation of more than one case to explore a phenomenon within its real-life context, with each case examined individually and then compared to generate broader insights (Hunziker & Blankenagel, 2024). This design was appropriate because it enabled the researcher to examine how ethnomathematics, through the use of the *omweso* game, was implemented as a teaching approach across different school settings. The multi-case design was applied by selecting several secondary schools as individual cases, each representing a distinct context in which *omweso game* was integrated into mathematics instruction. Data were collected and analyzed within each school separately and later synthesized across cases to identify common patterns and contextual variations.

3.3 Study Population

A population refers to the complete set of individuals or elements that share specific characteristics and are the focus of a study (Creswell & Creswell, 2018). In this study, the population comprised all ordinary level school mathematics teachers in the selected secondary schools of Sironko District. Specifically, 300 mathematics teachers from 25 secondary schools, including government, private, and community schools, were considered. The schools were categorized to ensure representation across different types, providing diverse perspectives on the use of ethnomathematics through the *omweso* game in mathematics teaching. The distribution of schools and teachers is summarized in Table 3.1:

Table 3. 1: Shows School category and Population of Mathematics Teachers

School Category	Number of Schools	Population
Government	8	120
Private	4	48
Community	13	132
Total	25	300

This population was appropriate for the study as it captured teachers actively involved in ordinary level mathematics instruction, enabling an in-depth exploration of how cultural games like *omweso* game are integrated into classroom practice (Sironko District Local Government, 2021).

3.4 Sampling Strategy and Sample Size

3.4.1 Sample Size

Sample size refers to the subset of individuals selected from a population to participate in a study, providing sufficient information to address the research objectives (Creswell & Creswell, 2018). In qualitative research, sample size is determined based on data saturation, richness of information, and the adequacy of insights needed to meet the study objectives, rather than strict statistical formulas (Mocănașu, 2020).

For this study, 12 ordinary level mathematics teachers were selected from the population of 300 teachers across 25 secondary schools in Sironko District. The number of teachers from each school category was calculated proportionally based on the total number of teachers in each category. The calculation is shown in Table 3.2:

Table 3. 2: Shows how 12 Mathematics Teachers were arrived at.

School Category	Number of Teachers in Population	Proportion of Total Population	Calculated Sample Size
Government	120	120/300 ≈ 0.4	0.4 × 12 ≈ 5
Private	48	48/300 ≈ 0.16	0.16 × 12 ≈ 2
Community	132	132/300 ≈ 0.44	0.44 × 12 ≈ 5
Total	300	1.0	12

3.4.2 Sampling Strategies

Purposive sampling was used to select 12 ordinary level mathematics teachers who were considered most knowledgeable and experienced in both teaching mathematics and understanding the cultural implications of the *omweso* game (Moser, 2018; Palinkas et al., 2015). Teachers were specifically chosen from the sampled secondary schools based on their capacity to provide rich, detailed insights into how mathematical concepts embedded in *omweso game* could be explored and related to the school mathematics curriculum. This approach was appropriate because the study was exploratory, aiming to gain an in-depth understanding of the phenomenon rather than to generalize findings, and allowed the researcher to focus on participants who could offer nuanced perspectives on the integration of ethnomathematics in teaching (Creswell & Creswell, 2018; Etikan et al., 2016).

3.5 Data Collection Methods

The data collection methods included:

3.5.1 Interviews

Data from objective three was collected using interviews from 4 ordinary level secondary school mathematics teachers. Roulston et al., (2018), asserts that interviews are a fundamental method for data collection in qualitative research. They are semi-structured to allow for follow-up questions and exploration of participants' responses and unstructured to allow a more conversational discussion, giving participants the freedom to express their thoughts.

3.5.2 Focus Group Discussion

Focus group discussion involves a small group (typically 5–10) of participants discussing a specific topic under a moderator's guidance (Moser & Korstjens, 2018). In this study, **8** secondary school mathematics teachers participated to explore their understanding of mathematics concepts, particularly how Omweso,game a traditional game, can be used to teach mathematical ideas through ethnomathematics, addressing the first two research objectives. The researcher facilitated the discussion, guiding and engaging the teachers to share their experiences and insights, which provided rich data on the integration of cultural games in mathematics instruction.

3.6 Data Collection Instruments

3.6.1 Focus Group Discussion Guide

This consisted of the purpose of the discussion, which explored the mathematical concepts embedded in omweso game and how they can be used in teaching secondary school mathematics as observed in objectives one and two. It emphasized that all responses were to be kept confidential and that there were no right or wrong answers. Participants were encouraged into open participation, respected differing opinions. This tool encourages researcher to provoke the teachers into the insights of mathematical concepts embedded in omweso game under discussion. (Nyumba, et al,2018).

3.6.2 Interview Guide

The Interview guide for Mathematics Teachers that facilitated qualitative data collection through one-on-one interactions, enhancing flexibility according to (Johnson et al., 2012), consists of three sections; section A has demographic information of the teachers and section B comprising information on the challenges that teachers face while developing mathematical concepts using omweso game-based teaching approach. Four questions were included. Semi-structured interviews, lasting around 30 minutes were conducted and videos were captured and recorded using laptop on each of the 4 teachers in each school sitting until data saturation was reached. Interviews, as per Amin (2005), provides ample room for detailed explanations, clarity, and eliminating ambiguity.

Despite being time-consuming and demanding (DeJonckheere, 2019), interviews allow for in-depth exploration of participants' challenges in the use of Omweso game as a teaching approach for secondary school mathematics.

3.7 Data Quality Control

In this study, reliability of the focus group discussion and interview guides was ensured through consistent and structured procedures. The same guiding questions were used across all sessions with 4 mathematics teachers in interviews and 8 teachers in a focus group discussion, while audio and video recordings, detailed notes, and careful transcriptions captured both verbal and non-verbal cues. Questions were read aloud and rephrased when necessary, and participants were given ample time to respond in a relaxed setting, with active listening and probing used to elicit in-depth responses. Member checking confirmed participants' views, and a consistent coding framework was applied during analysis to identify recurring themes. Using both interviews and focus group discussions allowed triangulation of data sources, enhancing the trustworthiness of findings. These procedures ensured that the tools consistently captured rich, contextually grounded insights into how mathematics concepts, including those embedded in cultural games like Omweso game can be applied in teaching through ethnomathematics.

3.8 Research Procedure

Proposal was developed through guidance and supervision by the allocated supervisor. Thereafter proposal vetting was conducted and the researcher made corrections in light to guidance got from proposal vetting. An introductory letter was then picked from the Dean, school of education to allow the researcher to go for field tool piloting, testing and their amendments before being used for data collection. The introductory letter introduced the researcher to the secondary schools were the participants (mathematics teachers) who had ideas of Omweso game. Thereafter, appointments for data collection were made on when the researcher was to visit participants. After data collection, data analysis was conducted, writing of dissertation and presentation to supervisors for advice. A final copy was prepared in light of the supervisors' advice in preparation for external examination and defense. On execution of the advice after the defense, final dissertation was to be submitted for graduation.

3.9 Data Management and Analysis

Data management and analysis began with the transcription of all audio and video recordings from both interviews and focus group discussions. The recordings were transcribed verbatim to ensure an accurate and faithful representation of participants' views. The transcripts were then read repeatedly to promote familiarity with the data and enable deeper engagement. During this familiarization stage, initial codes were generated to capture key ideas emerging from the data, including counting strategies, probability, spatial reasoning, and pattern recognition, which reflected core mathematical aspects embedded in the omweso game.

The study employed thematic analysis as the primary analytical approach for both the focus group discussions and the semi-structured interviews, following the procedures outlined by Nowell et al. (2017). This process involved systematic steps of data familiarization, initial coding, theme identification, theme review, definition and naming of themes, narrative writing, and report generation (Byrne, 2022). Once coding was completed, related codes were grouped into broader thematic categories that reflected shared and divergent viewpoints among participants.

Data from the focus group discussions, which involved eight secondary school mathematics teachers, were analyzed to identify mathematical concepts inherent in the omweso game and explore how these concepts could be applied in teaching secondary school mathematics. The interactive nature of the focus groups allowed participants to build on one another's ideas, debate differing perspectives, and provide richer insights into the instructive value of omweso. As a result, themes such as *conceptual understanding through play*, *enhancing learner engagement*, and *cultural significance in pedagogy* emerged. Trustworthiness was enhanced by cross-checking themes across different focus group sessions and ensuring that each theme was supported by multiple data points.

Interview data collected from four teachers focused on the challenges of implementing Omweso game-based mathematics instruction were analyzed using the same thematic approach to ensure consistency. Each interview transcript was analyzed independently, and recurring issues were coded and organized into themes such as *limited instructional time*, *lack of teaching materials*, *inadequate teacher training*, and *curriculum rigidity*. These themes highlighted the practical and systemic constraints teachers encountered when attempting to integrate this culturally grounded approach into classroom practice.

Findings from both data sources were then triangulated to develop a comprehensive understanding of the opportunities and limitations associated with using Omweso game concepts in secondary school mathematics teaching. Intra-method triangulation was employed to enhance credibility and accuracy, as recommended by Creswell (2012). While focus group discussions provided rich insights into the pedagogical potential of Omweso game, interview data added depth by illuminating implementation challenges. Data were presented narratively, with key quotations used to support and illustrate the findings. This integrated analysis offered a balanced perspective on the instructional value of Omweso game and the contextual realities influencing its use in formal mathematics education.

3.10 Ethical Consideration

To uphold informed and voluntary consent, the researcher provided all participants with detailed information about the purpose, scope, and procedures of the study prior to data collection. Participants were informed that the research aimed to explore mathematical concepts within the *Omweso* game and how these could be applied in teaching secondary school mathematics, as well as the challenges associated with this approach. A clear explanation of what participation entailed including the use of interview and focus group discussion guides, audio and video recording, and transcription was given verbally and in writing. Each participant was then provided with a consent form, which they signed to affirm their voluntary participation and understanding that they could withdraw at any point without consequence.During transcription and analysis, participants were referred to using pseudonyms or coded labels T1,T2,T3...T12 rather than real names. Audio and video files were securely stored in password-protected digital folders accessible only to the researcher to achieve confidentiality.

Additionally, any quotations used in reporting the findings were carefully selected to avoid revealing the identity or specific context of individual participants. These procedures ensured that the data could be used for academic purposes while safeguarding participants' identities and sensitive information. The researcher created a safe, inclusive environment during both interviews and focus group discussions by using respectful language, allowing participants ample time to express themselves, and actively listening to their contributions. Any discomfort or hesitation was met with reassurance, and the researcher made it clear that participants had the right to decline answering any question they were uncomfortable with. These actions demonstrated genuine regard for each participant's autonomy, cultural values, and personal experiences, aligning with ethical standards in qualitative research. Together, these ethical safeguards helped foster trustworthiness that upheld the integrity of the study findings.

3.11 Chapter Summary

This chapter looked at the methodology the researcher used to collect and analyse data on the exploration of how ethnomathematics, specifically omweso game, can be used as a teaching approach in learning school mathematics. This study employed a qualitative approach and a multi case study design. The sample was 12 ordinary level school mathematics teachers from Eastern Uganda and in particular Zesui subcounty Sironko district. The data collection instruments were Focus Group Discussion Guide and Interview Guide. The researcher analysed data using thematic analysis.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.0 Introduction

This Chapter, dealt with data presentation, analysis and interpretation in accordance to the research objectives with meanings and inferences as compared with the concepts in the literature review.

The data collection process for this study involved conducting interviews and focus group discussions with secondary school mathematics teachers to explore the use of the Omweso game in teaching mathematics. The interviews provided in-depth insights into the challenges that mathematics teachers face as they apply mathematical concepts embedded in omweso game in teaching secondary school mathematics while focus group discussion guides were used to gather data on the mathematical concepts in omweso game and how mathematical concepts embedded in omweso game can used in teaching mathematics. The discussions were recorded, transcribed, and organized based on the three research objectives.

Before the data analysis, the collected qualitative data were systematically categorized according to the research objectives. For the first objective, responses related to the mathematical concepts embedded in Omweso game were grouped together, highlighting common themes. The second objective focused on how teachers use these concepts in the classroom, and responses were presented in themes. The third objective involved organizing teachers' responses regarding the challenges they face, this thematic presentation allowed for a structured approach to analyzing and interpreting the data.

Presentation in chapter four (4) commenced with the response rate of respondents and demographic characteristics as indicated below.

4.1 Response Rate of Respondents

The response rate of the study was as follows:

According to Table 4.1, the study demonstrated full participant engagement throughout the data collection process, with all targeted mathematics teachers actively taking part in both focus group discussions and individual interviews. All eight teachers selected for the focus group discussions and all four chosen for interviews participated as planned, ensuring that the data reflected the complete range of intended experiences and perspectives. This comprehensive participation enabled the study to capture the key issues under investigation accurately and in sufficient depth.

Participants engaged openly and freely during the discussions and interviews, sharing detailed accounts of their classroom practices and experiences in regards to omweso game. As one participant noted, *"We were all able to speak openly and share what really happens when play omweso game."* The absence of non-participation strengthened the dependability of the findings, while the use of multiple data collection methods enhanced confirmability. The recurrence of similar views across participants indicated that key issues were thoroughly explored, providing a solid foundation for credible responses.

Table 4.1: Response rate of respondents

Instruments	Targeted group	Number	Interacted with
Focus group discussion guide	Mathematics teachers	08	08
Interview guide	*Mathematics Teachers*	04	04
	Total	12	

4.2 Demographic Characteristics of Respondents.

The results on demographic characteristics of respondents were represented in seen in the table below.

Table 4. 2: Demographic Characteristics of Respondents

Teacher Code	Gender	School Type	Teaching Experience
T1	Male	Government	6–10 years
T2	Female	Private	6–10 years
T3	Male	Community	2–5 years
T4	Male	Government	6–10 years
T5	Female	Private	6–10 years
T6	Male	Community	10+ years
T7	Male	Government	6–10 years
T8	Male	Government	6–10 years
T9	Female	Community	2–5 years
T10	Male	Government	10+ years
T11	Male	Private	6–10 years
T12	Male	Government	6–10 years

In accordance to Table 4.2 above, the demographic profile of the mathematics teachers who participated in the study indicates that most were male (nine) with a smaller proportion being female (three). The majority had moderate teaching experience, ranging from 6 to 10 years, while a few teachers had less experience (2–5 years) and some had extensive experience exceeding 10 years. Teachers were drawn from a mix of school types—government, private, and community—which provided varied institutional contexts for teaching mathematics (Table 4.2).

Participants highlighted the relevance of their experience to the integration of Omweso game in mathematics teaching. One teacher noted, *"Having several years in teaching helps me see how games like Omweso game can connect with our syllabus and engage students* *meaningfully."* Another added, *"Even though I am relatively new, I find that incorporating traditional games helps students understand mathematical concepts better."* This combination of experience levels ensures that the study captured both established teaching practices and innovative approaches to integrating ethnomathematics. The diversity of school types further allowed the research to explore how the Omweso game could be adapted across different institutional contexts, providing a comprehensive understanding of its instructional potential. Overall, the demographic distribution enhances the credibility and richness of the findings, reflecting a balanced representation of teachers' perspectives, experiences, and classroom realities.

4.3 Mathematical Concepts Embedded Within Omweso Game Process

The researcher observed the initial omweso game processes, board to be used, size of the board, people to play, seeds used, lines on the board with its line of axis and the number of circular holes for keeping seeds during game procession and initial mathematical concepts identification throughout the game.

The study revealed that the Omweso game embeds a variety of mathematical concepts that became apparent as the teachers, were actively involved in the game. Their engagement in the gameplay allowed them to identify and reflect on the underlying mathematical processes, such as counting, sequencing, and strategic planning among others. Teachers noted that involving multiple players enhanced collaborative thinking and problem-solving, as participants needed to anticipate each other's moves while distributing seeds across the board. One teacher remarked, *"As we played Omweso game, I realized that planning and predicting moves requires quick counting and thinking ahead, which mirrors the kind of reasoning we want students to develop in mathematics."* This demonstrates that active participation in the game enables teachers to uncover and understand the cognitive and strategic skills that learners can develop.

The size of the board, the arrangement of lines, and the circular holes for keeping seeds further highlighted important mathematical concepts. Teachers observed that distributing seeds across the holes naturally involved operations such as addition, subtraction, multiplication, and division, as well as spatial reasoning and pattern recognition. One participant noted, *"The layout of the board and the way seeds move from hole to hole made it clear how students can visualize numbers, practice grouping, and see patterns without using paper or calculators."* The seeds act as tangible objects that made abstract concepts concrete, allowing teachers to explore ideas of probability, sequencing, and strategic distribution.

Through actively playing Omweso game, teachers gained new insights into how culturally grounded games can be used to teach mathematics. They reflected on how the game encourages learners to recognize patterns, understand sequences, and apply strategic thinking in problem-solving contexts. As one teacher explained, *"Playing the game opened my eyes to how much mathematics is embedded in cultural practices; students can learn counting, planning, and predicting in a way that feels natural and engaging."* This indicates that involving teachers in hands-on gameplay is essential for discovering mathematical concepts, linking cultural experiences with formal mathematical understanding, and providing innovative approaches to teaching mathematics effectively. The preparations and mathematical concepts identification were all highlighted in the next sub-sections.

4.3.1 Materials For Omweso Game and Its Structure

The study revealed that the materials and structure of the Omweso game board are central to uncovering mathematical concepts during gameplay. The board itself is rectangular and divided into rows and columns of circular holes, each serving as a container for seeds used in play. Teachers observed that the arrangement of the holes, along with the size and layout of the board, helped learners visualize numerical groupings, understand counting sequences, and develop spatial reasoning. One teacher remarked, *"The structure of the board, with its rows and holes, allows students to see numbers as groups, plan moves, and follow sequences without needing written calculations."* This demonstrates that the board provides a concrete foundation for exploring abstract mathematical ideas.

The seeds and the organization of the board allowed teachers to identify additional mathematical concepts. Moving seeds across the holes naturally involved arithmetic operations such as addition, subtraction, multiplication, and division, while also fostering pattern recognition, probability understanding, and strategic thinking. As one participant explained, *"By distributing seeds from one hole to another, I could immediately see how students can learn grouping, counting, and even predicting outcomes in a very interactive way."* This highlights how the physical components of the gameboard, holes, and seeds that serve as manipulatives, making abstract mathematics tangible and promoting hands-on learning.

Through engaging with the board and seeds, teachers gained new knowledge on how culturally grounded games can be used in mathematics teaching. They realized that each part of the board and each seed can be deliberately leveraged to teach concepts such as sequence planning, operations, and problem-solving strategies. One teacher reflected, *"Playing with the board and seeds helped me understand how students can experiment with numbers and strategies, linking traditional games to classroom learning."* This indicates that the materials and structure of Omweso game not only reveal embedded mathematical concepts but also provide teachers with innovative, practical approaches to enhance students' understanding and engagement in mathematics.

Table 4. 3: Omweso Board Materials, Functions, and Relevance to Teaching Mathematics

Omweso Board Material/Part	Function in Gameplay	Relevance in Teaching Mathematics	New Knowledge Developed
Board (rectangular with rows and columns)	Provides the playing surface, organizes holes for seed distribution	Helps visualize numbers, understand sequences, grouping, and spatial arrangements	Teachers see how board layout supports counting, addition, and planning moves strategically
Circular Holes	Hold seeds and serve as positions for distribution during gameplay	Enables practice of grouping, counting, and understanding basic operations	Demonstrates concrete representation of numbers and operations, aiding conceptual understanding
Seeds	Act as manipulatives moved from hole to hole according to rules	Facilitates arithmetic operations, pattern recognition, and probability	Teachers recognize how tangible objects make abstract concepts observable, supporting hands-on learning
Rows and Columns	Define pathways for seed movement and strategy planning	Supports understanding of sequences, patterns, and systematic thinking	Teachers learn how structured arrangements guide learners in sequencing, predicting outcomes, and strategic reasoning
Player Positions	Assign turns and movement responsibility	Encourages collaborative problem-solving and anticipation of moves	Teachers observe how social interaction during gameplay enhances cognitive skills and mathematical reasoning

This is illustrated by the figures 4.1 and 4.2 as indicated below:

*Figure 4. 1: Omweso game board structure showing the rows and columns and seeds or stones used when playing. Photo by the Researcher***.**

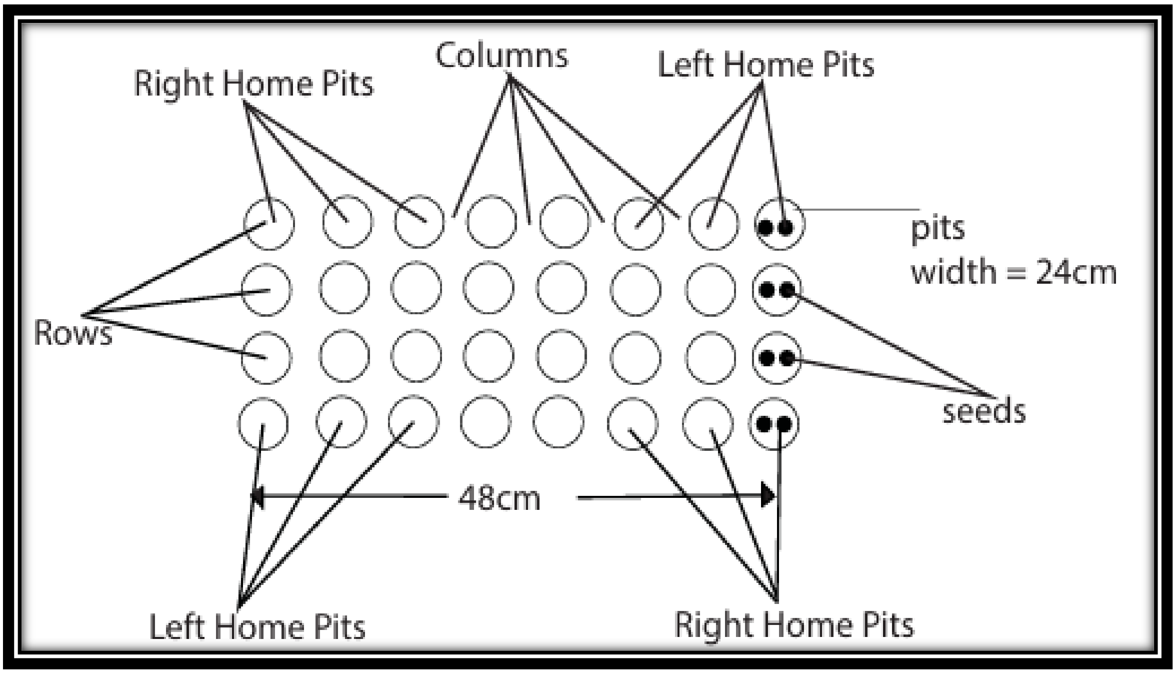


*Figure 4. 2: showing omweso game board structure illustrating its length and width, the seeds, rows, columns, left and right home pits on both sides. Illustration by the Researcher***.**

4.3.2 Omweso Game Playing Process

The Omweso game playing process begins with an initial setup of a rectangular board, consisting of 16 pits (two rows of 8), each initially filled with 2 seeds, giving a total of 64 seeds. Players are positioned opposite each other, and the aim is to capture the opponent's seeds through strategic moves. Each player must carefully distribute seeds from one pit to others in a clockwise pattern, where the mathematical concept of numeracy plays a key role. Players must calculate the number of seeds in each pit and apply basic arithmetic to determine the result of each move. This is a prime example of division and subtraction, as players divide the seeds among multiple pits, reducing the count in the starting pit. This was illustrated in figure 4.3 demonstrating how the teacher revealed the concepts during playing process opponent in the process of omweso game.

Figure 4. 3: Showing the omweso game playing process indicating the movements and spreading of the seeds from each pit in the rows and columns as omweso game players are playing in Sironko District Zesui Sub County in Eastern Uganda. Photo by the Researcher.

4.3.3 Mathematical Concepts of Counting, Addition, Substraction and Multiplication

In the course of playing omweso game, it was noticed that each pit had two seeds and this reflected that use of omweso game could help learners in counting, adding, substracting and multiplication where learners find it as an uphill task. The omweso game pits before the start of the game each pit has two seeds reflecting counting in two, substraction in twos and multiplication in twos. For examples four pits on the width side (vertical) contain eight seeds (8) while on the length were eight pits that contained sixteen seeds (16) representing two groups of four and two groups of eight (horizontal) respectively as illustrated in the Figure 4.4.

In the main stream, the concept can be applied in the form noted by mathematics teachers Kadijja and her friend Catherine who elaborated on how the two rows of 8 twos come about in omweso game play. This was more evident when they further demonstrated on paper how it would like as in Figure 4.4

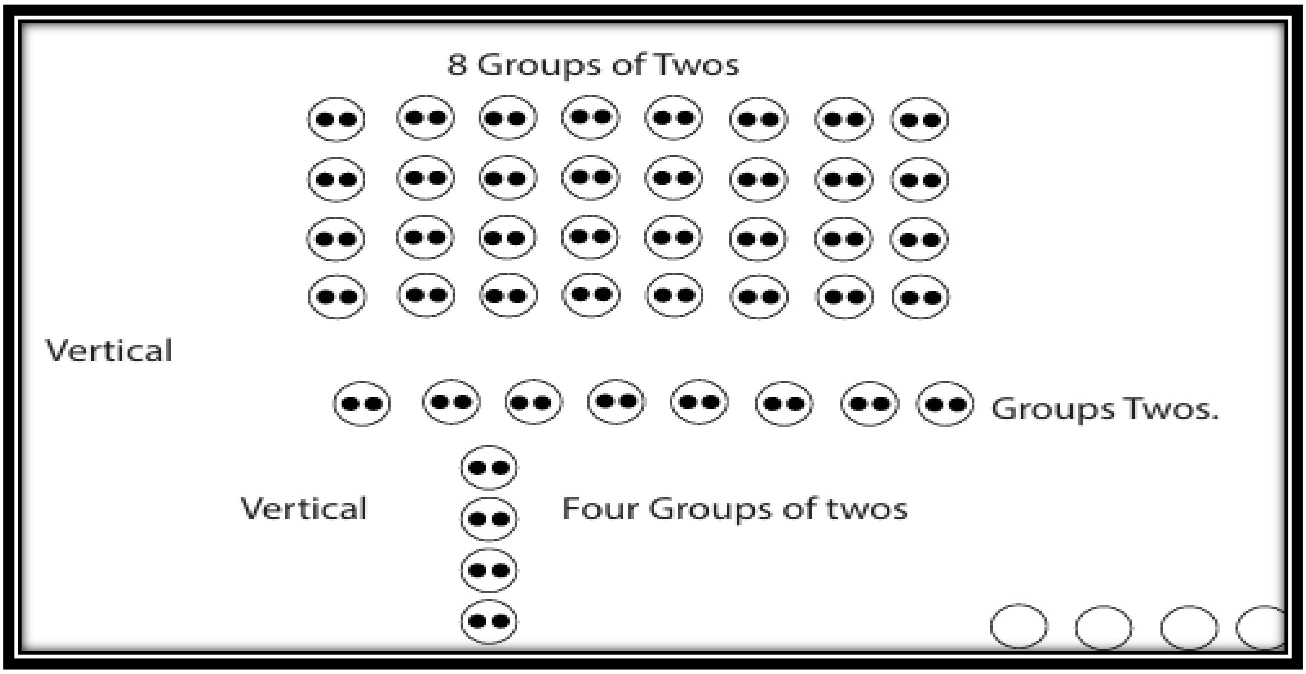


Figure 4.4: Showing counting, addition, subtraction and multiplication in twos using the length and width in Sironko District Zesui Sub County in Eastern Uganda. Illustration by the Researcher.

It was revealed that during the game, matrices and modular arithmetic are central to the game's strategy. Each pit can be considered an element in a 2D matrix, with players manipulating this matrix by redistributing seeds. The Omweso game board, as shown in the image, featured a 2D matrix structure with two rows of eight pits a 2×8 matrix. This structure allowed each pit to be treated as a matrix element, where the number of seeds in a pit corresponded to the value of that element. For example, pit (1,3) held 4 seeds while pit (2,7) ha 0. During gameplay, when a player chose a pit, they redistributed the seeds in a clockwise or counterclockwise direction (depending on local rules) into adjacent pits. This redistribution mimicked row-wise traversal in matrix operations, and players mentally tracked the number of seeds per pit. This introduced them to foundational matrix manipulation**,** as well as concepts of rows, columns, and iterative operations, which are essential in secondary mathematics, especially in algebra and linear algebra.

The board layout was mathematically represented as a 2x8 matrix, where each pit's seed count was an integer value. As players distributed seeds from one pit, they followed a modular pattern: after a pit with seeds was selected, the seeds were placed one by one in the subsequent pits in a cyclical manner. This invoked the use of modular arithmetic as players calculated how many seeds they placed in the following pits, ensuring the number of seeds in each pit did not exceed the total available. This followed the rule that seeds must be redistributed within the constraints of what the player initially collected. For instance, if a pit had 7 seeds, the player could only drop one seed in each of the next 7 consecutive pits. This called for modular arithmetic, especially as players "wrapped around" the board. For example, if a player distributed 12 seeds and reached the end of their row, they continued into the second row, modulo the total number of pits. This involved calculating (current pit index + seed number) mod 16, where 16 represented the total number of pits. This concept helps learners grasp division with remainders, cyclic operations, and iteration within fixed limits, all of which are key ideas in number theory and programming logic.

The strategic nature of Omweso game connected directly to game theory. For example, Omweso game requires players to analyze not only their current move but the consequences of several turns ahead. For example, a player might choose not to play a pit with 6 seeds if doing so would allow the opponent to capture them in the next turn. Instead, the player may choose a pit with fewer seeds to disrupt the opponent's strategy. This introduces decision analysis, payoff evaluation, and anticipatory thinking, all central to game theory. In secondary mathematics, this related to optimization problems and logical deduction. Example scenarios included: avoiding a pit that would set up the opponent for a capture, choosing a move that maximized future mobility; and blocking the opponent's pits from accumulating too many seeds, hence minimizing their gain.

During omweso game playing process it was earthed that Geometry and symmetry come into play through the board's mirrored structure. Each player's row was directly opposite the other's, which enabled players to predict symmetric moves. For example, if the opponent plays pit (2,4), a player might respond by mirroring the move at (1,4) to defend or counter. This geometric reasoning developed skills in reflective symmetry, position mapping, and coordinate identification which are key concepts in geometry lessons. For instance, using spatial awareness to plan where redistributed seeds would land, reflecting movements to counter the opponent, visualizing symmetrical patterns of seed spread, and utilizing geometric patterns to control both sides of the board strategically. Each pit was semi-spherical in shape when the board was open, and when the two halves were closed, the matching semi-circles combined to form complete circles (in 3D). This physical design offered multiple mathematical learning opportunities, particularly in geometry, measurement, fractions, ratios, symmetry, and spatial reasoning. The game's cultural familiarity made it an ideal resource for contextual learning in lower secondary mathematics.

4.3.3.1 The Concept of Circles and Semi-Circles

From the top view, each Omweso game pit appears as a circle**,** making it a practical example for studying circle geometry. The pits from which semi circles are picked are indicated in Figure 4.5

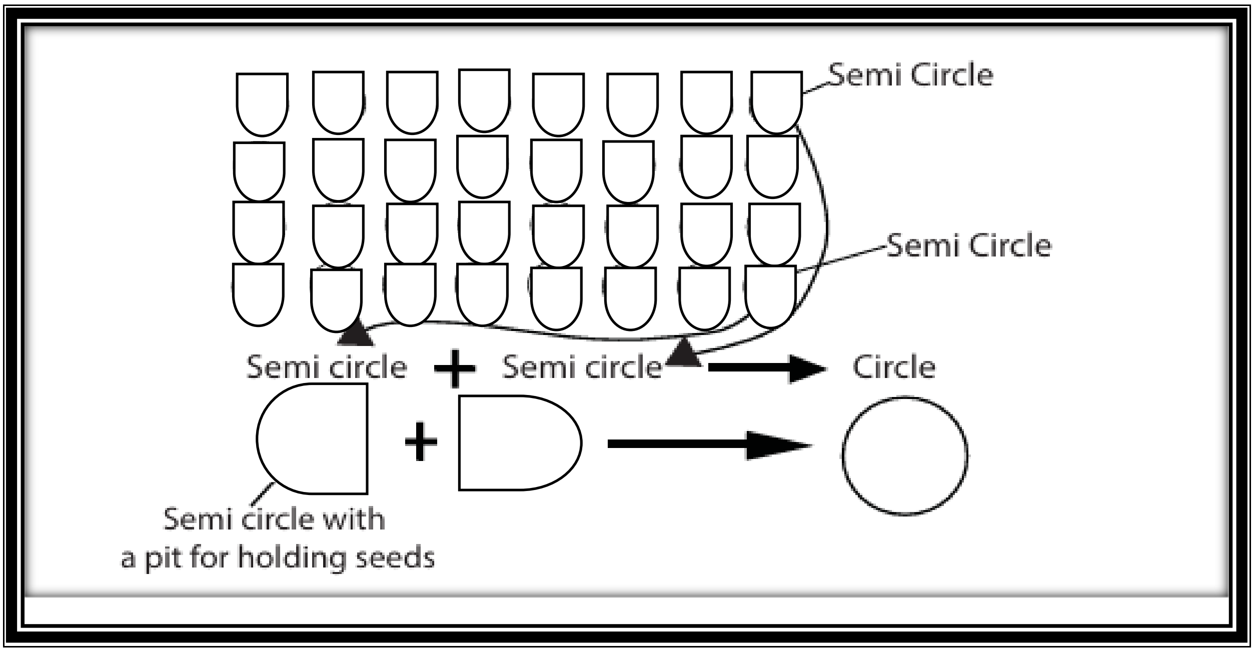


Figure 4. 5: Showing how pits were picked from omweso game board and used in formation of a circle. Illustration by the Researcher.

In the mainstream mathematics, the concept illustrated above can be applied as indicated in the scenario questions.

1. a) Suppose a semicircular pit of omweso game board has a diameter of 77cm. what is the area of the pit.

   b) Find the circumference of the pit

Each half of the board holds a semi-circle (2D view) or hemisphere (3D view), and two halves together form a complete shape called a circle as indicated in figure 4.6. Learners can physically measure a pit's radius and calculate its circumference and area, comparing their results with actual physical measurements.

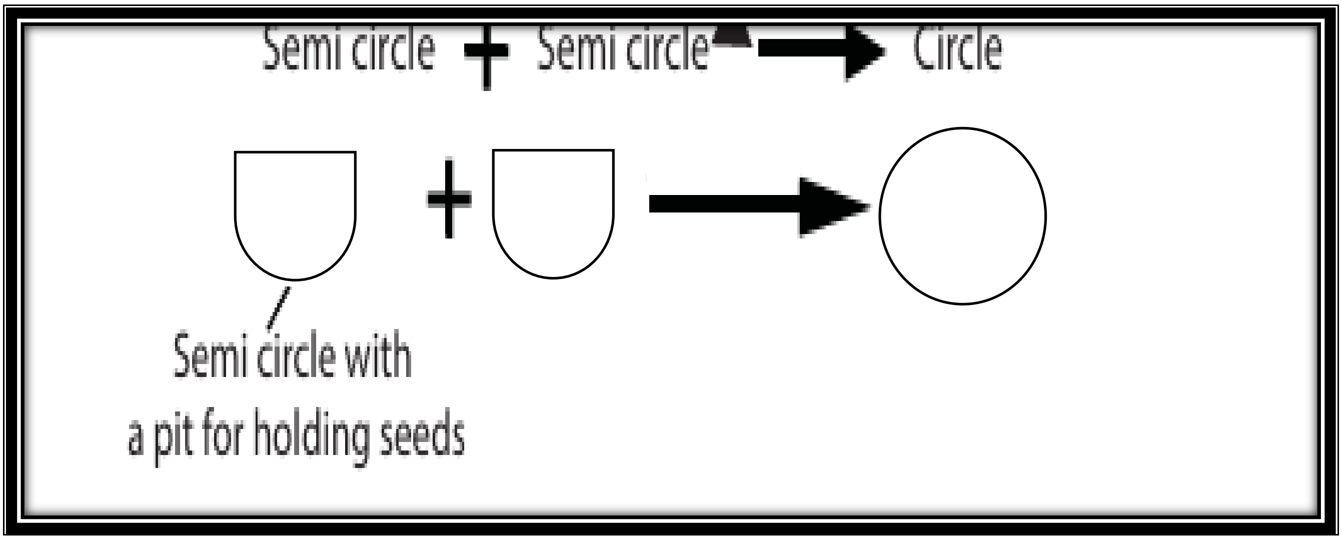


Figure 4. 6: Showing formation of a circle by combination of two semi circles from of the open pits of omweso game board. Illustration by the Researcher.

4.3.3.2 Parts of Circle

When interacted with the respondents, it was unearthed that obtaining semi circles as open pits of the open omweso game board cannot only teach the concept of circle but also the parts of the circle that include radius, diameter, chord, sector, secant, segment, arc and tangent.

In main stream mathematics, radius is a straight line from the center of a circle to any point on its circumference. This was evident during interactions with the respondents. For Example, the semicircular parts of the hole of Omweso board game were compared to a wheel of radius of 7 cm, whose center to the rim distance is 7 cm. this scenario helped the researcher to get more detailed parts that was later demonstrated in paper form for clarity as respondents willing to bring out all what could be applied even at the time of classroom instruction. The application of the concept circle geometry as in relation to omweso game were summarized with aid of Figure 4.7. the following explanations were revealed:

Diameter is a straight line passing through the center of the circle and touching two points on its circumference; equal to twice the radius for example: If the radius is 7 cm, the diameter is 14 cm.

Chord is a straight line joining two points on the circumference of a circle but not necessarily passing through the center for instance a string stretched across part of a drum skin forms a chord.

Sector is a portion of a circle enclosed by two radii and the arc between them. For instance, Example: A slice of chapati represents a sector of the chapati circle.

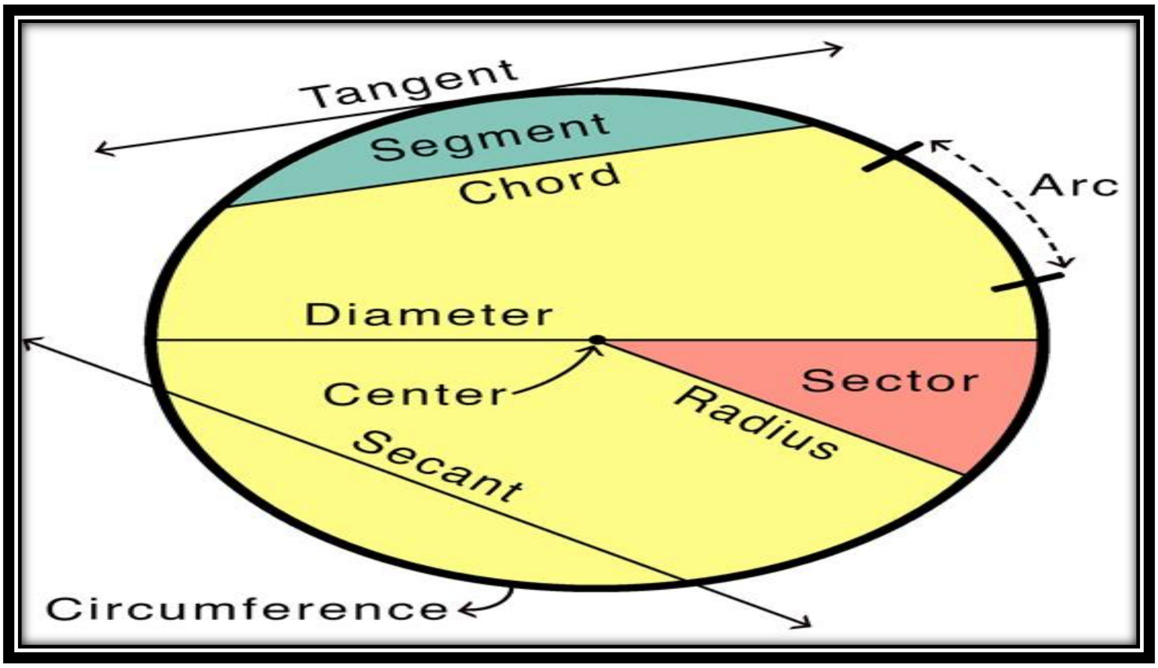


Figure 4. 7: Showing parts of a circle obtained from two semi circles from of the open pits of omweso game board. Illustration by the Researcher.

4.3.3.2 Symmetry in Omweso

During playing omweso game, the Omweso board clearly demonstrated reflectional symmetry**.** When the two halves were closed, each pit matched exactly with the pit opposite it creating a perfect mirror image along the hinge line. This line illustrated Symmetry concepts which were vertical symmetry (longtitudinal line of symmetry) where left half is a mirror of the right half and horizontal symmetry (transverse line of symmetry). This could be extended to rotational symmetry when the board is turned 180° in play. This was illustrated as shown in Figure 4.8.

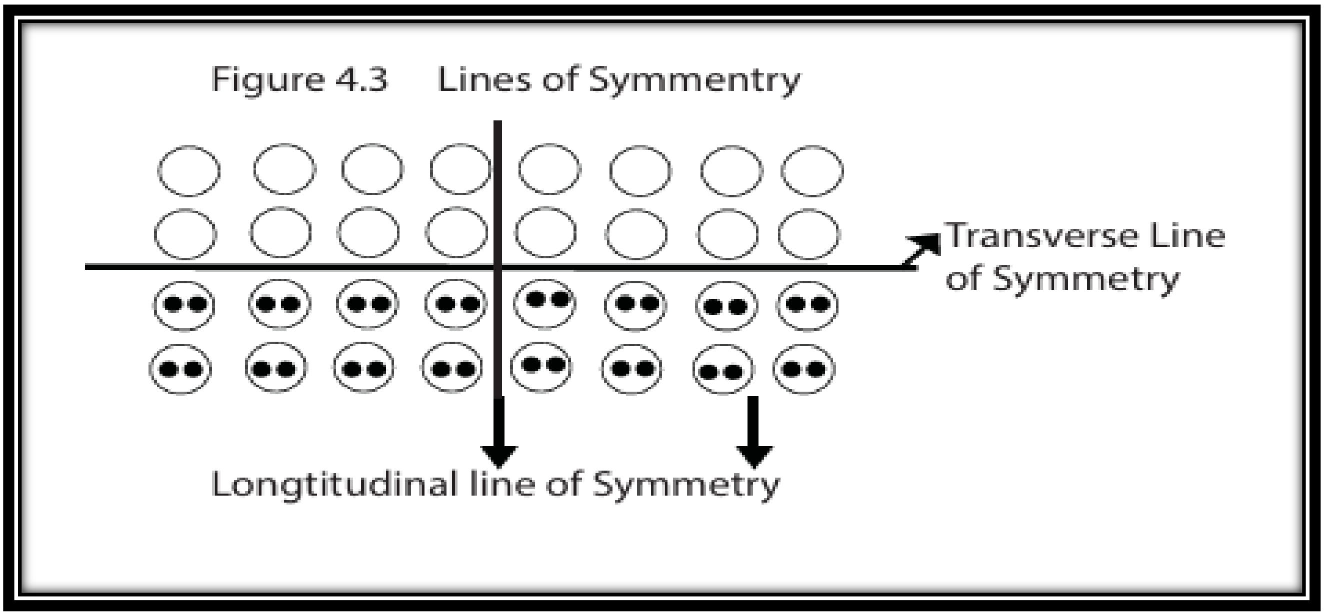


*Figure 4. 8: Showing the vertical and horizontal lines of symmetry from the omweso game board. Illustration by the Researcher***.**

4.3.3.3 Mathematical Concept of Reflections

On interaction with omweso game players, I revealed that there are reflections with the omweso game board. For example, when divided transversely, one rectangle made up of two lines of having sixteen pits was mapped to another rectangle containing the same number of pits. This is illustrated in the Figure 4.9.

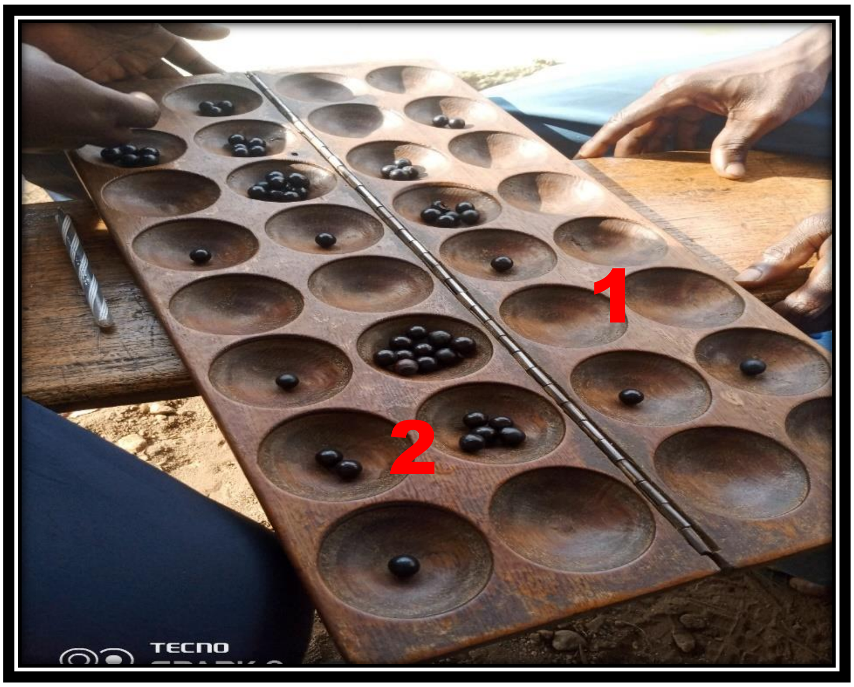


Figure 4. 9: showing transverse reflection of a rectangle in omweso game. Illustration by the researcher.

A similar reflection was evidenced with a triangle where figure 1 was mapped to figure 2. This is illustrated in Figure 4.10

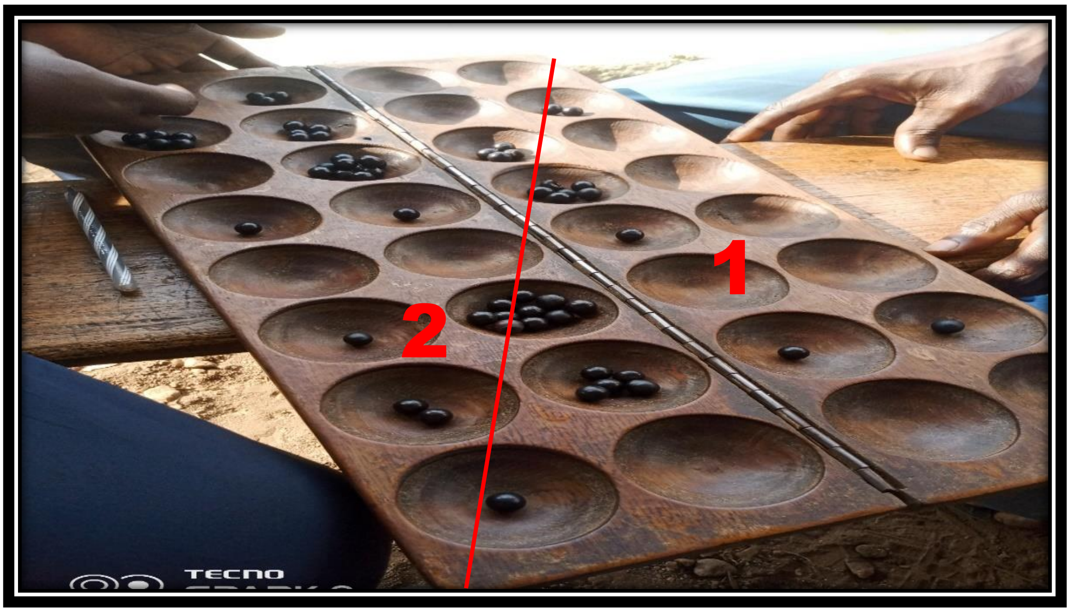


Figure 4. 10: Showing reflection with omweso game board on triangles

In addition to the above, the omweso game playing process also indicated probability and decision trees which is essential as players evaluate possible outcomes and the likelihood of capturing seeds with each move. For example, a player may evaluate the chance that their redistribution will end in a capture based on the opponent's remaining seeds. This involves listing possible scenarios**,** assigning likelihoods**,** and choosing optimal branches just like building a decision tree in statistics. In secondary school math, this translates into: (1) using tree diagrams to predict seed distributions; (2) estimating the most likely pit the opponent will target; (3) assigning probabilities to capture scenarios; and (4) evaluating moves based on their expected value or risk factor. These elements strengthen statistical reasoning and decision-making under uncertainty**.**

Omweso game becomes a dynamic application of mathematical concepts, as it requires players to manage numerical values for instance, at the core of every move there is need for arithmetic precision. Each player must count and manage seeds, typically beginning with 2 seeds in each of the 16 pits (totaling 64 seeds). For instance, if a player selects a pit containing 7 seeds, they must distribute them one by one into the next seven pits in a counterclockwise direction. This task involves addition and sequencing: 1 seed per pit until all are distributed. The player must mentally calculate where the final seed will land, making it a real-time example of sequential arithmetic. Moreover, mathematical operations such as subtraction (removing seeds), multiplication ("4 pits each with 3 seeds = 12"), and division (splitting seed counts for multiple sowings) come into play. These numerical operations help build fundamental concepts like place value, estimation, and operations on whole numbers, which are key in primary and secondary mathematics that help the players apply spatial relationships, and strategic predictions to outmaneuver their opponent and secure a win.

Omweso game also develops a strong sense of spatial relationships, as the board layout and pit positions form a structured 2×8 matrix on one side of the player. This configuration requires players to think in two dimensions, akin to navigating a coordinate grid in mathematics. For example, if a player sows seeds starting from pit A3, they must mentally track where each seed lands through a clockwise or counterclockwise loop, looping back after pit A8 to B1. Understanding this cyclical path relates directly to modular arithmetic and reinforces spatial awareness. Spatial judgments also involve measuring distances between a player's current position and the opponent's vulnerable pits. Suppose Pit A4 is four pits away from a weak opponent pit on the second row this spatial spacing must be calculated quickly for an effective capture. Such estimations align with topics like symmetry, distances on a number line, and geometric reasoning.

Equally important is the strategic prediction that players employ throughout the Omweso game. Strategy involves assessing the immediate outcome of a move while also forecasting future responses by the opponent. A player, for instance, may choose to sow 9 seeds starting from Pit 5, predicting that the last seed will land in a pit with existing seeds, allowing them to continue playing (a bonus move). This mirrors the concept of "if-then" logic in mathematics and encourages pattern recognition. Another scenario includes evaluating whether placing seeds close to an opponent's pit with a low seed count is safe or risky this is basic probability and risk assessment in action. Furthermore, players learn to recognize and exploit patterns in seed distribution, a skill vital to understanding arithmetic sequences and trends, such as "every third pit is likely to be full" or "alternate pits are always empty." This cognitive process reflects strategic thinking akin to chess and is foundational for mathematical modeling and problem-solving.

4.3.3 The Mathematics Concepts Involved in Omweso Game

The results from the conducted interviews with 12 lower secondary school mathematics teachers (T1-T12) in Zesui Sub County, Sironko District, revealed that Omweso game incorporates several fundamental mathematical concepts as indicated in the figure 4.9

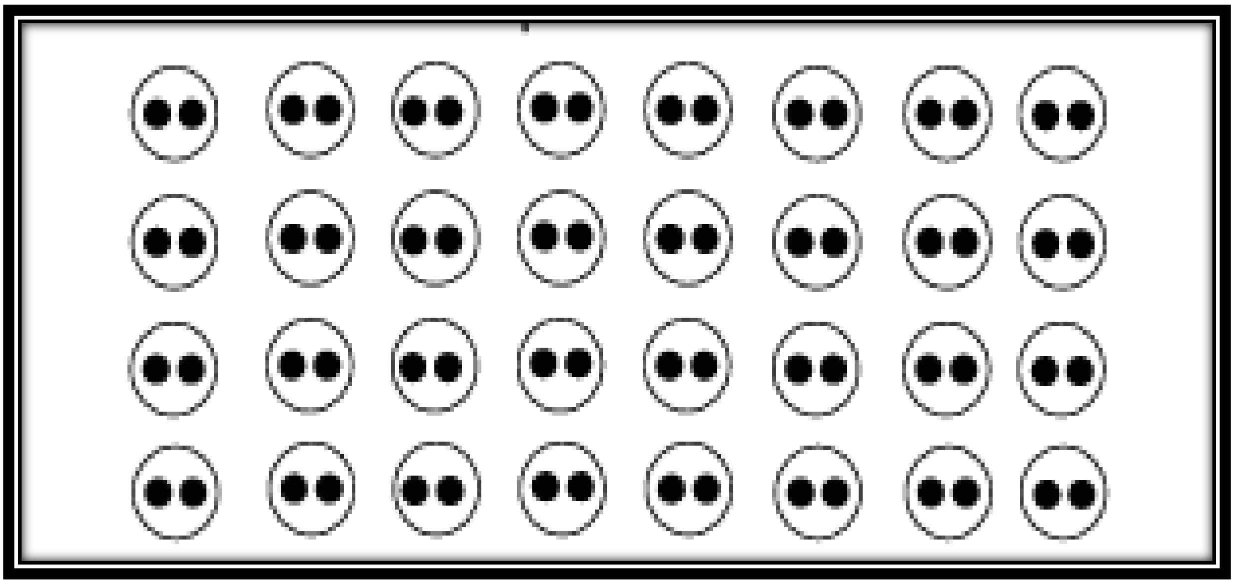
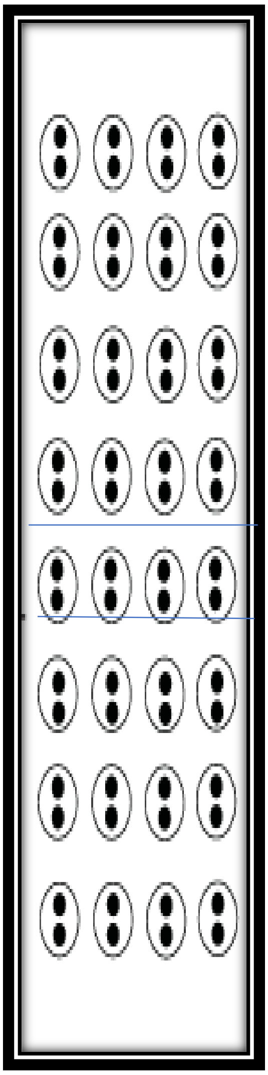
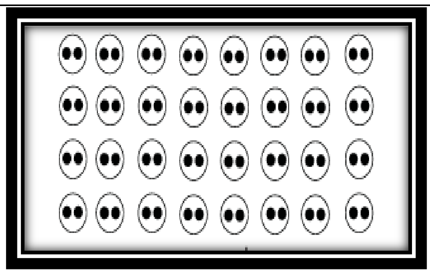
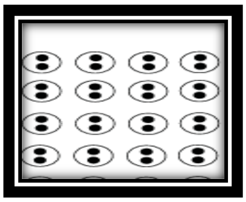
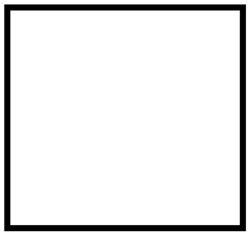
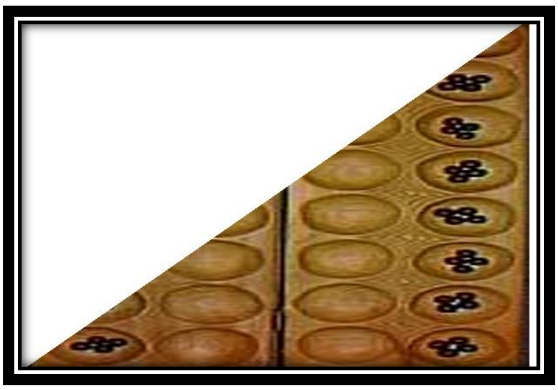
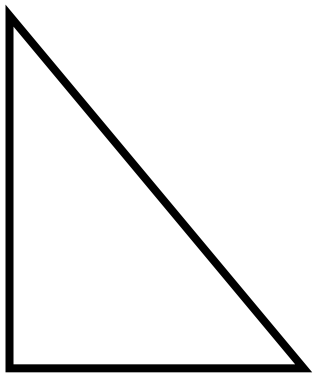


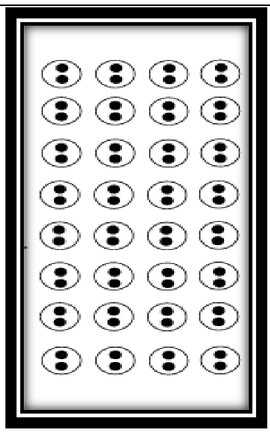
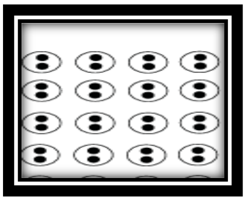
Figure 4. 11: Showing omweso game board with seeds. ***Illustration by the Researcher****.*

Some of the mathematical concepts identified from the omweso game board were; rectangles, squares, triangles, circles, parallel lines, point of intersections, and lines of symmetry. These mathematical concepts were extracted from the omweso game board as shown in the table 4.1 below with more emphasis on their properties and key definitions.

__Table 4. 4__: Mathematical Concepts Embedded in Omweso Game and Their Secondary School Levels.

Some shapes and designs in the omweso game board	Extracted concepts	Shapes obtained
	 Rectangle (two opposite equal sides -length and width)	
	 Square all sides are equal	
	 Right angled Triangle	
	When a move results in multiple seeds being distributed, it demonstrates repeated addition. Seeds are evenly distributed among pits, illustrating division principles.	**(S.1 – S.3)**

	The board setup and movement of seeds form circular patterns.	**(S.2 – S.4)**
	The Omweso game board is symmetrical, teaching reflectional symmetry.	**(S.2 – S.3)**
	Seeds shift positions during moves, illustrating translations and reflections.	**(S.2 – S.4)**
	Players visualize seed movement and predict future distributions.	**(S1-S4)**
	Players estimate the chances of winning a move based on seed distributions.	**(S.3 – S.4)**

Some shapes and designs in the omweso game board	Extracted concepts	Secondary School Level
	 Players count the seeds in each pit before making a move.	(S.1 – S.2)
Addition	 Seeds collected are added to a player's pits.	
Subtraction	When capturing, a player removes seeds from an opponent's pit.	
Multiplication	When a move results in multiple seeds being distributed, it demonstrates repeated addition.	(S.1 – S.3)
Division	Seeds are evenly distributed among pits, illustrating division principles.	
Circle Geometry	The board setup and movement of seeds form circular patterns.	(S.2 – S.4)
Lines of Symmetry	The Omweso game board is symmetrical, teaching reflectional symmetry.	(S.2 – S.3)
Reflections & Transformations	Seeds shift positions during moves, illustrating translations and reflections.	(S.2 – S.4)
Spatial Reasoning	Players visualize seed movement and predict future distributions.	(S1-S4)
Probability	Players estimate the chances of winning a move based on seed distributions.	(S.3 – S.4)

Most respondents recognized that counting is an essential part of the game, as players must continuously track the number of seeds in each pit to make strategic decisions. T1, T3, and T6 pointed out that: "*Omweso game naturally reinforces counting skills because players repeatedly count and recount seeds as they redistribute them across the board*." T5 added that: "*this constant counting process helps students develop numerical fluency and enhances their ability to quickly perform mental calculations".* However, T9 noted that "*while counting is evident in the game, students may not always be aware that they are practicing a mathematical skill, suggesting the need for explicit instructional guidance".*

In addition to counting, teachers (T2, T4, and T7) "*highlighted the role of addition in Omweso game. T4 explained that when a player picks up seeds and distributes them, they are essentially performing repeated addition, as they place one seed in each successive pit."* T7 further elaborated that: "*students unknowingly engage in addition every time they accumulate seeds in a pit, reinforcing the concept of sums".* T2 noted that: "*the game's interactive nature makes addition more engaging than traditional pen-and-paper exercises, potentially helping students who struggle with arithmetic in conventional settings".* However, T8 expressed concern that: "*students might not directly relate the addition process in Omweso game to classroom mathematics unless teachers explicitly highlight these connections through guided questioning and reflection".* Similarly, subtraction emerged as a key mathematical concept in the game, particularly when players capture seeds from an opponent's pit. T3 and T9 emphasized that: "*every move in Omweso game involves an element of subtraction, as players remove seeds from their own pits to redistribute them or capture them from opponents".*

T10 had this to say "this *aspect of the game provides a real-life application of subtraction, which can help students understand how quantities decrease over time*". However, T11 also questioned whether all students would internalize subtraction as a mathematical operation while playing, suggesting that structured reflection sessions after gameplay might be necessary to reinforce the concept. T12 had this to say: "*using Omweso game to teach subtraction could be particularly beneficial for students who struggle with abstract mathematical operations, as the physical act of removing seeds offers a concrete representation of numerical reduction".*

Division was another mathematical concept that some teachers identified in the game, though with varying levels of clarity. T6 and T8 noted that: *"when players distribute seeds across multiple pits, they are essentially dividing a total number of seeds into equal or near-equal groups"*. T5 pointed out that: "*Omweso game provides a practical demonstration of division with remainders, as some seeds may not be evenly distributed among pits, reinforcing the concept of quotients and remainders in division"*. T1 suggested that: *"teachers could use Omweso game to introduce the concept of fair sharing, making division more relatable for students*". However, T7 and T9 *expressed concerns about whether students would easily recognize division as a mathematical operation within the game, emphasizing the need for structured explanations and problem-solving exercises based on Omweso gameplay.*

Teachers (T2, T4, T7, and T10) furthermore identified geometry concepts within Omweso game, particularly circle geometry, lines of symmetry, reflections, and transformations. T4 explained that: *the circular arrangement of Omweso game pits could help students understand properties of circles, such as arcs and sectors, by observing movement patterns*. T7 and T10 further noted that: "*when seeds are distributed across pits, their movement resembles transformations—particularly translations and reflections since the arrangement changes based on gameplay*." T2 also observed that "*lines of symmetry emerge when considering the board's two halves, as each side mirrors the other, making the game a potential visual aid for symmetry and reflection lessons"*. However, T8 and T12 expressed that:" *skepticism about whether students would grasp these abstract concepts merely by playing, emphasizing the need for structured instructional methods to make the connections explicit."*

The figure 4.3, shows the participants taking part in playing omweso game during the pre-activity session

Figure 4.12: showing teachers playing omweso game in Sironko District Zesui Sub County in Eastern Uganda. Photo by the Researcher.

Teachers T3, T5, and T8 emphasized that Omweso game requires players to mentally visualize how seeds move across the board, which can enhance students' spatial awareness and strategic planning. T3 mentioned that advanced players develop the ability to predict the spatial distribution of seeds several moves ahead, a skill that directly correlates with spatial intelligence in mathematics. T5 highlighted that the game naturally teaches proportional reasoning, as players must divide and allocate seeds efficiently to gain an advantage. However, T11 pointed out that while spatial reasoning is involved, some students may struggle to relate this to formal mathematical topics without guided instruction. T12 agreed, arguing that while Omweso develops intuition, structured exercises linking the game to mathematical principles would be necessary for effective classroom integration.

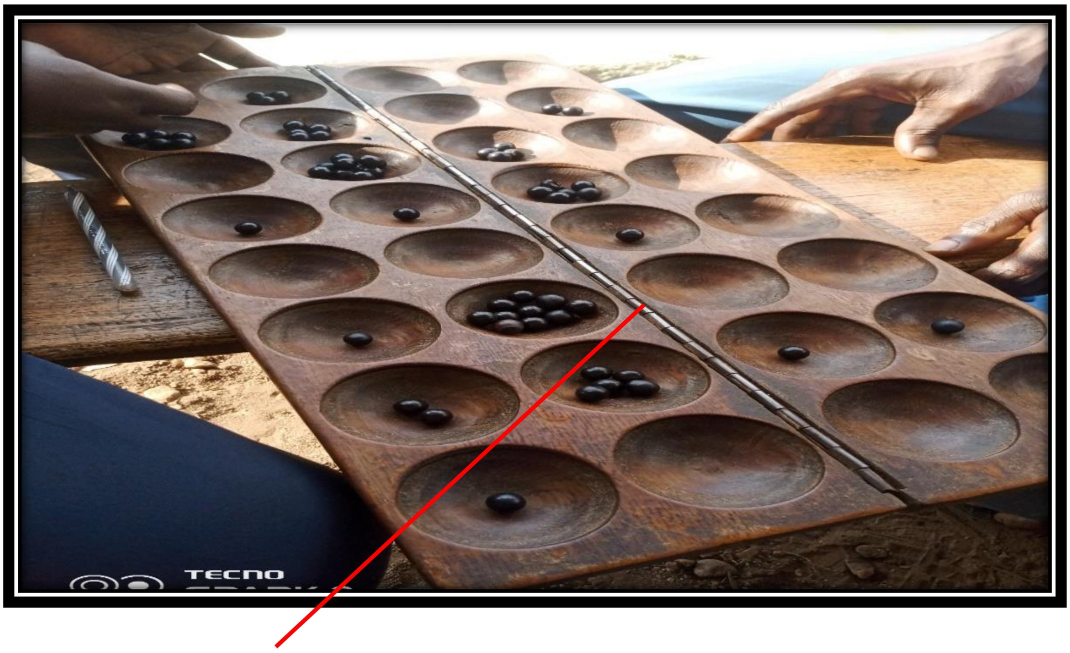
Probability and strategy were also recurring themes among respondents, with T1, T6, and T9 discussing how Omweso game fosters strategic thinking through probability-based decision-making. T6 emphasized that experienced players calculate the likelihood of specific outcomes based on the number of seeds in each pit and their distribution, a fundamental aspect of probability theory. T9 added that players unknowingly engage in conditional probability, as each move depends on the preceding one, reinforcing the concept of dependent events. However, T11 and T12 expressed concerns about using Omweso game to teach probability, stating that while strategy is involved, the lack of clear numerical probabilities in the game could make it difficult for students to grasp theoretical probability concepts effectively. T10 suggested that: *"teachers could design supplementary probability exercises based on Omweso scenarios to bridge this gap."*

4.4 Using the Mathematical Concepts Embedded in Omweso Game in a Mathematics Classroom

Mathematics teachers expressed enthusiasm for integrating Omweso game into their lessons, particularly in developing counting, addition, and subtraction skills. T1 and T2 emphasized how the game naturally introduces learners to sequential counting as they distribute seeds in pits. T3 noted that addition and subtraction occur dynamically as players move seeds across the board, fostering mental calculations. A key strength is that learners grasp these operations through hands-on engagement rather than abstract formulas. However, T4 raised a minor concern that weaker students struggle with speed, as Omweso game requires quick calculations during gameplay.

Regarding division, T5 and T6 explained that Omweso game reinforces the concept of equal sharing, a fundamental division principle. Players must distribute seeds evenly among pits, demonstrating division with and without remainders. T7 highlighted that learners who play Omweso game develop an intuitive understanding of divisibility rules, making classroom division exercises easier. A notable strength is that the game visually represents division, which benefits kinesthetic learners. However, T8 worried that some students might misinterpret the grouping mechanism and need additional explanations to relate it to formal division methods. Interactions with respondents on circle geometry and lines of symmetry during interviews, T9 and T10 pointed out that the Omweso game board is structured in a rectangular shape but involves circular movements when capturing and distributing seeds. This encourages learners to think about rotational symmetry and equal partitioning. T10 further stated that the distribution of seeds across pits reflects symmetrical balancing, reinforcing geometric properties in a playful context. The major strength is that learners visualize these concepts in real-time, making abstract concepts in mathematical topics more tangible. The minimal concern raised was that some students might overlook symmetrical patterns without explicit teacher guidance.

The Figures showing lines of symmetry is indicated below:



Line of symmetry

The figure below indicates circle geometry

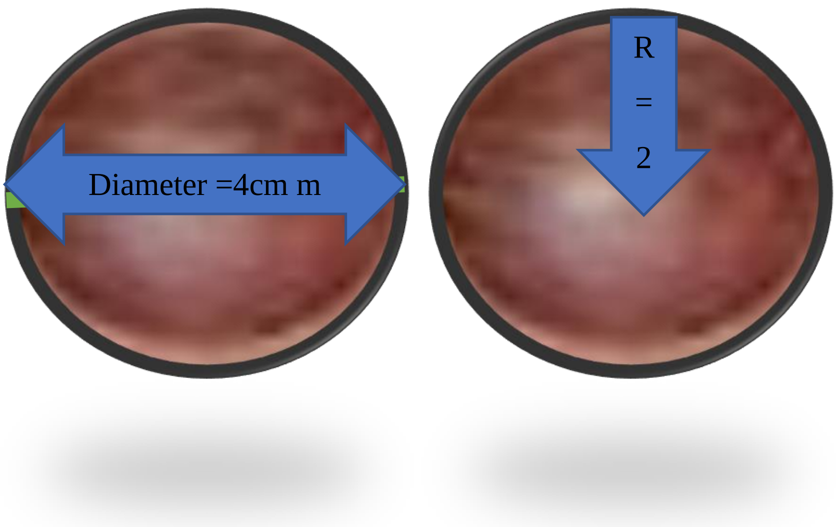


Figure 4. 13: showing diameter, radius and how to get pi from the circular pit

Extracting the circular part from the circular pits (figure 4.) above, the study showed that the value of "Pi" could be obtained as follows using the concept of the shape of the pit.

Since diameter is 4 cm then the circumference of the circular pit of the omweso game above 12.57cm using the formular c=πd, Pi (π) is equal to 12.57/4 = 3.14cm. Still from the circular pit above, its area can be calculated as $A = \pi r^2$ where π is 3.14 and radius is half of 4 which is equal to 2. Therefore, area of the circular pit is $3.14*2*2=12.56cm^2$

When reflecting on numeracy concepts, reflections, and transformations, T11 described how the movement of seeds mirrors mathematical reflections, as patterns repeat symmetrically across the board. T12 added that transformations, such as translation and rotation, are observed as players shift seeds to different positions.

Figure 4. 14: showing the reflected circular holes from both sides of the omweso game board

Circular holes

The game's structure enhances learners' spatial awareness, making abstract transformation rules more accessible. A key strength is that students engage in problem-solving while recognizing these mathematical patterns naturally. A minor challenge is ensuring that learners connect gameplay movements with formal transformation notation in mathematics.

Teachers also noted the relevance of **s**patial reasoning and distribution, where T2 and T5 stated that Omweso games enhances students' ability to estimate distances, visualize quantities, and plan moves based on available space. Learners develop an awareness of how objects (seeds) are arranged and manipulated, which is crucial for geometry and measurement topics senior one to senior four. T6 emphasized that spatial reasoning in Omweso games is directly linked to understanding area, volume, and mapping skills. While this is a major advantage, T3 noted that some students might focus on the game's competitive aspect rather than its mathematical applications unless properly guided. Interviews with teachers on probability and strategy, T7 and T8 highlighted that Omweso games requires players to predict outcomes based on seed distributions and previous moves, mirroring probability principles. Players unknowingly apply logical reasoning and risk assessment, which are fundamental in probability theory. T9 added that strategic thinking in Omweso games teaches learners about decision-making, making them more analytical.

Table 4.5: Omweso games teaches learners about decision-making, making them more analytical.

Mathematical Concept	Criteria for Assessing Impact	Indicators of Effective Use
Counting	Ability to engage students in counting seeds and predicting moves.	Students accurately count seeds and relate them to real-life counting.
Addition	Incorporation of Omweso game to model real-life addition scenarios.	Students demonstrate understanding of addition through seed accumulation.
Subtraction	Use of Omweso game to demonstrate subtraction practically.	Students effectively remove seeds and explain the concept of taking away.
Multiplication	Ability to illustrate repeated addition through Omweso game.	Students recognize multiplication patterns in seed distribution.
Division	Engages students in equal distribution of seeds.	Students distribute seeds fairly and understand the concept of division.
Circle Geometry	Teaching movement of seeds using circular paths.	Students recognize rotational movement in Omweso game.
Lines of Symmetry	Demonstrates board symmetry and equal distribution of pits.	Students can identify symmetrical aspects of the board.
Reflections & Transformations	Shows how seed movement represents reflection and translation.	Students can predict transformations of seeds across pits.
Spatial Reasoning	Encourages visualization of future moves and distributions.	Students can mentally track seed positions after moves.

Probability	Explains likelihood of winning a move based on seed positions.	Students can assess and predict the probability of capturing seeds.

Source: Field data from respondents.

However, **T10** cautioned that some students may struggle to articulate their probabilistic reasoning without structured classroom discussions. From the FGDs with teachers, it was noted that the omweso game, given its mathematical nature, can be used in the classroom as a useful tool for assessment, learning and pedagogy.

4.4.1 Omweso Game as an Assessment Tool

Based on the analyzed data and interpreted data in objective one**,** the integration of Omweso game into secondary school mathematics offers a practical and culturally relevant assessment tool. As revealed in the teachers' interviews, the game embodies core mathematical concepts ranging from counting and operations to geometry, symmetry, and probability. Observing learners during gameplay and guiding them to reflect on their moves, teachers are able to evaluate understanding beyond rote procedures, assessing both knowledge application and problem-solving in authentic situations. As players constantly keep track of seeds in each pit, redistributing them accurately. Teachers can assess learners' ability to count sequentially, estimate totals, and check for mental calculation speed. For instance, when a teacher asks a student to explain how many seeds will remain in a given pit after three rounds of redistribution, he or she is assessing mental agility and accuracy in real time.

Furthermore, addition and subtraction naturally emerge during seed accumulation and capturing, while multiplication arises in the form of repeated addition when distributing many seeds. Teachers can design assessment rubrics that reward learners who identify and explain these operations as they play. For example, when a player picks 12 seeds and distributes them, a teacher may ask: “How is this an example of multiplication?” This connects classroom arithmetic with gameplay, reinforcing skills while providing evidence of conceptual understanding. Also, division is strongly embedded in the equal distribution of seeds across pits. Teachers are able to assess whether learners recognize the principle of grouping and remainders as seeds are distributed. For example, a task that require learners to calculate the number of seeds per pit when 17 seeds are shared across four pits, with an explanation of what happens to the remainder. This assessment builds bridges between the game and division with remainders in classroom mathematics.

The geometry of the Omweso game board and pits provides a visual assessment opportunity. Through the use of omweso game, teachers can ask learners to identify rectangles, squares, or circular pits and use them to calculate area, circumference, or symmetry. For example, as the study illustrated, the circular pit with a 4 cm diameter can be used to derive π through circumference calculations. Assessment here focuses on learners’ ability to apply geometric formulae in a familiar, contextualized scenario.

Omweso game lends itself well to assessing transformations in mathematics. Teachers were able to lead learners to identify lines of symmetry on the board, or to describe how a move reflects or translates seeds across rows. For instance, a teacher when asked: “If seeds are shifted three pits clockwise, what kind of transformation is this?” Assessments included drawing seed movements and labeling them as reflections, translations, or rotations, thus linking abstract transformations to tangible actions. Spatial reasoning is another assessable competency that Omweso game cultivates. Players visualized how seeds move after several rotations, predicting their final positions. Teachers set tasks that require students to mentally track seeds over a sequence of moves and explain their reasoning. A learner’s ability to visualize and plan demonstrates higher-order thinking, which is assessed through observation and reflective questioning. Relatedly, probability was assessed through prediction of outcomes based on seed distributions. Teachers asked learners to calculate the chances of capturing a certain number of seeds given specific board conditions. For instance: "What is the probability of capturing at least 4 seeds if there are 10 seeds in the opponent's front row?" Such questions allow teachers to assess understanding of dependent events, likelihood, and risk assessment, making probability tangible through cultural play.

4.4.2 Omweso Game as a Learning Tool

Omweso game, a traditional Ugandan board game, provides a rich context for learning mathematics in secondary schools. Its structure that comprises of thirty-two pits arranged in four rows of eight naturally introduces learners to concepts of arrays and matrices. Each pit holds seeds, which learners must continuously count and redistribute. This setup mirrors the foundational structure of a 2×8 matrix, making Omweso game an authentic, culturally grounded tool for introducing linear algebra and array manipulation. The game thus bridges abstract mathematics with concrete, hands-on experience. At the most basic level, Omweso game nurtures numeracy skills. Players engage in continuous counting, addition, and subtraction as they pick and sow seeds across pits. Teachers noted that this constant engagement fosters mental agility in arithmetic operations. For example, when a player begins with 7 seeds, they must distribute them one by one in sequential pits, tracking totals mentally. This repetitive counting develops number sense, estimation, and accuracy skills that are often difficult to strengthen through traditional pen-and-paper exercises alone.

Beyond basic operations, Omweso game models multiplication and division concepts. Distributing seeds evenly across several pits mirrors equal grouping and repeated addition. For instance, sowing two seeds in each of eight pits reflects $2 \times 8 = 16$. At the same time, redistributing 15 seeds across multiple pits shows division with remainders. Teachers in Sironko District highlighted that students intuitively practice quotients and remainders during gameplay, linking the concept of fair sharing to real-world mathematical division.

The circular pits of Omweso game provide a natural entry point to circle geometry. Each pit can be measured to derive radius, diameter, circumference, and area. For example, a pit with a diameter of 4 cm gives a circumference of 12.57 cm and an area of 12.56 cm^2, reinforcing formula application ($C = \pi d$, $A = \pi r^2$). Learners are also able to identify circle parts such as chords, tangents, arcs, and sectors by examining the board's semi-spherical design. By directly linking geometry to a familiar cultural object, Omweso game turns abstract diagrams into tangible realities. Omweso game reflected symmetry and transformations. The board demonstrates reflectional symmetry when closed and rotational symmetry when turned. During gameplay, the movement of seeds mirrors transformations such as translation and reflection. For example, sowing seeds from pit A4 to pit B4 creates mirrored effects across the central line. This real-time observation of symmetry helps learners grasp abstract transformation rules more effectively, making classroom geometry more engaging.

Spatial reasoning also emerges strongly in Omweso game. Players must track where seeds will land after several moves, developing visualization skills. This aligns with coordinate geometry, as the board's pits can be labeled (e.g., A1 to A8, B1 to B8). A player sowing from pit A3 must calculate how seed placement loops around the matrix, which parallels modular arithmetic. This cyclical sowing (using the rule of modulus 16) strengthens learners' understanding of remainders, iteration, and spatial navigation on grids key skills for algebra and computer science. Strategic decision-making in Omweso game links directly to game theory and probability. Players weigh potential outcomes before choosing moves, often calculating the likelihood of captures. For instance, if sowing from pit A5 could end with a capture, the player evaluates the probability of success relative to the opponent's seed distribution. This introduces learners to conditional probability and dependent events. Teachers suggested that Omweso game can support lessons on probability trees, expected outcomes, and risk assessment, making statistics less abstract. The results also revealed that Omweso game enhances logical reasoning and pattern recognition**.** Players must think several steps ahead, predicting not only immediate moves but also future consequences. This "if-then" logic mirrors mathematical proofs and sequences, while pattern recognition in seed distribution parallels work with arithmetic and geometric sequences. Learners thereby cultivate inductive reasoning, spotting recurring structures and deductive reasoning that leads to formulation of strategies based on rules which are both central to mathematics learning. Despite its benefits, teachers emphasized that students may not automatically connect gameplay to mathematics without structured instructional guidance**.** For Omweso game to function effectively as a learning tool, teachers must facilitate reflection sessions after gameplay. This includes asking guiding questions such as, "What operation were you performing when you distributed these seeds?" or "How did symmetry appear when the board was closed?", teachers ensure that learners explicitly link Omweso's game mechanics to mathematics concepts.

4.4.3 Omweso Game as a Pedagogical Tool

When omweso game is introduced into secondary mathematics classrooms, it functions not merely as entertainment but as a pedagogical tool that demonstrates counting, arithmetic, geometry, and probability in an engaging and culturally relevant way. At the foundation of the game lies the skill of counting. Each pit starts with two seeds, requiring players to calculate totals, track changes, and recount during every move. Teachers can leverage this to help learners practice sequential counting, skip counting in twos, and basic mental arithmetic.

Instead of abstract tallying on paper, learners physically engage with numbers, reinforcing numerical fluency in a dynamic, hands-on manner.

Every move in Omweso game involves arithmetic. When seeds are redistributed, addition occurs as pits accumulate seeds, subtraction when seeds are removed, multiplication when repeated addition is observed across several pits, and division when seeds are spread evenly among pits. For instance, distributing 12 seeds into consecutive pits illustrates division with remainders, while capturing 5 seeds from an opponent demonstrates subtraction. This transforms abstract operations into concrete experiences. The circular pits of Omweso game introduce learners to circle geometry. By measuring the diameter and radius of a pit, students calculate circumference and area, using formulas like $C=\pi d$, and $A=\pi r^2$. The game board's semi-spherical design also illustrates concepts of semi-circles, chords, arcs, tangents, and sectors, making geometry more accessible. These real, physical examples help students link formulas to observable contexts.

Omweso game's mirrored design demonstrates reflectional and rotational symmetry. Each half of the board mirrors the other, which learners can relate to vertical and horizontal lines of symmetry. Seed distribution during play models transformations: translations occur as seeds move along rows, reflections when distributions mirror across the board, and rotations when play cycles back after the last pit. Thus, Omweso game provides a live model of abstract transformation geometry. The board itself functions as a 2×8 matrix, where each pit represents a matrix element. Seed distribution simulates row traversal and introduces learners to basic matrix operations. The cyclical nature of sowing employs modular arithmetic: if a pit contains 12 seeds, players distribute them across the next 12 pits, looping around with calculations like (current position+seed count) mod 16 (current/position seed/count) \mod 16(current position+

seed count) mod16. This naturally illustrates division with remainders and cyclic operations foundational to algebra and computer science.

Decision-making in Omweso game introduces learners to probability. Players must evaluate chances of capturing seeds or losing them based on distributions, resembling conditional probability and dependent events. For example, if a pit has three seeds, what is the likelihood of it leading to a capture in the next turn? Teachers can transform these scenarios into probability exercises, requiring learners to build tree diagrams or calculate expected outcomes, thus blending play with statistical reasoning. Omweso game sharpens spatial awareness by forcing players to mentally project where seeds will land several moves ahead. The board layout can be mapped onto a coordinate grid, with pits labeled as (row, column) (row, column). Learners track distributions across coordinates, predicting end positions. This nurtures visualization skills important for geometry, graphing, and navigation across the Cartesian plane. In effect, Omweso game embodies real-time spatial problem-solving.

4.5 The Challenges that Teachers Face While Developing Mathematical Concepts using Omweso Game-Based Teaching Approach

The researcher interacted with the secondary school mathematics teachers in as regards the omweso game and they recognized Omweso game as a valuable tool for teaching mathematical concepts. However, different teachers expressed differently for example T1 and T2 highlighted the rigid nature of the curriculum, which prioritizes theoretical content delivery over practical, interactive methods. Mathematics teachers are under pressure to complete vast syllabi, leaving little room for innovative game-based approaches. As a result, even though Omweso game can be useful in reinforcing concepts such as numeracy, probability, and symmetry, teachers struggle to justify its inclusion within the strict academic schedules.

Teachers T3 and T4 noted that many schools lack Omweso game boards and seeds, making it difficult for teachers to implement the game effectively. In cases where the game is introduced, there are often too few materials for an entire class, limiting participation and engagement. T5 observed that the shortage of resources creates a situation where only a few students can actively interact with the game, leaving others as passive observers. This reduces the effectiveness of Omweso game in developing mathematical concepts such as addition, subtraction, and spatial reasoning. Added to that, T6 and T7 reported that while some students find it easy to connect Omweso game to mathematical principles, others struggle to relate the game to formal classroom concepts. For example, while the game inherently involves addition, subtraction, and division when distributing seeds, some students fail to transfer these skills to abstract problem-solving scenarios. T8 added that some learners see Omweso game purely as a leisure activity, making it difficult for teachers to maintain academic focus during lessons. Ensuring that all students remain engaged and understand the mathematical relevance of the game requires additional instructional effort.

Teachers also face difficulties in applying Omweso game to higher-level mathematical concepts. T9 and T10 emphasized that while the game is excellent for introducing basic arithmetic, symmetry, and probability, its application to topics such as algebra, graph interpretation and trigonometry is less straightforward. For instance, while Omweso game visually demonstrates transformation concepts such as reflections and translations, it does not easily align with abstract algebraic representations. T11 noted that due to these limitations, teachers often have to revert to conventional teaching methods for more advanced topics, reducing the overall impact of Omweso game as a comprehensive teaching tool.

Teachers**,** T5 and T6 pointed out that in many communities, Omweso game is traditionally associated with boys, leading to reluctance among female students to participate in game-based learning activities. T 7 explained that some parents and school administrators perceive the game as mere entertainment rather than an educational tool, further discouraging its integration into formal lessons. These cultural attitudes make it challenging for teachers to promote Omweso game as a legitimate method for teaching mathematical concepts such as symmetry, probability, and spatial reasoning.

Furthermore, T8 and T9 explained that traditional assessment methods such as written tests do not adequately capture the mathematical reasoning students develop through Omweso game-based learning. Unlike standard exercises, the game involves strategic thinking and real-time decision-making, making it difficult to quantify students' mathematical progress in a conventional manner. T10 suggested that developing alternative assessment tools, such as observational checklists and performance-based tasks, could help measure how well students grasp concepts such as division, probability, and symmetry through Omweso game.

In light of the above, while Omweso game offers a rich opportunity to develop mathematical concepts in an engaging and practical manner, several challenges hinder its widespread use in secondary schools. These include curriculum rigidity, resource shortages, varying student engagement levels, limitations in higher-level mathematics applications, cultural perceptions, and assessment difficulties. To maximize the potential of Omweso game in mathematics education, schools should invest in adequate teaching materials, train teachers on game-based pedagogy, and develop structured assessment strategies that align with interactive learning. By addressing these challenges, Omweso game can be effectively integrated into secondary school mathematics instruction, enhancing students' understanding and appreciation of key mathematical concepts.

4.6 Chapter Summary

In this chapter, analysis and interpretation of data was presented, various figures and tables were used to present and interpret data. The findings of the study were categorized according to research tools and objectives. The following chapter presents the findings, conclusions from the discussions and makes recommendations depending on the conclusions.

CHAPTER FIVE

DISCUSSION OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This Chapter, discusses the researcher's main findings of the study, conclusions and recommendations. The presentation of the main findings of the research were guided in accordance to the three main research objectives.

In this study, an attempt was made to explore ethnomathematics as a teaching approach in learning school mathematics, a case of omweso game in Zesui Sub County.The rationale for the study was to explore ethnomathematics as a media in teaching and learning mathematics. A case study was done to identify the mathematical concepts found in omweso game, and on how they can facilitate the teaching and learning of school mathematics. The study was guided by the following research questions:

1.What are the mathematical concepts are embedded within omweso game?

2.How these concepts can be used by teachers in a mathematics classroom

3. What are the challenges in developing mathematical concepts using omweso game-based teaching approach.

5.1 Discussion of the Findings of the Study

5.1.1 Mathematical Concepts Embedded Within Omweso Game Process

Counting emerged as a foundational mathematical activity in Omweso game, serving as a gateway into more complex arithmetic operations. Teachers T1, T3, and T6 emphasized how players constantly engage in counting while redistributing seeds, reinforcing numerical fluency and real-time mental math skills. T5 noted that this iterative process enables students to internalize one-to-one correspondence and sequence patterns naturally. However, T9 cautioned that students may not consciously recognize they are practicing mathematics unless teachers provide explicit reflection prompts. This aligns with Akayuure (2016) and Snounu (2019), who advocate for culturally relevant pedagogies that use indigenous games to anchor abstract mathematical concepts in familiar contexts. Through Vygotsky's SCT lens, the collaborative nature of Omweso game, where players negotiate and verbalize counts, creates a shared zone of proximal development, enabling peers to scaffold one another's learning. This suggests that counting in Omweso game is not just a mechanical skill but a socially constructed mathematical experience. Therefore, mathematics curricula and pedagogy at the secondary level should purposefully incorporate games like Omweso game to ground students' understanding in contextual and socially meaningful activities.

The integration of multiplication, addition, and subtraction in Omweso game play reveals the organic development of arithmetic reasoning through repeated practice. Teachers T2, T4, and T7 observed that the sequential sowing of seeds amounts to repeated addition and subtraction, forming an intuitive bridge to multiplication concepts. T10 remarked that subtracting seeds during captures presents a concrete, tactile representation of quantity reduction. These findings resonate with Meaney and Lange's (2012) assertion that informal numeracy practices in cultural games offer rich platforms for mathematical modeling. However, as T8 and T11 pointed out, students may fail to transfer these embedded skills to formal classroom contexts unless guided through targeted reflection and meta-cognitive tasks. Rosa and Orey (2015) argue that ethnomathematical practices provide fertile ground for developing mathematical literacy when pedagogically aligned with curriculum standards. Under SCT, learners engage in meaning-making through mediated action in this case, the manipulation of physical seeds in socially negotiated contexts. Thus, embedding arithmetic operations within game-based learning can foster deeper conceptual understanding, particularly for learners who struggle with abstract reasoning.

The physical layout of the Omweso game board naturally embodies principles of circle geometry and symmetry, offering students visual and spatial representations of abstract geometric ideas. T2 and T10 highlighted that the symmetric design of the board where opposing rows mirror each other can help students grasp reflectional symmetry. T4 further noted that the cyclical sowing motion mirrors arcs and rotational paths akin to those studied in circle geometry. Yet, as T8 and T12 emphasized, students may not independently extract these mathematical patterns without structured intervention. Solikhah and Budiharso (2019) emphasize that embedding geometry in cultural practices not only deepens comprehension but also validates students' lived experiences, promoting inclusivity in math learning. Through SCT, symmetry becomes more than a visual concept; it is dialogically constructed as players negotiate strategic moves. When symmetry and geometric transformations are explored through gameplay, teachers can demystify complex visual-spatial topics and cultivate students' geometric thinking using culturally embedded tools. This calls for curricular reforms that encourage the use of indigenous games in teaching geometry at the secondary level.

Omweso gameplay involves constant movement of seeds across the board, inherently demonstrating concepts of reflection, translation, and transformation. Teachers such as T7 and T10 explained how players observe and mirror opponents' moves actions that closely parallel mathematical reflections across lines of symmetry. T4 illustrated how the dynamic rearrangement of seeds helps learners visualize translations and sequence transformations. This supports the argument by Lafer and Tarman (2018) that experiential learning environments foster a deeper and more intuitive grasp of abstract mathematical concepts. Under Vygotsky's SCT, such transformations occur within social interactions where meaning is jointly constructed, such as peer collaboration during gameplay. T12, however, warned that without deliberate instructional framing, students may not perceive these transformations as mathematical phenomena. Therefore, to maximize pedagogical value, teachers should integrate guided observation and journaling tasks to connect gameplay dynamics with formal transformation geometry. The implication for policy is the development of teacher training modules that help educators recognize and harness these informal mathematical practices within structured learning environments.

Spatial reasoning and probability were frequently identified by teachers (T3, T5, T6, and T9) as vital cognitive domains exercised during Omweso game. Players must mentally project the movement of seeds, anticipate outcomes, and evaluate risks skills directly related to visualization and probabilistic thinking. T5 pointed out that predicting the effects of moves requires proportional thinking and strategic foresight, closely mirroring the spatial planning involved in coordinate geometry and the probability trees used in statistics. T6 noted that players often make probability-based decisions even if they lack formal training in the topic, exemplifying informal statistical reasoning. Nosis (2018) and Snounu (2019) support the integration of indigenous games into school curricula to develop cognitive domains such as estimation, visualization, and risk evaluation. However, as T11 and T12 argued, the absence of explicit numerical probability in Omweso game may limit its direct applicability in teaching theoretical concepts unless supplemented with classroom-based analysis. SCT emphasizes the co-construction of knowledge; thus, strategic gameplay discussions and collaborative move analysis can facilitate the development of probabilistic literacy in a social learning context. Teachers and policymakers should consider integrating structured probabilistic tasks into game-based learning frameworks.

Omweso game offers a fertile ground for teaching students to think ahead, analyze possibilities, and optimize decisions a skillset that sits at the heart of mathematical problem-solving. T1, T5, and T9 described how experienced players use pattern recognition and strategic foresight to assess both their own and their opponents' potential moves, closely aligning with the principles of decision trees and logic in secondary mathematics. These practices reflect Rosa and Orey's (2015) claim that indigenous games foster metacognitive and higher-order thinking essential for mathematical modeling. Under SCT, this aligns with the development of internal cognitive functions through social and cultural interaction. The collaborative nature of Omweso game—negotiating moves, predicting outcomes, and adapting strategy based on the opponent—epitomizes Vygotsky's vision of learning as a mediated process. However, as T11 noted, students might engage in strategy without necessarily connecting it to formal mathematical logic unless prompted by reflective questioning. This finding implies that while Omweso game fosters critical thinking and decision-making, the transition to formal logic and algorithmic reasoning requires teacher facilitation. Educational policy should thus prioritize training educators to guide learners in connecting strategic reasoning in games to abstract mathematical problem-solving frameworks.

5.1.2 How mathematical concepts embedded in Omweso game can be used by teachers in a mathematics classroom?

The study found that Omweso game functions as a powerful, authentic assessment instrument, enabling teachers to observe learners' procedural fluency and problem-solving in ways that traditional pen-and-paper tests cannot capture. Teachers reported using in-game questioning, such as asking learners how many seeds remain after a sequence of moves, to gauge mental calculation speed and strategy. One participant remarked, *"When I ask students to explain their moves, I can see not just if they counted correctly, but how they planned and predicted outcomes."* This aligns with Muhammad et al. (2020), who argue that culturally embedded games provide insights into learners' transferable understanding. However, the study also revealed that in-game assessment is often underutilized. To systematize evaluation, the findings suggest developing short, competency-based rubrics mapping observable behaviors such as counting accuracy, explanation of operations, and strategy use to curriculum standards, and training teachers in real-time note-taking during gameplay. This extends existing knowledge by proposing concrete methods to transform informal observations into structured assessment evidence, bridging the gap between culturally grounded play and formal classroom evaluation.

On numeracy and basic operations, the study found that addition, subtraction, multiplication (as repeated addition), and division with remainders emerge naturally during gameplay. Teachers T2, T4, and T7 observed that sowing and capturing seeds provides a tactile experience of these operations, supporting number sense development. T10 explained, *"Students see subtraction physically when seeds are captured; multiplication emerges as repeated distributions."* These findings corroborate Fitrianawati et al. (2020) and Mauluah & Marsigit (2019), who highlight the role of manipulatives and indigenous games in making abstract operations concrete. Importantly, the study contributes new pedagogical insight: sequencing lessons so that guided gameplay precedes formal notation through the cycle of game guided reflection and symbolic representation that helps learners transfer tactile experience to written procedures. Pairing gameplay with targeted questioning prompts students to articulate the mathematical rationale behind each move, which strengthens conceptual understanding.

The study also revealed that Omweso game provides opportunities to explore geometry and spatial reasoning. Teachers highlighted that the circular pits can model circumference and area, while the symmetric design of the board illustrates reflectional symmetry and rotational paths. T2 noted, *"Measuring pit diameters and comparing them to calculated circumference helps students connect the game to formal geometry."* While prior studies such as Supriadi (2019) and Gundogdu (2021) emphasize that cultural artifacts can make geometric concepts accessible, this study extends knowledge by showing that without teacher facilitation, students often fail to make explicit connections. Introducing brief measurement labs and reflection protocols immediately after gameplay encourages learners to verbalize geometric reasoning before moving to abstract symbols, highlighting the need for deliberate scaffolding in translating informal experiences into formal geometric understanding.

The study found that Omweso game also naturally models matrices, cyclic traversals, and modular arithmetic, which teachers can exploit to introduce early algebraic concepts. Teachers observed that anticipating seed positions fosters iterative thinking and modular reasoning, skills applicable in coordinate systems and introductory algebra. T7 explained, *"Labeling pits and predicting seed positions allows students to see patterns in numbers and perform modular arithmetic without realizing it."* This builds on Mauluah & Marsigit (2019) and Gundogdu (2021) by demonstrating a concrete method for mapping cultural games to formal mathematical structures. The study extends existing knowledge by recommending explicit mapping activities, such as labeling pits (A1–B8), converting moves into coordinate updates, and practicing modular addition exercises, enabling teachers to transform game play into meaningful algebraic learning experiences.

With respect to probability, decision-making, and strategic reasoning, the study found that players estimate the likelihood of captures and weigh expected outcomes, which aligns with Owusu (2023) and Gundogdu (2021), who link strategic traditional games to conditional probability and early game-theoretic thinking. Teachers observed that while students intuitively make probabilistic decisions, they rarely formalize these insights in classroom exercises. T5 noted, *"Students guess which move is safer or more rewarding, but we need to structure it so they write down probabilities or analyze outcomes."* The study thus extends current understanding by proposing structured probability mini-projects and classroom protocols where strategic choices are recorded and analyzed quantitatively, transforming informal intuition into assessable statistical reasoning.

Finally, the study highlighted that Omweso game is pedagogically beneficial only when paired with deliberate reflection and teacher scaffolding. Teachers emphasized that gameplay alone does not guarantee learning; guided questioning, reflection tasks, and teacher mediation are essential. T1 stated, *"The game is engaging, but students won't automatically connect moves to mathematics unless you ask them to explain and reflect."* This supports Fitrianawati et al. (2020) and Muhammad et al. (2020), who stress the importance of teacher facilitation, while extending existing literature by offering pragmatic interventions: short CPD modules for teachers, exemplar lesson plans and assessment rubrics, student reflection templates, and low-stakes diagnostic tasks derived from game scenarios. These measures provide a clear pathway for transforming Omweso game from a cultural pastime into a validated assessment, learning, and pedagogical tool in secondary mathematics classrooms.

5.1.3 The challenges that teachers face while developing mathematical concepts using omweso game-based teaching approach.

The study found that one of the primary challenges teachers face in using Omweso game as a game-based teaching approach is fostering effective collaboration among students. Teachers T1, T2, and T3 reported that while the game naturally encourages interaction, some students are more engaged than others, making it difficult to ensure equitable participation. T1 noted, *"Some students grasp the game quickly and dominate, while others struggle to keep up, which can hinder group learning."* This aligns with Tangkur (2023), who observed that varied levels of understanding and interest among learners complicate collaborative learning in game-based environments. The finding underscores that while Omweso game provides an interactive platform, teachers must intentionally facilitate peer support, ensuring that stronger students scaffold the learning of those who struggle. This extends existing knowledge by highlighting the need for structured strategies within culturally grounded games to promote cooperative learning rather than leaving group dynamics to chance.

Another significant challenge identified relates to teachers' expertise in using Omweso game effectively. Teachers T5, T6, and T7 indicated that although they recognized the educational potential of the game, they lacked confidence and proper training to integrate it into the mathematics curriculum. T6 remarked, *"I know the basic rules, but I struggle to link moves to learning objectives or assess student understanding systematically."* This mirrors Nabie (2015), who emphasized that a lack of professional development in game-based teaching undermines learning outcomes. The study adds new insights by showing that even culturally familiar games require deliberate pedagogical strategies to align with curriculum standards, and that teachers' knowledge gaps can limit the utility of such games in classrooms. Respondents T8 and T9 highlighted the difficulty of balancing traditional teaching methods with innovative, game-based approaches, reinforcing the notion that professional development must address both content knowledge and instructional design in game-based learning.

Classroom management during Omweso gameplay also emerged as a challenge. Teachers T10, T11, and T12 observed that student behavior could become difficult to manage when the game environment was overly competitive or when some students became disengaged. T12 stated, *"Students sometimes get frustrated if they don't understand the game's logic, and this distracts others from the learning objectives."* These observations support Gullain (2023), who found that insufficient teacher preparation in managing game-based activities can lead to classroom disruption. The study extends this knowledge by demonstrating that assigning structured roles or turn-taking within Omweso game sessions can mitigate competitive dominance and maintain focus on mathematical learning, highlighting the importance of deliberate instructional design and classroom management strategies.

Finally, the study found that adapting Omweso game to accommodate diverse learning needs poses additional challenges. Teachers T1, T2, and T3 reported that some students struggle because the game relies heavily on pattern recognition and spatial reasoning, skills not uniformly developed across all learners. T4 and T5 emphasized that while they attempt individualized support, resources are limited: *"We try to help struggling students one-on-one, but with many learners, it's hard to give the attention needed."* This echoes Nabie (2015), who cautioned that games requiring strategic thinking and problem-solving may not be equally accessible to all students. The study contributes new knowledge by underscoring the need for differentiated instruction, scaffolding strategies, and supplementary resources to ensure that Omweso game-based learning is inclusive and effective for diverse student populations.

Overall, the study highlights that while Omweso game offers rich opportunities for teaching mathematics, its effectiveness is contingent on teacher preparation, scaffolding, structured classroom management, and attention to diverse learning needs. These findings extend existing literature by demonstrating that successful integration of culturally grounded games into the mathematics classroom requires deliberate instructional design and professional support, rather than relying on the intrinsic appeal of the game alone.

5.2 Conclusions

This section, presents conclusions of the study findings per objective as elaborated below;

(i) Omweso game embeds a wide range of mathematical concepts, including counting, addition, subtraction, multiplication, division, geometry, spatial reasoning, probability, and strategic thinking. Teachers' engagement with the game revealed that these concepts emerge organically through gameplay, enabling students to develop numerical fluency, visualization, pattern recognition, and problem-solving skills. The findings demonstrate that Omweso game provides a culturally grounded platform for contextualizing abstract mathematical concepts and fostering collaborative, socially mediated learning.

(ii) Teachers can effectively use Omweso game in mathematics classrooms by integrating guided reflection, targeted questioning, and structured observation. Gameplay can precede formal notation to bridge tactile and symbolic understanding, while activities such as measuring board pits, labeling positions, and analyzing moves can reinforce geometry, algebra, and probability concepts. Teacher facilitation is essential to help students' transfer intuitive, game-based reasoning into formal mathematical knowledge, highlighting the pedagogical value of combining culturally embedded games with structured instructional strategies.

(iii) Whereas Omweso game embeds a variety of mathematical concepts, including counting, arithmetic operations, geometry, spatial reasoning, probability, and strategic thinking, which can be effectively used in secondary mathematics classrooms. Teachers' engagement in gameplay revealed that these concepts are contextualized, tangible, and socially meaningful. However, successful implementation depends on teacher facilitation, structured reflection, classroom management, and addressing diverse learner needs. While the game offers rich pedagogical potential, challenges such as varying student engagement, limited teacher expertise, and resource constraints must be addressed to fully leverage Omweso game for teaching and assessing mathematics.

5.3 Recommendations

(i) Teachers should actively engage in Omweso gameplay to identify and understand the mathematical concepts embedded within the game. Lesson plans should explicitly link game activities to curriculum objectives, ensuring that areas such as counting, arithmetic, geometry, and probability are effectively addressed. Additionally, professional development workshops are recommended to train teachers in recognizing mathematical concepts in culturally grounded games and in implementing strategies to scaffold student learning, thereby maximizing the pedagogical value of Omweso game in mathematics classrooms.

(ii) Teachers should integrate guided reflection, in-game questioning, and structured observation to help students articulate their reasoning and connect gameplay to formal mathematical understanding. Lessons should be sequenced so that gameplay is followed by symbolic representation, measurement activities, and exercises in probability or strategic reasoning to reinforce conceptual learning. Furthermore, differentiated support and adequate resources should be provided to accommodate diverse learner abilities, ensuring that all students can meaningfully engage with and apply the mathematical concepts derived from Omweso gameplay.

(iii) Teachers should receive targeted professional development on integrating Omweso game into lessons, linking gameplay to curriculum objectives, and employing structured classroom strategies such as role assignments and guided reflection. Competency-based rubrics and observation tools should be used to assess students' reasoning and strategy during gameplay. Lessons should sequence gameplay before formal notation, with differentiated support to ensure all learners access the embedded concepts. Additionally, probability and strategic decision-making exercises should be formalized to turn intuitive gameplay skills into assessable and transferable mathematical knowledge. The urgency of the recommendations are rated in line with the objectives that guided the study with one in objective one being most crucial.

5.4 Limitations of the Study

The study was confined to Zesui Sub County in Sironko District, which restricts the generalizability of the findings. Differences in cultural practices, resource availability, and educational settings across other regions could yield different results.

The study employed a cross-sectional approach, which only captured a single point in time. This makes it difficult to assess the long-term impact of Omweso game-based teaching on learners' mathematical development.

The study relied mainly on teacher interviews as the primary data collection method. While insightful, this limited triangulation with other data sources (such as classroom observations) that could have strengthened the validity of the findings.

The study did not directly examine how Omweso game-based teaching aligns with the national mathematics curriculum across all grade levels. This makes it unclear how scalable or sustainable the approach is in formal educational policy.

The research mainly focused on arithmetic, spatial reasoning, and probability, but did not fully explore how Omweso game could support higher-order concepts (e.g., algebraic structures, calculus foundations), limiting its scope in the wider secondary mathematics curriculum.

5.5 Areas for Further Research

Future studies should investigate the long-term impact of using Omweso game on learners' mathematical understanding. Since this study provided only a snapshot of classroom practice, longitudinal research would help determine whether the benefits of Omweso game in developing arithmetic, probability, and spatial reasoning persist or evolve over time.

Further research is needed to explore the use of Omweso game in different regions and cultural contexts beyond Zesui Sub County. Such comparative studies could reveal variations in effectiveness that arise from differences in socio-economic, infrastructural, and cultural factors, thus strengthening the generalizability of the findings.

Studies could also focus on how teacher training influences the integration of Omweso game in mathematics classrooms. Investigating the role of professional development, differentiated instructional strategies, and classroom management approaches would provide insights into how teachers can overcome challenges and maximize the pedagogical value of Omweso game

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APPENDICES

Appendix A: INTERVIEW GUIDE FOR SECONDARY SCHOOL MATHEMATICS TEACHERS

Dear Respondent,

I am Musika Rogers a graduate student from Makerere University pursuing a Masters' Degree in education Mathematics Education (MESE). I am conducting research on "exploring Ethnomathematics as a teaching approach in learning school mathematics a case of omweso game in Zesui Sub County". You have been selected because you are key informant in this study. Please spare one hour and respond to the five questions that follow. Your responses shall contribute to the success of this study and will be treated with maximum confidentiality. Your responses will be used only for purposes of this study.

Sign …………………Date……………………Name…………………………………….

SECTION A: Demographic information

Please tick [√] the most appropriate alternative that corresponds to items given.

A1 Gender: Male ☐ Female ☐

A2 Highest Qualification: Diploma ☐ Bachelors ☐ Postgraduate Diploma ☐ Masters ☐

A3 Period of Service: 0-5 years ☐ 6-10 years ☐ 11 years and above ☐

School Name…………………………………………………………………

Place of the interview…………………………………………………………

Time of the interview…………………………………………………………

Duration of the interview…………………………………………………….

SECTION B: Ways in which the mathematical concepts that are embedded in omweso game can be used by secondary school mathematics teachers.

1. How do you perceive the role of traditional games, such as Omweso game, in teaching mathematical concepts to students?

…………………………………………………………………………………………

2. Have you previously used Omweso game or any other traditional games in your mathematics lessons? If so, can you describe your experience and the outcomes?

………………………………………………………………………………………

3. In what ways do you think Omweso game can be integrated into the mathematics curriculum to enhance students' understanding of mathematical concepts?

…………………………………………………………………………………………

4. What teaching strategies or approaches would you use to incorporate the Omweso game into your mathematics lessons to make the learning process more engaging and effective?

………………………………………………………………………………………..

SECTION C: Challenges that teachers face while developing mathematical concepts through the use of omweso game-based teaching approach

5. What potential challenges do you face in using Omweso game as a teaching tool for mathematics? How would you address these challenges to ensure successful implementation?

…………………………………………………………………………………………………

Thank you for your active participation

Appendix B: The Ethnomathematics as a Teaching approach in Learning School Mathematics: A case of Omweso Game Focus group discussion guide for teachers

Dear respondent,

I am Musika Rogers a graduate student from Makerere University pursuing a Masters' Degree in in education (mathematics education). I am conducting research on "exploring Ethnomathematics as a teaching approach in learning school mathematics -a case of omweso game in Zesui Sub County". Please spare one hour and respond to the questions that follow. Your responses shall contribute to the success of this study and will be treated with maximum confidentiality. Your responses will be used only for purposes of this study.

SECTION A: Demographic information

Please tick [√] the most appropriate alternative that corresponds to items given.

A1 Gender: Male [ ] Female [ ]

A2 Period of service : 0-6 years [ ] 7-10 [ ] 11-13 [ ] 14 and above [ ]

Section B: Ways in which Mathematical Concepts that are embedded in Omweso Game can be used by Teachers in a Mathematics Classroom

1. Can you describe your experience playing the Omweso game?

2. How often do you play, and what do you enjoy most about it?

3. While playing Omweso game, what mathematical skills or concepts do you find yourself using or thinking about the most? Can you give specific examples?

4. How has playing Omweso game helped you understand or improve your skills in mathematics? Are there any particular topics or concepts in math class that seem easier to you because of this game?

5. In what ways does Omweso game require you to use problem-solving or strategic thinking? How do these skills relate to the math problems you solve in class?

Thank you for your active participation

Appendix C: Field letter

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DEAN'S OFFICE

14th August, 2024

TO WHOM IT MAY CONCERN

RE: MUSIKA ROGERS (2022/HDO4/22334U)

Mr. Musika Rogers is a Masters student in the School of Education, College of Education and External Studies, Makerere University, offering Master of Education in Science Education. He is proceeding to collect data for his dissertation titled: "***Exploring EthnoMathematics as a Teaching Approach in Learning School Mathematics: A case of Omweso Game in Zesui Sub-county*"**.

Any assistance rendered to him will be highly appreciated.

Yours Sincerely,

Mulumba Bwanika Mathias, PhD
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