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Mathematical Dimensions of *Amenama Man Wankyo* Children Play of the Tiv People of Iyon Shangev-Ya in Kwande Local Government Area of Benue State, Nigeria

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Abstract

This study applied phenomenological design to explore the mathematical dimensions of the *Amenama Man Wankyo* children play of the Tiv People of Iyon Shangev-ya in Kwande Government Area of Benue State, Nigeria. The sample comprises 12 Iyon indigenes selected via purposive sampling. The instrument for the study is a semi-structured in-depth interview rubric and video recorder. Narrative analysis was used to analyze and interpret the shared experience of Iyon people with the local children play. The results of the study revealed the richness of the *Amenama Man Wankyo* children play as basis for mathematics instruction in the core areas of counting, arithmetic of addition, subtraction, multiplication and division, fractions and ordinal numbers, geometry of shapes, matrices and systems of

linear equations as well as arithmetic of sequence and probability. The outcomes also revealed that Iyon people through the help of *Amenama Man Wankyo* children play, can identify smart and intelligent children who can keep correct records, take good decisions and are responsible for their actions or inactions, pursue their own interests, show independence in thought and action, exhibit intrinsic motivation, persistence and confidence under pressure or in a very critical situation. Based on the findings, the study recommended that curriculum developers should carefully consider the traditional game, incorporate the of *Amenama Man Wankyo* into the design of the mathematic curriculum, Mathematics teachers who are the curriculum implementers should plan their work systematically involving largely ethnomathematical elements, government should train and encourage mathematics teachers on the use of ethnomathematics in primary and secondary schools, and learners should be encouraged to play with traditional games such as the game of *Amenama Man Wankyo* as it provides them with an all-round development. The study suggested a further study on incorporating the Iyon children game of *Amenama Man Wankyo* into the classroom mathematics of secondary schools in Kwande Local Government Area of Benue State, Nigeria.

Keywords: Ethnomathematics, Mathematics Education, *Amenama Man Wankyo*, Iyon Shangev-ya, Kwande, Basic Education

Introduction

The word Mathematics comes from the Greek (Mathema) meaning 'Science, Knowledge or Learning' and (Mathematiko's) meaning 'fond of learning' (Simonson & Gouvea, 2007 in Singh & Agnihotri, 2015). In explaining this, Agwagah (2008) noted that mathematics is often defined as the study of topics such as quantity, structure, space and change. These topics provide the major subdivisions of mathematics into: Arithmetic, Algebra, Geometry and Analysis.

Abraham, Florence and Ibrahim (2019) also stated that mathematics is the study of patterns, space and change. In the same line, National Teachers' Institute (2000) explains mathematics as the study of patterns and relationships which can be expressed in symbols. It embraces many important ideas about numbers and space which involves problem solving activities and a very powerful way of communication. In the light of this, Elaine (2013) describes mathematics as the science that deals with the logic of shape, quantity and arrangement. Mathematics is all around us in everything we do (Elaine, 2013). It is the building block for everything in our daily lives, including mobile devices, architecture (ancient and modern), art, money, engineering and even sports.

According to National Teachers' Institute (2000), mathematics was invented because man needs to solve his domestic and economic problems which lie in buying and selling. This is simply the philosophy behind the growth of the subject and this is also the basis for the philosophy of its teaching and learning. Mathematics is foundational in many ways that informs our decisions in areas of our lives and a key subject in the study of science subjects (Nigerian Turkish International Colleges, 2014). Teaching and learning mathematics is at the heart of education. Learning mathematics aims to link school to everyday life, provide skill acquisition, and prepare students for the workforce and foster mathematics thinking. Mathematics involves learning to problem-solve, investigate,

represent and communicate mathematical concepts and ideas, and making connections to everyday life (Sinay & Nahornick, 2016). Learning takes place through experiences that are mediated by tools the can be mental (like spoken language), symbolic (like Mathematical signs), or physical (like counters) and assistance drawn from other competent individuals (Per-Eskil, 2011).

Despite the relevance of Mathematics in our daily life and national development, analysis of school certificate examination in mathematics results show that students have consistently low marks as less than 42% of registered candidates obtain credit pass (Mamman & Eya, 2014). Mathematics is considered as one of the most difficult subjects. The examination results from pre-primary grades to senior secondary schools itself prove its significance to more extent. Muna (2015) explains that mathematics is being very difficult to understand to the students due to the lack of background and the concept of Mathematics subject and in some cases the teacher getting the certificates without entering to the training class. Thapa (2005) outlined some of the problems faced by mathematics teachers to include large class size, irrelevancy of teacher guide, lack of instructional materials, and lack of supervisory and financial help. Bhattarai (2005) argued that learning mathematics is affected by so many factors which include lack of sufficient instructional materials, back of physical facilities, teacher's negligence towards curriculum planning and students' weak background in subject matter.

Solving problems in different ways is strongly advised for Mathematics learning and teaching (Bingolbali, 2011). There is however, little data available on the examination of the use of ethnomathematics as a solution to the problems of Mathematics teaching and learning.

The term ethnomathematics is used to express the relationship between culture and Mathematics. The term requires a dynamic interpretation because it describes concepts that are themselves neither rigid nor singular- namely, ethno and Mathematics. The term ethno describes "all of the ingredients that make up the cultural identity of a group: language, code, values, jargons, beliefs, food and dress, habits and physical traits, and games and plays". Mathematics expresses a “broad view of Mathematics which include counting, arithmetic, classifying, ordering, inferring and modeling” (D’Ambrosio, 2001). Many educators may be unfamiliar with the term, yet a basic understanding of it allows teachers to explain their mathematical perceptions and more effectively instruct their students. An important component of Mathematics education today, should be to reaffirm, and some instances to restore, the cultural dignity of children. As our students experience multicultural mathematical activities that reflect the knowledge and behaviors of people from diverse cultural environments, they not only may learn to value the mathematical concepts but, just important, may develop a greater value for those who are different from themselves.

To acquire these skills while maintaining cultural dignity and to be prepared for full participation in the society require more than what is offered in the traditional curriculum. Much of today's curriculum is so disconnected from the child's reality that it is impossible for the child to be full participant in it. The mathematics in many class rooms has practically nothing to do with the world that the children are experiencing. Just as literacy

has come to mean much than reading and writing, mathematics must also be thought of as more than, and indeed different from counting, calculating, sorting or comparing (D'Ambrosio, 2001).

It is on this basis that this study seeks to bring to light the Mathematical dimensions of *Amenama man Wankyo* children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, Nigeria. *Amenama man Wankyo* is children played plays by the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, Nigeria. By direct interpretation, *Amenama* means "dragon fly", *man Wankyo* means "and a stone" hence, *Amenama man Wankyo* means "Dragon fly and a stone". In the game, *Amenama* is the judge and *Ako* (the plural of Wankyo) are stones usually 12 in number. The game involves only two people (the player and the judge) at a time. But players may take turns up to five or even more. It may also be played in teams of twos. Each team involves a player and a helper while the competing teams serve as judges. Twelve shallow holes (*ahungwa*) are dug in the ground and *Ako* (12 stones) are distributed across the holes, one stone in each hole. The holes are dug in an array of 4 by 3. The three columns from left to right are called *Vegher u hiihii* (first fraction), *Vegher u sha uhaa* (second fraction) and *Vegher u maseityo* (last fraction) respectively.

In a two persons play, the main player sits with the holes behind him or her. The second player (also the judge) sits and faces the holes. That is, the holes are dug between the player and the judge. On starting the game, the main player whom the *Ako* are behind him or her, ushers the judge (2nd player) through the song:

Amenama oo Amenama oo (judge judge)

Tor wankyo la na ma (pick up the stone and give me)

The judge responds:

U ngu num? (Is it this one?) Pointing at the first stone in the first row on the first column (R1C1)

The main player agrees knowing that there is a stone in the hole.

Oonna ma se. (yes, give it to me).

The judge picks the stone out from the hole leaving the hole empty. The main player sings the song again:

Amenama oo Amenama oo (judge judge)

Tor wankyo la na ma (pick up the stone and give me)

The judge responds:

U ngu num....? Pointing the empty hole in row 1column 1 (R1C1).

The main player disagrees:

N vende ye (no I refuse).

The judge points the second hole on row2 column 1 (R2C1)

U ngu num...? (Is it this one?).

The main player agrees:

Oonna ma se. (yes, give it to me).

The judge removes the stone from the second hole and the game continues in the same order until all the stones are removed.

At any point the main player agrees for a stone to be removed from a hole from which a stone had already been removed, it is said that the main player *gbabo* (has failed), the next player tekes his turn.

The game of *Amenama man Wankyo* involves a lot of mathematical concepts in its composition and in some ways teaches these concepts to its players.

Firstly, counting, every successful player of *Amenama man Wankyo* must be able to count *ako*, the twelve stones, and retain the information cognitively while playing. Counting whole numbers is one of the first topics in Number and Numeration in the school curriculum.

Secondly, the game involves arithmetic's of addition and subtraction. From the beginning of the game to the end, addition and subtraction skills are basic skills the players employ so as to successfully complete the game. The game thus, will be relevant to strengthen the concepts of addition and subtraction for school children.

Thirdly, the *Amenama man Wankyo* game teaches fractions and ordinal numbers. In the game, terms such as '*vegher u hihir', 'vegher u shauhwagh'* and *'vegher u maseityo'* are used which means first fraction, second fraction and last fraction respectively. The fractions here represent the columns formed by the holes which are dug on the ground.

Fourthly, the *Amenama man Wankyo* children play, teaches probability from the decisions the player has to make, whether the hole from which a stone is to be removed, actually has a stone or not? If he agrees for a stone to be removed from an empty hole, he fails. He also fails, if he refuses the remover of a stone from a hole which has a stone.

Finally, the indigenous game emphasis the concept of matrices. The holes are dug in rows and columns. The direction of the game follows column after column. This are the first concepts a child needs to know in other to do well in the study of matrices and systems of linear equations.

These mathematical skills and confidence are essential for students (Sinay & Nahornick, 2016). Given the importance of Mathematical skills and confidence, this study focuses on the Mathematical dimensions of the *Amenama man Wankyo*, a children play of the Tiv people of IyonShangev-ya in Kwande Local Government Area of Benue State, Nigeria, that can provide the basis and guidance for effective classroom practices for supporting students' development in Mathematics.

Statement of the Problem

Regardless of the relevance of Mathematics in our daily life and national development, analysis of school certificate examination in mathematics results show that students have consistently low marks as less than 42% of registered candidates obtain credit pass (Mamman & Eya, 2014). Historical results of Education Quality and Accountability Office (EQAO) assessment also shows considerable decline in Mathematics achievement over time (Sinay & Nahornick 2016). The trends in International Mathematics and Science Study (TIMSS) conducted in 2011, which examined Mathematics achievement for pupils and students in selected classes in the primary and secondary schools demonstrated that only an average of 32.5% of students have high level of confidence in Mathematics . Also, chief examiners report on students' areas of deficiency in school certificate examinations showed that students least understood Mathematics as shown by their achievement (WAEC 2007). The analysis has shown that the problem of students' poor performance in Mathematics is perennial. This has made researchers to put their search light on the various factors responsible for this poor performance of students in Mathematics and have to remedy the problem. However, practically little or nothing is done to investigate the effect of ethnomathematics on the Mathematical attainments of pupils and students in the class particularly from the Kwande study Area. This is what necessitates this study to examine and bring to light the Mathematical dimensions of the *Amenama man Wankyo*, children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, Nigeria.

Literature Review

Theoretical Frame Work

Klafki's Theory of Critical- Constructivism (Klafki, 2000)

The German University Teacher, Wolfgan Klafki (1927-2016) has been the dominant figure in general didactics in Germany. But while in the past, his publications were virtually unknown in Nigeria, in France, in the UK, in the United States and many other countries, this has changed recently. Parallel to this process, talking and writing about 'Bildung' has become more and more accepted outside the German didacticism.

In Klafki's categorical 'Bildung' as a strategy for selecting teaching and learning content, he argues that the general always has to be observed within the concrete and the specific. The basic model of Klafki's analysis consists of five questions that could be applied in analyzing the didactic situation from the perspective of the learner (Erik, 2020; Bladh, Stolare & Kristianson, 2018).

i. What particular meanings (fundamental principles, basic structures) are basic to the learning content of the subject?

ii. What is the significance of the learning content with regard to the acquisition of knowledge, skills, proficiency and experience by the child?

iii. What is the significance of the learning content with regards to the child's future?

iv. What is the structure of the learning content?

v. How can the child's interest in the learning content be stimulated, and how can the structure of the learning content be explained to the child?

In the context of this study, 'child' should be understood to refer to a mathematics learner. The importance of taking into consideration what the learner already knows in creating a meaningful learning environment was documented years ago (Nkopodi & Mogege, 2009). According to constructivist theory, learners construct new knowledge based on what is already known to them (Akpan, Igwe, Mpamah & Okoro, 2020)

This is in line with Hansman and Wilson's (2020) view that learning is an everyday event that is social in nature because it occurs with other people, it is tool-dependent because the setting provides mechanisms that aid and more important, structure the cognitive process and finally, the interaction with the setting itself in relation to i social and tool dependent nature that determines learning. In the light of this Nkopodi and Mogege (2009), stated that, it is important for learners to be exposed to learning opportunities that link mathematical concepts and principles with their applications encountered in everyday experience. Play is a relevant tool to help achieve this connection if it can be linked to school mathematics.

According to Meral, Elvan and Arzu (2020), play as an entertaining action or relaxation that takes place according to rules is the leading figure among the activities that a child enjoyably perform and the basis of physical, social , mental and emotional development of the child and has the function of bridging among his cognitive, affective and kinetic development. Moh, Sri and Emma (2018) explain that traditional games and play teach children to be creative and socially interact and in learning mathematics, students are not only taught to simply memorize mathematical formulae but most importantly, solve mathematical problems relating to everyday life which will make students understand the benefits of the science they learn. But actually, teachers sometimes do not notice that in traditional games or play children can also learn mathematics.

In a game, participants have to follow the rules of the game or come to a consensus on how the rules can be amended. Each player wishes to win the game while simultaneously having the same interpretation of the rules as the opponent. This is in line with mathematical problem solving as certain rules have to be followed in solving a mathematical problem. By using indigenous games, the problem of inadequate finances may be partly alleviated, because indigenous games can often be constructed simply without spending any money hence the use of indigenous games and play in the teaching of mathematics may be both cognitive and affectively advantageous for the learners (Nkopodi & Mogege, 2009).

Conceptual Framework

Indigenous Games, Indigenous Knowledge Systems and Ethnomathematics

South African Sports Commission (SASC) defined indigenous games as games linked to traditions of a cultural group, being a local origin and requiring physical skill, strategy

and/or chance (SASC, 2001). Elly (2021) stated that most traditional games contains such mathematical concepts as length, height, depth, to name a few for traditional games in Northern Nigeria, most of them include the concepts of algebra, set theory, geometric coordinates, arithmetic progression, geometric progression, matrices, probability and many other concepts in mathematics. Most of these have been inherent in the culture and traditions of the tribes (indigenous people) in accordance with Umbara, Wahyudin and Prabawantos (2021) notion that people's cultural activities are carried on from generation to generation, including estimating, patterning activities, and building geometric patterns. To this effect, Nkopodi and Mogege (2009) described indigenous knowledge system (IKS) as a systematic body of knowledge acquired by local people through the accumulation of experiences, informal experiences and intimate understanding of their environment in a given culture. Mascarenhas (2004) sees indigenous knowledge as the sum total of the knowledge and skills which people in a particular geographic area posse and which enable them to get the most out of their natural environment. Most of these knowledge and skills have been passed down from earlier generations but individual men and women in each new generation adapt and add to this body of knowledge in a constant adjustment to changing circumstances and environmental conditions. They in turn pass on the body of knowledge intact to the next generation in an effort to provide them with survival. According to Mosimege and Onwu (2004), indigenous knowledge is an all-inclusive knowledge that covers technologies and practices that have been and are still used by indigenous and local people for existence, survival and adaptation in a variety of environment. Such knowledge is influenced by both internal and external circumstances and interactions with other knowledge systems. Such knowledge covers contents and contexts such as agriculture, architecture, engineering, mathematics, governance and other social systems and activities, medicinal and indigenous plant varieties, etc.

The study of the analysis of indigenous games has shown that they are a component of indigenous knowledge systems. Both indigenous games and indigenous knowledge systems deal with knowledge of local origin which is known largely by specific cultural groups. However, this knowledge may sometimes strictly be confined to a specific group, as evidenced by the Tiv cultural group's knowledge of the *Amenama man wankyo* children play of the Tiv people of Iyon Shangev-Ya in Kwande Local Government Area of Benue State, Nigeria.

Indigenous knowledge system is a broad concept which incorporates ethnomathematics. This can be seen in the definition given by Matang (2006) that ethnomathematics is an interdisciplinary field of research covering cultural anthropology, mathematics, mathematics education and mathematics cognition.

Ethnomathematics studies the cultural aspects of mathematics. It presents mathematical concepts of the school curriculum in a way in which these concepts are related to the students' cultural and daily experiences, thereby enhancing their abilities to elaborate meaningful connections and deepening their understanding of mathematics. Ethnomathematical approaches to mathematics curriculum are intended to make school mathematics more relevant and meaningful for students and to promote the overall quality of their education (Rosa & Orey, 2011).

Ethnomathematical Studies and the Mathematics Classroom

D'Ambrosio and Rosa (2017) stated that ethnomathematics refers to the way that members of various cultural groups mathematize their own reality. It examines how both mathematical ideas and practices are processed and used in daily activities. Putu, Nyoman and Ngurah (2021) pointed out that ethnomathematics aims to draw on cultural experiences and the use of mathematics so that it not only makes learning mathematics more meaningful, but also to provide students with the insight that mathematical knowledge is embedded or inherent in the social and cultural environment, and student value the use of mathematics more in everyday life. Our view however, is that this focus has contributed to a greater understanding of how various cultures can contribute and how they can be viewed and interpreted with respect to mathematical classroom challenges. Studies that focus on relations between mathematics and culture enable one to reflect on the different cultures and find ways in which classroom challenges may be explored in classroom settings.

In mathematics teaching and learning, according to Aguirre, Mayfield– Ingram, and Martin (2013), ethnomathematics approach helps us expand, affirm and redistribute mathematical authorship and empowerment, draw from and expand resources to teach and learn mathematics, recognize and challenge spaces of marginality of knowledge of many communities; and strengthen the relationship between learners and mathematics. In this context, Rosa and Orey (2011) stated that, the implementation of an ethnomathematical perspective in the school mathematics curriculum helps to develop students' intellectual, social, emotional and political learning by using their own unique cultural referents to impart their knowledge, skills and attitudes. This in turn, provides ways for students to maintain their identity while succeeding academically.

The Tiv People of Iyon Shangev-ya

According to the history handed down by ancestors through words of mouth, the Iyon people of shangev-ya in Kwande L.G.A.of Benue State, Nigeria, migrated many years ago, from the mythical Swen Kalagba mountains in the Cameroon, years after their brothers (other Tiv extractions) had migrated to the Benue valley leaving them behind with the Utanga, another group of the Tiv people who are currently residing in Obanliku Local Government Area of Cross-River state. On the arrival of the Iyon people, they helped their brothers, the people of Shangev-ya to fight against an enemy, the Ugeb people of Cross-River State. In the fight, they defeated the Ugeb people of Cross-River state and push them off the borders. The Iyon people were known for super powers, charms, fighting skills who could fight wars invincibly and invisibly, a reason why they are also called the *Iyon Azembe* (Iyon the flying Eagles).

After the fight, the Iyon people were given to settle where they are currently, at latitude 6.7^0north, longitude 9.2^0 East, at the boundary between Shangev-ya and the Ugeb people of Cross-River State. The Iyon people who reside in the Iyon village in Kwande L.G.A. of Benue State, speak Tiv language (their tribal language). Some of the Iyon people who reside in the village speak other languages which include English language, Ugeb language and Udam language. Ugeb language and Udam language are languages of the neighboring villages in Cross-River State.

The zip code of the village is 982104. The population of the village is more than the land mass. Presently, the people of Iyon Shangev-ya are mostly small scale farmers. They have only one market which is observed after every four days and is named after the village "Iyon". The Iyon market is a popular market in the axis hence it attracts buyers and sellers from within, far and near the village. Items found in Iyon market in large quantities among others are: bananas, red palm oil, red and white processed garri and milled rice. Also, on Iyon market day, some Iyon women produce and sell *brukutuu*, a local drink made from corn and millet which attracts many buyers both men and women of the village and the neighboring villages. The village is dual religious; Christianity and Paganism. Most of the Iyon people who practice paganism are good herbal medicine men. The village has produced a few numbers of professors but a good number of priests and pastors.

Empirical Studies

In a research on the "Developmental Framework of Ethnomathematics Curriculum through Realistic Education Approach" Nofikusumawati (2019) arrived at a conclusion that linking the culture in the process of teaching and learning in the form of games, learning becomes more meaningful. Especially in mathematics learning, contextual learning is highly relevant to the cultural community and it makes learning interesting and fun for the children. Nofikusumawati (2019) further explained that bringing the realistic mathematics education approach into the pedagogy for teaching mathematics within the culture is helpful as it create awareness about the children's culture as well as reach the mathematics modern and helps the teacher to support students to understand mathematical concepts and analyze their level of understanding in the learning process as well. In the light of this the current study explores the mathematical dimensions of the *Amenama man Wankyo* children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State.

Putu *et al* (2020) on their study on "Integration of Ethnomathematics in Learning Geometry Transformation" opined that one effort that has the potential to improve student learning outcomes in mathematics is to make mathematics learning meaningful in the sense of linking mathematics in the classroom with aspects of students' culture and that the use of ethnomathematics in mathematics learning will help to reduce the notion that mathematics is final, abstract, absolute (certain) and will help students develop the ability to formulate, apply and interpret various context as well as social emotional attitude.

In the same line, D'Ambrosio and Rosa (2017) in a study on "Ethnomathematics and Pedagogical Action in Mathematics Education" elucidated that ethnomathematical approach help us understand mathematics from a perspective wider than traditional school mathematics of seeing mathematics as a human act. In view of this development, Shaibu (2014) in his study on "Mathematics in Hausa Culture: Some Examples from Kano State-Nigeria" stated that the culture of the Northern people of Nigeria, is rich with mathematics stuffs such as riddles, games, crafts, events, folk lore, customs, objects and other traditional festivals. Emmanuel, Benjamine and Emmanuel (2009) also shared the same view as Shaibu however, specifically noting that the people of Benue state of Nigeria especially the Education Zone B which comprise of the Tiv speaking tribe mainly have

very rich cultural practices that could be used to advantage to teach mathematics. It is in this direction, that the current study exists.

Umoru and Abah (2021) carried out a study aimed at determining the rules and mathematical aspects of the Krita, Charabke and Gofu local children plays of the Irigwe people of Miango village in Bassa L.G.A. of Plateau State Nigeria. The study revealed that certain mathematical concepts such as Basic Geometry, Arithmetic, Mensuration, Numerical Cognition and Logic and Reasoning permeates the Krita, Charabke and Gofu local children plays. The study also, reveals that, the indigenous local children play Krita, Charabke and Gofu, when carefully engrafted into the mathematics curriculum can enhance in-depth understanding of classroom mathematics and better performance especially at the Elementary and Basic Education levels. Lastly, the study reveals that the indigenous children plays proved to promote socio-cultural unity and foster peaceful coexistence between the Irigwe people and neighboring villages. This present work is similar to Umoru and Abah (2021) in that, both studies involve the use of semi-structured in-depth interview rubric and interpretive phenomenological design to explore lived experiences of villagers in distinct indigenous villages with named indigenous games. However, Umoru and Abah (2021) focused on the local lives of the Irigwe people in Miangovillage of Bassa Local Government Area of Plateau State, with divided attention on three different indigenous games; the Krita, Charabke and Gofu and limited their study to the Elementary and Basic Education levels. This present study considers the Tiv people of Iyonvillage in Shangev-ya, Kwande Local Government Area of Benue Stats and gives it total attention to the game of *Amenamaman Wankyo*, an indigenous children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, to explore the mathematical dimensions of the game. This makes the study relevant, and findings from the study may be useful for ethnomathematical tool development.

Furthermore, Aba and Abah (2012) in a study investigated the Ethnomathematical Dimensions of the Shiva and Uyerver children plays of the Tiv people of Akor village in Guma Local Government Area of Benue State, Nigeria. In their study, six research questions were formulated and used as guide to the study which employs a phenomenological research design to achieve the objectives of their study. Their study population consisted of the entire people of the Akor village in Guma Local Government Area of Benue State. The data collected was analyzed using the narrative analysis and the result showed that traditional games influenced language skills. The study also revealed that games like Shiva and Uyerver influenced social skills development and mathematics of pupils through their abilities to tell stories, report experiences, sing and dramatize and logically scale through the conditions of the game to emerge as winners. This recent work is also an ethnomathematical exploration using qualitative methods. However, its focus is on the mathematical dimensions of the "Amenama man Wankyo" children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State. This new study is also similar to Aba and Abah (2012) in some ways, including that, both studies use a phenomenological research design to achieve their set objectives of the study, each study population for both studies is made up of indigenous village people and data from both studies are analyzed using the narrative analysis. However, while Aba and Abah (2012) divided attention on two different indigenous games, the Shiva and Uyerver children play

of the Tiv people of Akor village in Guma Local Government Area of Benue State, the present study intends exploring the mathematical dimensions of the game of*Amenama man Wankyo*, which has a different structure, composition and rules from those of the *Shiva* and *Uyerver*, in Aba and Abah (2012). It is therefore wise for the present study to be carried out since no recorded work has been done on the topic and also, exploring the game of *Amenama man Wankyo* may bring to light more tools for ethnomathematics development and richness.

Lastly, Turmud, Elly, Dewi and Marhayati (2020) embarked on the study on Ethnomathematics and Mathematical Cconcepts of Tong Tong Galitong Ji for High School which aimed at describing the result of the exploration of the mathematical concepts in Malang City's traditional game Tong Tong Galitong Ji or Nasi Goreng Kecap. The research was a qualitative study with an ethnographic approach. Data were collected through field observations, documentations and in-depth interviews. Data analysis to explore the internal structure of mathematical concepts in the five stages of the game was performed by taxonomic analysis. Exploration of the concept of basic mathematical operations (addition, subtraction and multiplication) occurs in stages one through five, exploration of the concepts of arithmetic modulo 6 and 3 operations in stages two through four and exploration of the concept of arithmetic sequence and probability in stage five of the game Tong Tong Galitong Ji; stage five features basic mathematics operations of addition, subtraction and multiplication (division excluded), as well as the concept of arithmetic sequence during the determination of punishment quantity. The current study explores the mathematical dimensions of *Amenama man Wankyo* children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, Nigeria. Comparing Turmudi *et al.* (2020) with the current study, it is clear that both studies are qualitative studies in which each study uses ethnographic/phenomenological approach to explore lived experiences of village people and narratively describes the results. However, while Turmudi et al (2020) focused on Malang City's traditional game of *Tong TongGalitong Ji* or *Nasi Goreng Kecap,* which is a five staged game played by two or more people at a time, counting stretched out fingers in a patterned manner, the current study is concerned with theIyon people's indigenous game of *Amenama man Wankyo* children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, played by two people at a time using 12 stones and 12 shallow holes dug on a leveled ground and guided by a defined set of rules.

From Klafki's Theory of Critical –Constructivism reviewed in the study, the problem of selecting and concentrating contents of education means reflecting on the existential concentration in which the human historical world is given to us in our life context, from the perspective of the tasks which arise in our specific and individual situations. The theory also stresses that teaching and learning must be understood as process of interaction i.e., as processes in which relationships between people- between the teachers and learners and between the learners themselves- play a central role. These processes must therefore be comprehended not only as processes of acquisition in which subject matter and problems are confronted but also as social processes or processes of social learning.

A considerable number of prior studies are in consensus that traditional games contain elements of ethnomathematics. Hence traditional games are not mere play but also an avenue of extracting educational benefit however, the majority of the games in the work reviewed are played and understood by a specific indigenous group and influenced more of language and social skills development with little or no influence on mathematical skills. Mathematical concepts in the games from the works reviewed exclude concepts such as fractions, division and matrices. From the description of the game of *Amenama man Wankyo* it is obvious that greater number of mathematical concepts is present in it. This leads the question, what are the mathematical dimensions of the game of *Amenama man Wankyo* children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, Nigeria? It is therefore necessary to perform an investigation to explore the elements of ethnomathematics which are present in the game.

Purpose of the Study

The purpose of this study is to investigate the Mathematical dimensions of *Amenama man Wankyo*, children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State Nigeria. Specifically, the study sought to:

i. Explore the composition of the *Amenama man Wankyo* children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, Nigeria.
ii. Explore the rules of the *Amenama man Wankyo* children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, Nigeria.
iii. Explore Mathematical concepts embedded in the game of *Amenama man Wankyo*n children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, Nigeria.
iv. Investigate the experience of the Iyon people of Shangev-ya in Kwande Local Government Area of Benue State with the *Amenama man Wankyo* children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, Nigeria.

Research Questions

The following research questions were asked in this study:

i. What is the composition of the *Amenama man Wankyo* children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, Nigeria?
ii. What are the rules of the *Amenama man Wankyo* children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, Nigeria?
iii. What are the Mathematical concepts embedded in the game of *Amenama man Wankyo* children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, Nigeria?

iv. What is the experience of the Iyon people of Shangev-ya in Kwande Local Government Area of Benue State, with the game of *Amenama man Wankyo* children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, Nigeria?

Methodology

Design of the Study

The study adopted a phenomenological method. Findings are allowed to emerge rather than being imposed by the researcher. The research revolves round interpretative phenomenology specifically in the course of the research. The concern of the study is to understand lived experience of the people of Iyon Shangev-ya in Kwande Local Government Area and how they make sense of these experiences with the *Amenama man Wankyo* local children play of the Iyon people.

Area of the Study

The research was carried out in Iyon Shangev-ya village in Kwande Local Government Area of Benue State, Nigeria. Iyon Shangev-ya is a small village under Kwande Local Government Area of Benue State located at latitude 6.7 north and longitude 9.2 east. A major road (Adikpo-Usankula road) divides Iyon village into two namely: *Mbachaku* (on the right) and *Mbamanyam* (on the left). The two factions of the Iyon village are made up of enclosed extended family compounds that are clustered together closely.

Population of the Study

The population of the study consists of the entire Iyon people living in Iyon village in Kwande Local Government Area of Benue State, Nigeria. Iyon village is topographically divided into four groups namely: *Halebul* (high level), in the north part of the village; *Don* (Down), in the heart of the village; *Yande-Aya* (the other side of river Aya), in the south and *Yande-Udegele* (the other side of Udegele stream).

Sample and Sampling Technique

The study used a sample of 12 Iyon people both young and old who willingly volunteered to participate in the study. The study used purposive sampling. These participants were considered based on their knowledge and experience in the subject matter under study.

Instrument for Data Collection

The data were collected using two instruments. A semi-structured and in-depth interviews rubric, and video recorder were the two instruments for data collection. A number of planned questions were included in the semi-structured interview but the investigator exercise more freedom in modifying the wordings and order of the questions in the course of the interview. In-depth interviews made the session to be less formal and least structured in the set of questions, this made the participants to be freer and relieved in the whole process of the interview. The interview enabled the researcher collect complex information with a higher proportion of opinion based information. The questions were more focused on the lived experience of the Iyon people with the *Amenama man Wankyo* local children play. A video coverage also highlights the indigenous play in action, capturing the entire process of the game as currently played by the children.

Method of Data Collection

The researcher visited the homes of the sampled respondents and at some points met some participants in open places to administer the interview. Semi-structured rubric interview and photographic/video recorder were the instruments used to collect data. Also notes were taken, observations made were noted. A close watch on the participant's gestures was also taken into consideration at each moment of the process. Participants' experiences and feedback added insight to the research questions posed in this study. By observing, listening and analyzing the experiences of these participants, valuable information was obtained about the study. Most interview questions were asked as they were written. However, the researcher often followed up the semi-structured questions with open ended questions such as 'why', 'how' and 'can you please tell me more?'. This was to enable the researcher get a deeper meaning and richer understanding of the participants experiences. To ensure confidentiality, the names of participants are coded throughout the study. For example, R1 refers to respondent 1.

Method of Data Analysis

The Study used the narrative analysis method for analyzing the data. The analysis made were adopted and used to interpret the shared experiences of the Tiv people of Iyon Shangev-ya village of Kwande Local Government Area of Benue State, Nigeria in their everyday lives in relation to the *Amenama man Wankyo* game played in the study area.

Results

The presentation of the data for this study is done according to the research questions. To protect the identity of the respondents, they are coded R1, R2, R3, and so on. The respondents provided answers in Tiv language and were interpreted by the researcher since he is also of Tiv origin and speaks and understands the language.

Research Question One

What is the composition of the *Amenama man Wankyo*, children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, Nigeria?

When asked of the origin of the game of *Amenama man Wankyo*, R4 explained that

"It is an Iyon people's generational game which is handed down to the current generation by generations of old". Speaking on the composition of the game, R2 explained that "the game of *Amenama man Wankyo* involves 12 shallow holes dug in an array of 4 by 3 on a leveled ground, 12 smooth small stones (*ako*) and two players (a main player and a judge). Where turns are taken in competition, the game may involve even up to 6 persons". R3 said that, before the game is played, the shallow holes are dug up on the ground as shown below:

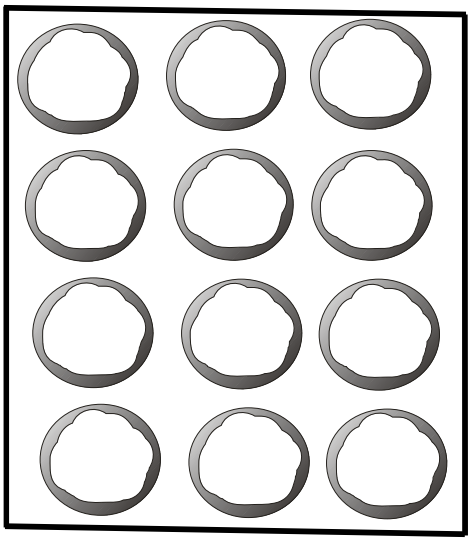

Figure 1: *ahungwa* (shallow holes) for the game of *Amenama man Wankyo*

The 12 *ako* are then distributed in the holes. Two of the *ako* (stones) are then removed from two of the holes as agreed by the players usually, the two *ako* in the middle of the middle column. The two empty holes are tagged *whagh* (river). The arrangement of the stones (*ako)* in the*ahugwa* is as shown below:

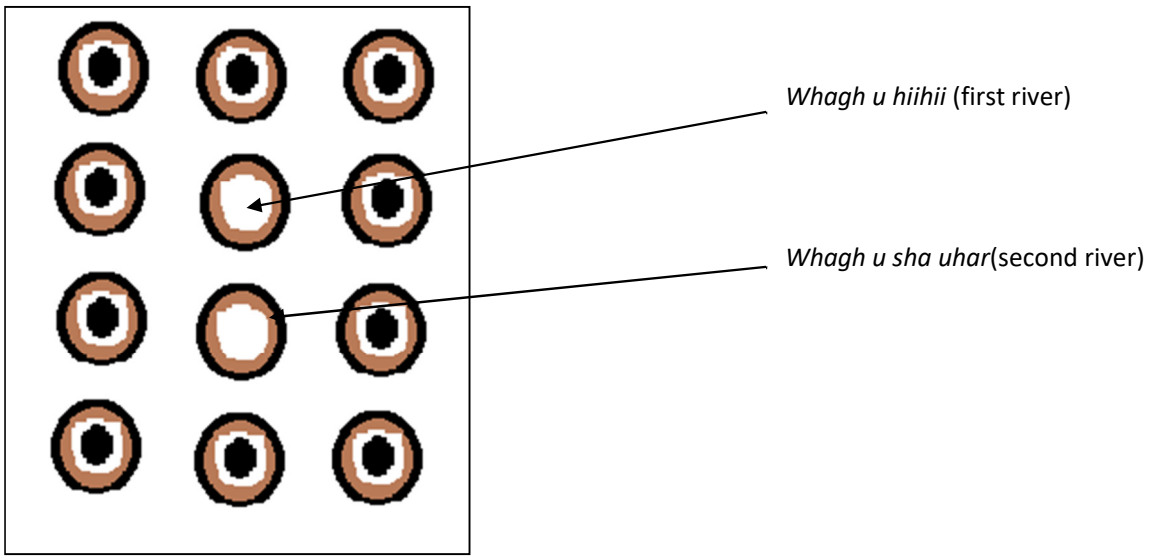

Figure 2: Whagh u hiihii and Whagh u sha uhar

Research Question Two

What are the rules of the *Amenama man Wankyo* children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, Nigeria?

The game of *Amenama man Wankyo* is a mental and cognitive testing and challenging exercise which is interesting both to watch and play. In an interview with R2, the following rules were enumerated:

i. The main player must not at any point turn to look at the level to which the stones have been removed from the holes while playing the game. To this Effect he/she sits with the holes behind him/her.
ii. The main player sits with his/her hands folded behind his/her back or placed in a position that can be checked by the judge (*Amenama*). The main player is not allowed to use his/her hands to count or make marks on the ground while playing the game.
iii. The recommended stone to be removed must be from a hole which is presently having a stone and next to the previously removed stone except when the river is crossed, when two consecutive holes are skipped.
iv. The main player agrees for a stone to be removed before *Amenama* (the player facing the holes) removes the stone.
v. If the main player demands for a stone to be removed from an empty hole then, he/she *gbabo* (has failed the game). This includes demanding for a stone from *whagh u hiihii* and *whagh u shauhar* (first and second rivers respectively).
vi. The game is successfully completed and the main player wins if he is able to demand for all the *ako* to be removed one after the other from the holes correctly without fail.

Research Question Three

What are the Mathematical Concepts embedded in the game of *Amenama man Wankyo,* children play of the Tiv people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, Nigeria?

The *Amenama man Wankyo* Iyon children play, has the ability and capability to enhance easy learning of concepts, improve recall of learned experiences, spur critical thinking in children as well as improve social relations and interaction, through various mathematical concepts it features. These include:

1. Counting: Every successful player of *Amenama man Wankyo* must be able to count mentally and retain the information cognitively while playing the game.

2. Arithmetic of addition and subtraction: while playing the game, the main player mentally continuously removes (subtract) a stone from a known number of stones and simultaneously add to a group of removed stones.

3. Fractions and ordinal numbers: the terms used in describing the parts in the design of the game features fractions/ordinal numbers.

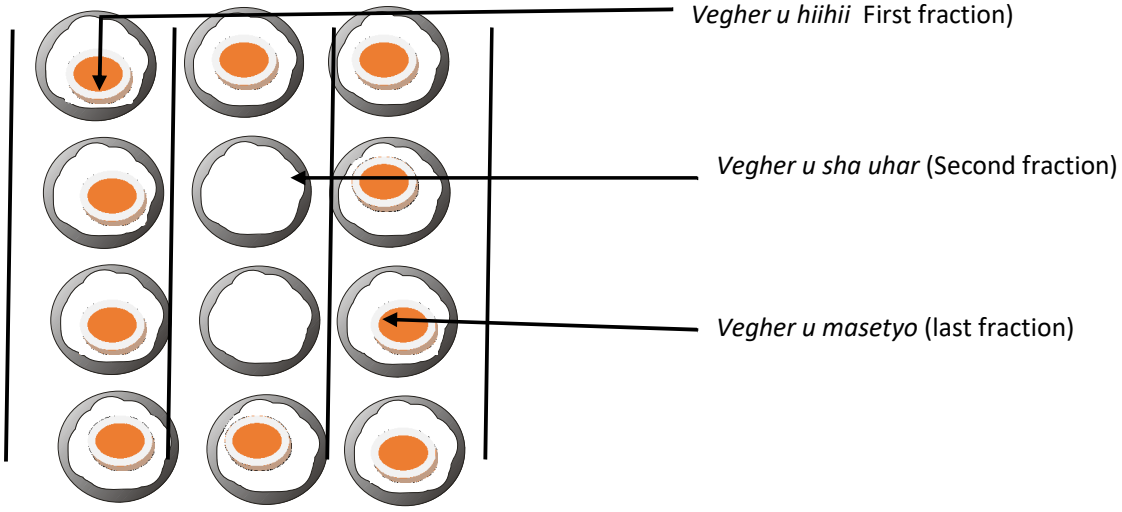

Figure 3: Terms used for the parts in the game of Amenama ama Wankyo

4. Geometry of shapes: the semi-spherical holes on the ground and the rectangular appearance of the arranged holes on the ground, the symmetric pattern, the vertical and horizontal arrangement of the *ahungwa* (holes) on the ground are all Geometric in nature.

5. Division and Multiplication: the holes across the columns are arranged in 3s while those across the rows, in 4s featuring the arithmetic of multiplication and division.

6. Matrices and systems of linear equations: the holes are dug in rows and columns. The direction of the game follows column after column featuring aspects of matrices and systems of linear equations.

7. Arithmetic of sequence: at the beginning of the game, after the two *ako* from the middle of the column are removed, the remaining 10 *ako* mark the first term of the sequence featured in the game for the stones yet removed. The positive difference between the first and second terms is 1. Each time that the main player demands for *wankyo*t o be removed from a hole, the remaining stones in the holes become$10 - n$, that is, $f(n) = 10 - n$. Where n is the number of previous times the main player demanded for a stone to be removed.Graphically, the progress of the game of *Amenama man Wankyo* is as shown below:

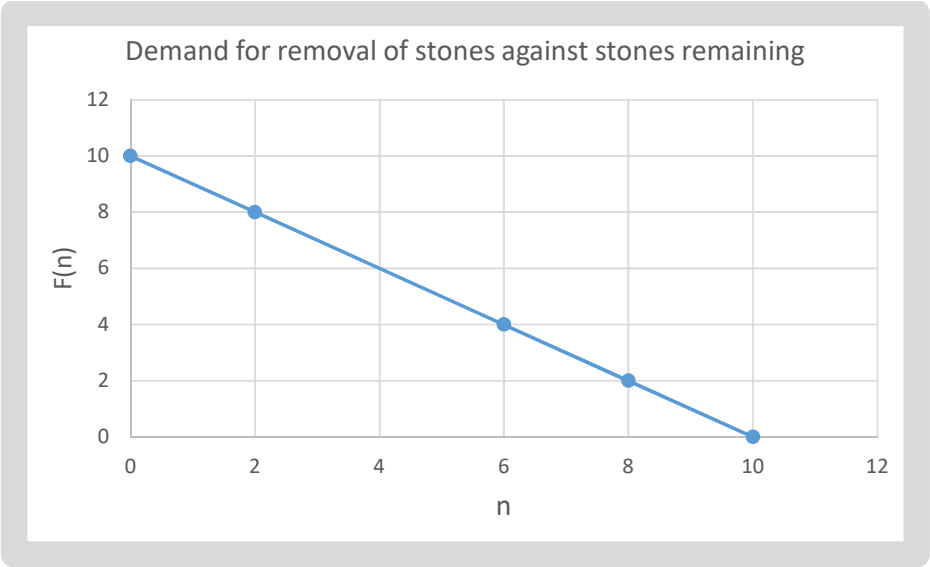

Figure 4: Demand for removal of a stone (horizontal) against number of stones remaining

Similarly, the *ako* removed are also in a sequence of $f(n) = 2 + n$. The number of holes from which *ako* are removed share the same sequence as that of number of stones removed, $f(n) = 2 + n$.

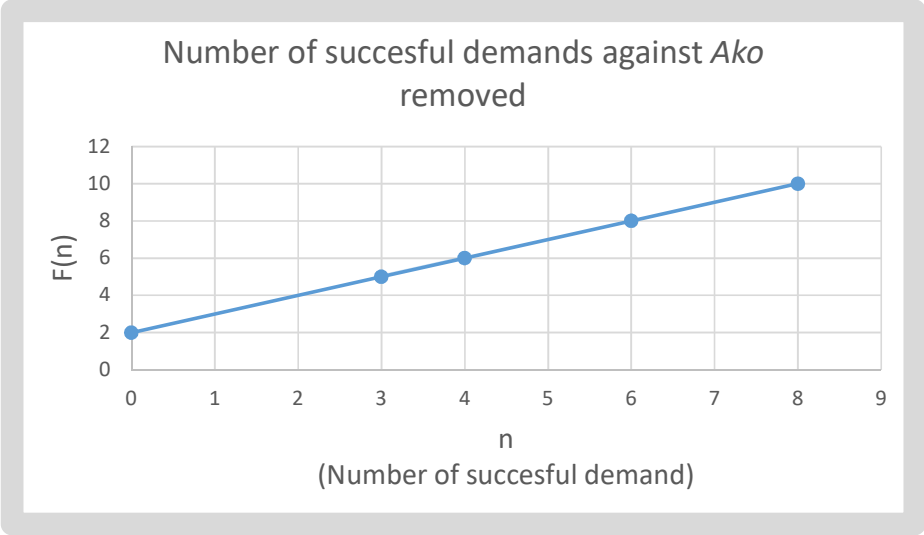

Figure 5: Number of successful demands (horizontal) against *ako* removed (vertical)

8. Probability: the game of *Amenama man Wankyo* features the concept of probability as well. This is observed in the main player's decisions at every instant demand for *wankyo* to be removed. In *vegher u hihii* (first fraction or part), at every instant demand, the player has $4 - n$ out of 4 *ako*to remove and a 1 out of 2 affirmations to make a right choice. Hence, the probability of success at each instant demand;

$$P(success1) = \frac{4 - n}{4} * \frac{1}{2} = \frac{4 - n}{8}$$

Where n is the number of times the main player demanded for a stone to be removed previously. Similarly, in *vegher u sha uhar* (second column, part or fraction), the main player has $2 - n$ out of 4 *ako* to remove and a 1out of 2 affirmations to make a success at every demand hence, the probability of success in *vegher u sha uhar* is

$$\text{P(success 2)} = \frac{2 - n}{4} * \frac{1}{2} = \frac{(2 - n)}{8}$$

The probability of success in *Vegher u maseityo* (last fraction or part or column) is same as that of *vegher u hiihii* hence

P(success 3) = P (success 1).

Thus, for a total success in the game, the probability of success is seen as

$$\text{P (Total success)} = \frac{4 - n}{8} * \frac{2 - n}{8} * \frac{4 - n}{8}$$

Research Question Four

What is the experience of the Iyon people of Shangev-ya with the game of *Amenama man Wankyo*, children play?

The game of *Amenama man Wankyo* is played and enjoyed by the people of Iyon Shangev-ya in Kwande Local Government Area of Benue State, Nigeria, especially among children. In an interview, R6 said, "interestingly, the game is challenging as it involves a lot of mental calculations and once you are involved in the game, it keeps you busy and highly occupied with the task and challenge of passing all the huddles and finishing the game. This sweeps your mind away from stress, grief and even hunger". R3 said that, "the game is played for fun and some times, to test the IQs of children of the same age bracket". R3 added, "Children who play the game enjoy singing the song featured in the game which has the tendency of healing broken relationships among children and bringing about social unity". R1 said that, "the game of *Amenama man Wankyo* builds in players counting skills, logical thinking abilities, ability to sing rhymes as well as long lasting sense of commitment during the course of playing the game. It also brings about unity and co-existence among children of same village as well as those from neighboring villages whenever it is played in competitions.

Still on the experiences of the Iyon people with the *Amenama man Wankyo* children play, R5 said "through interactions brought about by the game of *Amenama man Wankyo*, children learn about the rules and values of their culture, develop fond childhood memories which are essential for healthy and holistic development. Children also learn in the game decision-making, the ability to pursue their own interests, show Independence in thought and action, exhibiting intrinsic motivation, persistence and confidence. The game also helps in language development and acquisition of motor skills as well as empathy towards others."

Discussion of Findings

The results of this study have shown how rich the culture of the Iyon people is, and the presence of Mathematical based concepts embedded in their local children play of *Amenama man Wankyo*. The composition of the game of *Amenama man Wankyo* involves 12 shallow holes dug on a leveled ground, 12 smooth small stones from which 10 are actively used in the game and 2 players at a time. This is very much similar to the game of *Toor Kyo la Nam* in Ugee and Abah (2021) in Ethnomathematical Aspects of the *Toor Kyo la Nam* and *Ishiva-dar* Indigenous Games of the Tiv people of Mbayom Village of Gwer-East Local Government Area of Benue State, Nigeria, on the ground that, both games involve 2 players at a time, use of stones in a seemingly same manner as well as use holes for *Amenama man Wankyo* and circles for *Too Kyo la Nam*. However, where the game of *Toor Kyo la Nam* uses 6 stones and 6 circles drown on a straight line on a paper or leveled ground, *Amenama man Wankyo* uses 12 stones and 12 shallow holes dug on a leveled ground in an array of 4 by 3.

The game of *Amenama man Wankyo* has a clear underlying structure and is governed by a set of rules making it a mathematical game (Fouze & Amit, 2017). The game involves six defined rules which guide the players from the beginning of the game to the end. Moh, Sri and Ema (2018) asserted that mathematics is considered as an abstract knowledge, so to understand it requires the ability to think and that mathematics is a tool for developing ways of thinking and in the learning of mathematics, informal knowledge of mathematics is developed into mathematical concepts through games. This assertion is supported by this study as the study revealed that the game of *Amenama man Wankyo* in its content features various important mathematical concepts such as counting, fraction and ordinal numbers, geometric of shapes as well as multiplication and division. This also aligns with Ugee and Abah (2021) and Shuaibu (2014) that our cultural games reveal and provide opportunities of understanding more about mathematics.

Other concepts embedded in the game of *Amenama man Wankyo* are the concepts of matrices and systems of linear equations as well as arithmetic of sequence thereby aligning with Lopeze, Brown and Llamas (2021) who pointed out that mathematics is a human endeavor present across human civilization and cultural practices such as playing games.

Also, from the study, the game of *Amenama man Wankyo* features probability and mental problem-solving skills upholding the claim by Yusuf, Saidu & Halliru (2010) that traditional games played by children or adults are meant to shape individual brain as it involves there in the existence of basic mathematical concepts. Traditional games like the game of *Amenama man Wankyo* influences the development of cognitive and logical thinking abilities as well as Problem-solving skills in Children through their ability to carry out speedy mental calculations, retain calculated and classical information and logically scale through the complex conditions of the game. On this ground, this study is on the same page with Putu *et al.* (2020) that students become more enthusiastic, can see, and use mathematics in a cultural aspect, and their problem-solving skills will improve.

Actually, the results revealed in this study has addressed those who erroneously believe mathematics only starts and ends in the classroom, thereby divorcing the rich cultural elements from the use of mathematics. This indigenous generational and cultural game presents a more interesting approach to the teaching and learning of mathematics for children.

The game of *Amenama man Wankyo* has numerous educational relevance as a historical and cultural artifact, when consciously and carefully introduced into the classroom mathematics of the school. Umoru & Abah (2021) stated that indigenous games, when carefully grafted into the mathematics curriculum can enhance in-depth understanding of classroom mathematics and better performance, and also that indigenous children plays prove to promote social cultural and foster peaceful co-existence between people of a community and neighboring villages. This claim is supported by this study as through the interactions brought about by the game of *Amenama man Wankyo*, and through singing of rhymes in the game, children learn about the rules and values of their culture, develop their language, acquire flexibility and empathy towards others, learn to make decisions and the ability to pursue their own interests, show independence in thought and action, exhibit intrinsic motivation, persistence and confidence as well as development of fond childhood memories which are essential for healthy and holistic development. This also supports the view that traditional games can be used in the learning of mathematics as a form of social interaction based on the local culture.

Lastly, this study agrees with Khalid (2008) that traditional games expose children to a number of invaluable life lessons and that both individually and collectively, children exhibit and sharpen cognitive and physical abilities through play. The challenging game of *Amenama man Wankyo* influences psychomotor and creative skills in children through the process of gathering stones, digging up holes in a beautifully designed pattern and through the removal and replacement of *ako* from in the dug holes instantaneously as well as singing a correspondence rhyme at every move while playing the game.

Conclusion

The result of the study revealed that ethnomathematical elements are present in the traditional game of *Amenama man Wankyo* at every stage of the game. The formation and design of the game features geometric concepts of shapes, as well as matrices and systems of linear equations. Mathematical concepts of multiplication and division are featured in the number and patterned holes made (dug) on the ground. Arithmetic concepts of addition and subtraction as well as number counting are employed by the players from the beginning to the end of the game.

Arithmetic sequence is featured in the game through the progressive movement of the game. The concept of probability appears in the decisions made by the player. Language skills are observed in the game through the rhyme said and sung throughout the time of the game by the players.

Recommendations

Based on the results of the study, the following recommendations are made:

i. A conscious effort be made by relevant stake holders with the primary and secondary School sectors to device means of incorporating rich indigenous children's games such as *Amenama man Wankyo* children's play into the Mathematics Curriculum of Instruction at the primary and secondary Schools' levels of education.

ii. Mathematics curriculum planners should plan their scheme of work systematically by involving largely, ethnomathematical elements. The use of children game in this study specifically holds a broad Implication for classroom practices in Mathematics Education.

iii. The government is encouraged by this study to see the need to train and encourage mathematics teachers on the use and relevance of ethnomathematics in the primary and secondary education sectors.

iv. Learners should be encouraged to play with traditional games like the game of *Amenama man Wankyo* since through their interaction with games such as this, provides them with an all-round development more so academic excellence.

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