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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

Tertsegha Timothy UGEE and Joshua Abah ABAH

Department of Mathematics Education
Joseph Sarwuan Tarka University, Makurdi, Nigeria

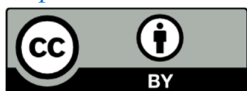
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Abstract

This study applied phenomenological design to explore the 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. The sample comprises 15 Mbayom indigenes selected via purposive sampling. The instrument for the study is a semi-structured interview rubric. Narrative analysis was used to analyze and interpret the shared experience of Mbayom people with the local children plays. The results of the study revealed the richness of the *Toor Kyo la Nam* and *Ishiva-dar* indigenous games as basis for mathematics instruction in the core areas of Arithmetic, Geometry, Logic, Everyday Statistics, Mensuration and Trigonometry. The outcomes also revealed

that Mbayom people through the help of *Toor Kyo la Nam* and *Ishiva-dar* can identify smart and intelligent children who can keep correct records and are responsible for their actions or inactions and can also take right decision under pressure or in a very critical situation. Based on the findings, the study recommended that Curriculum developers should carefully consider these local indigenous games in the design of the mathematic curriculum and Mathematics teachers who are the curriculum implementers should as a matter of fact appreciate the mathematical aspects of indigenous games and should relate them with topics in mathematics for easier understanding.

Keywords: Ethnomathematics, Indigenous Games, *Toor Kyo la Nam*, *Ishiva-dar*, Mbayom Village, Mathematics Education, Tiv

Introduction

Mathematics is the chief among disciplines in terms of its rich cultural and historical roots in the practice of ordinary people. This is because mathematics is always adopting to the needs of the society (Abah, 2017). Different scholars have their views of what mathematics is all about. According to Merriam-Webster dictionary, Mathematics is the science of numbers and their operations, interrelations, combinations, generations and abstractions and of space configurations and their structure, measurement, transformation and generalizations or is the science of numbers, quantities and shapes and the relations between them. Mathematics can also be defined as the study of measurement, properties and relationship of quantities and sets using numbers and symbols. Mathematics can be described as an organized active thinking, which involves the search for patterns and relationships that may be expressed in symbols. It is an expression of the human mind that reflects the active will, the contemplative reason, and the desire for aesthetic perfection. Mathematics is essential for the full comprehension of technological and scientific advance economic policies and business decision, and other complexity of social and psychological issues (Abah, 2018).

Mathematics has been the bedrock of modern breakthrough of science and technology, the physical science all rest on a knowledge of mathematics, its roles in the field of engineering and all other fields of science cannot be overemphasized. The recognition of the importance of science and mathematics in the socio-economic and political development of the nation has led to the encouragement of Nigerian citizens to pursue science, technology and mathematics education instead of the inherited colonial theoretical education. The importance of mathematics as further observed by Popoola (1998) spread across every field of human endeavour to the pure science (Physics, Chemistry, Biology), mathematics is the basis and language for the course. To the applied science and technology (Engineering, Medicine, Pharmacy, Food technology and so on) mathematics is the indispensable tool, this means that no applied science can be understood without the aid of mathematics. To the art (English, Law, History, Fine art, Music, e.t.c) mathematics is the light that gives completeness and consistency.

The bright future of every country depends upon the educational system that builds morality and behaviour of its citizens. Achieving this requires attractive investment in education on a global scale. Education is considered as the optimal instrument that is used for the integration of the individual with the society for the sake of developing national goals and achieving high levels of progress, promotion of unity, self-actualization and strive for political constancy, social evolution, economic welfare, scientific standards, cultural consciousness and technological

progress. For acquiring such multi tasks mathematics is studied as fundamental component of education (Jameel, 2016).

The role of teachers in teaching and learning mathematics cannot be over emphasized. Teachers play key roles in the interpretation of the curriculum, syllabus and scheme of work. Odili, (2012) observed that in our educational set up some of the mathematics are not adequately qualified. This implies that, Mathematics-Teacher factor cannot be left out of students` performances. In order to ensure effective teaching and learning of mathematics, teachers should adopt correct teaching methods so that the interest of students would be captured and maximum result may be obtained at all levels.

Many scholars, stakeholders, organizations, individuals and the government have put in efforts in perfecting teaching strategies such as concept mapping approach, programmed institution, learner`s centered approach, discussion, demonstration among others, to ensure teaching and learning of mathematics is effectively made easy. Teachers should not just be concerned about what students learn only but also how they learn and how it is applicable in real life.

Obodo (2004) opined that the type of interest a student brings to the classroom is very important. This implies that if a student has positive interest towards a particular subject he or she will not only enjoy studying the subject but would also derive satisfaction from the experience and knowledge of the subject. Teachers of mathematics should identify activities that students are interested in, in order to know how best to present a particular topic so that it can be meaningful, interesting and practical to students.

Teaching and learning of mathematics has being a challenge right from time till date. According to Jameel and Ali (2016) mathematical knowledge is fundamental, but alas, it is poorly taught in elementary schools and ultimately mathematical performance remains down, leading to lower ability of individuals in comparison to their abilities. Students, particularly girls run away from mathematics. This difficulty reaches at its peak when it is taught by unqualified and non-professional teachers. Attractive and impressive teaching methods are not used to teach mathematics and ultimately its results are shown in the failure of students. Several factors such as learner`s incompetence, poor achievement in mathematics. Teaching mathematics is a complex matter while lack of students` interest on the other hand probably overwhelms the abilities of adults and ultimately cause as one of the most important factors for poor performance in mathematics. Developing and raising level of student`s interest and involvement means how much time, energy and effort they devote towards achieving high goals in mathematics as a learning process is fast and instinctual on one hand while on the other hand the belief that supports the idea based on working with strategy and planning for the sake of improving mathematical abstract and logical fundamental concepts works efficiently in most situations. Parents and government both agree that the investment on education especially elementary is not giving desired output due to their lacks in understanding mathematical terms and its concepts. The deficiencies in representing and retrieving fundamental numerical facts and figures ultimately hinder in the way of gaining improvement in mathematics by the perspective of adult students and acquiring high standards in mathematics by the perspective teachers and its country as well. Low performance in mathematics may be dealt with special instruments and programs designed to meet the special or additional needs of individuals for developing essential mathematics skills. Poor academic

performance is also seen in secondary school students at all levels find mathematics as a difficult and boring subject and develop feelings of inferiority, hesitation and complex. They have outright fear when they confront mathematics. Such a situation directly hinders their learning progress as they do not actually learn that which is meant for them. Similarly, motivational studying environment and level of interest play vital role in achieving high goals especially in mathematics. Students' learning environment and the way of stimulating them in accordance with their interests and tendencies will automatically lead them towards their performance based destination that will surely reduce the level of frustration amongst all. The main reason for failure in mathematics is directly related to the development of curriculum and the ways teachers teach mathematics in the classes. Different teaching approaches, techniques, methods and ways can influence the outcomes in mathematics. Akinsola and Popoola (2004) noted that lack of interest by the students is a major problem associated with students' low and poor academic performance in mathematics. Also worthy of note is the teacher's methodology which is another powerful factor that contributes greatly to students' low performance in mathematics.

The mathematics teacher is expected to stimulate students by pin-pointing mathematics-based activities and their applications in the society. It is on this note of teachers' methodology that researchers have suggested that Ethnomathematics could be very useful to motivate learners' interest and bring about good or excellent academic performance in mathematics and other fields that are dependent on mathematics.

The realization that every culture generates its own ways of explaining, understanding and coping with reality gave rise to Ethnomathematics as a view in mathematics education (Abah 2019). Ethnomathematics refers to any form of cultural knowledge or social activity characteristic of a social and/or cultural group that can be recognized by other groups such as Western anthropologists, but not necessarily by the group of origin, as mathematical knowledge or mathematical activity (Pompeu, 1993). According to North American Study Group of Ethnomathematics - NASGEM (2014) ethnomathematics study is not limited to small-scale groups but the prefix "ethno" can refer to any group such as nation, labour unions, religious traditions, and so on. It includes the use of mathematical symbols, spatial design, methods of calculations, measurement in space and time, specific ways of reasoning, and other human activities that can be translated into a formal mathematical representation in field of study. There are two main aspects that must be considered by educators in teaching and learning activities namely, teachers do not merely transfer the knowledge but also must be able to transfer the values of the local wisdom in the student's neighbourhood. Unfortunately, not all the instruction in the classroom uses the local wisdom as the starting point in learning activities.

Abah, (2018) observed that modern thinking of the ethnomathematics programme acknowledged that there are different ways of doing mathematics by considering the appropriation of the academic mathematical knowledge developed by different sectors of the society as well as by considering different models in which different cultures negotiate their mathematical practices. This approach to ethnomathematics is related to the real life is been developed to improve both the level of student's cognitive and effective abilities so that students can understand the concept being studied or taught. A significant part of ethnomathematics research has educational aims, seeking to bring to the schools or other formal educational environments the knowledge and the mathematics practices and plays or concepts of various cultural groups of people (Gerdes, 1995).

The Tiv people of Mbayom village enjoys culture and heritage that is endowed with interesting local games and children`s plays which could supply tremendous ethnomathematical backgrounds for mathematics lessons and classes. The Mbayom people are one of the three districts in Gwer-East Local Government Area of Benue Stata, Nigeria and they are of the Tiv-speaking ethnic group.

The Mbayom people are predominantly farmers and are also known for their large orchards (oranges, mangoes, cashew, etc.). Worthy of note is that these people are friendly and hospitable, honest and peaceful. These people, especially children have so many games and which aids cognitive development. Specific examples of their local games worth considering are the *Toor kyo la Nam* and *Ishiva-dar*.

The *Toor Kyo la Nam* (pick that stone and give me) is a game that is played by two players per time. The basic materials required for this game are six (6) stones of the same sizes and six (6) circles of equal sizes drawn on the floor on a straight file. Three (3) straight lines would also be drawn, the first two vertical and the last one horizontal. Note that the three (3) lines are drawn with three (3) circles on the left and right respectively. The six (6) stones are placed in the six (6) circles and the two players sit on the floor facing the circles with the stones in them and another backing the system completely. The player backing the system starts requesting the player facing the system to pick the stones for him with a song that says “pick that stone and give me”. As the stoners are being removed and given to player he/she must not look at the stones but also keep record of the stones given to him/her and the empty circles. The player backing the system must not demand for a stone from an empty circle or one of the straight lines else he/she losses and the other player takes the turn of requesting for the stones. It could be observed that the drawing of circles, straight lines (both vertical and horizontal), selection of stones, removal of stones from the circles, and so on, reflects mathematical concepts such as Geometry, Mensuration, Arithmetic, and Probability.

The *Ishiva-dar* is another interesting game that is played by two people at a time. A square is drawn on the floor or any surface with lines in the middle running from top to the bottom (vertical) and left to right (horizontal) and the diagonals. Six (6) objects are needed and these copuld be stones, seeds or anything that the players chooses to use but of course the first three (3) objects for one player must be different from that of his/her opponent. The two players would sit in opposite direction both facing the *Ishiva-dar* (square-like structure on the floor) and the objects (stones) would be placed in front of each player at the points where the earlier drawn lines meets with the square. The center where all lines meet is usually empty at the beginning. Each player`s target is to have his stones on a straight line either horizontal, vertical or diagonal compulsorily including the center. For example, considering vertical line, the winner`s stone is right in front of his opponent, one stone at the center and last stone is in his front on a straight line. Worthy of note is that, this game makes the players to be responsible for their actions, this implies that at each point a player is to move his stone, he must be calculative, must put himself in the shoes of his opponent and reason critically as if he were the opponent, what he would have done after he must have moved his stone to another point then takes his decision. Spectators are not allowed to aid any of the players and the game continues until a winner emerges. In this game also there are some interesting elements of mathematics such as Geometry, Critical Thinking, and Arithmetic. The basic things to note about this game is that two stones must not be at a point the same time,

you move your stone only to the next available empty space, that means you don't just jump or move your stone to any available empty space.

These games (*Toor Kyo la Nam* and *Ishiva-dar*) are not restricted to a particular gender, they are for both male and female, adult and children alike. The adults use the *Ishiva-dar* to teach their children that any decision you take in life has consequences and also to test arithmetic (addition and subtraction) skills to know if these children are qualified to be sent on errands.

Considering the mathematical richness of the *Toor Kyo la nam* and *Ishiva-dar*, this study seeks to explore ways of making them useful in the teaching and learning of mathematics at the Basic Education level. The study intends to add to the significance of demystifying mathematics as a subject by building on the learner's fund of indigenous knowledge.

Statement of the Problem

The importance of mathematics to national development cannot be overemphasized. The attitude of both teachers and students towards teaching and learning of mathematics is of great concern. The problem of mathematics teaching and learning such as teacher's methodology, poor instruction strategies, teacher's incompetence, lack of students' involvement and lack of interest have been lingering for years. The increasing nature of poor academic performance of senior secondary school students in mathematics especially in external examinations like West African Examination Council (WAEC), Senior School Certificate Examination (SSCE) and Unified Tertiary Matriculation Examination (UTME) is worrisome. This is blamed on teacher's methodology and students lack of interest. Majority of the students might not understand the relevance of mathematics to their everyday life and future education endeavours. Mathematics is created out of human needs to solve problems which can arise from many sources including the learner's culture. This is why every student needs to be carried along through the teacher's method given the opportunity to learn as much mathematics he/she can in order to function effectively and intelligently in the society. The mathematical dimensions of cultural games and plays are hardly explored, particularly among the Tiv people. Blending the components of these games into classroom instruction may stir up learner's interest and improve mathematics richness of these indigenous games (*Toor Kyo la Nam* and *Ishiva-dar*) of the Tiv people of Mbayom village of Gwer-East Local Government of Benue State, Nigeria and suggest or ascertain how it can be applied in the classroom for better academic performance in mathematics.

Literature Review

Experiential Learning Theory (Kolb, Boyatzis & mainelres, 2000)

Experiential learning theory (ELT) provides a holistic model of the learning process and a multiline model of adult development, both of which are consistent with what people know about how people learn, grow and develop (Kolb *et al.*, 2000). The emphasis on experience in ELT is due to the central role experience plays in the learning process. ELT defines learning as the process whereby knowledge is created through the transformation of experience, with knowledge resulting from the combination of grasping and transforming experience (Kolb *et al.*, 2000). There are four major stages in instructional approaches based on the ELT. Stage one involves planning the next experience through setting of objectives and learning activities and exploration of learning experience. In stage three provision is made for reflecting on what actually happened in the delivery. This third stage helps to develop metacognition in the student. The fourth stage gives

room for discussion and interactions among all elements of the instructional process with the openness to repeat the same cycle to ensure effectiveness (Chesiment *et al.*, 2016). When these stages are executed in the mathematics classroom, the outcome is an active interaction in which students process new information in such a way that it makes sense to them in their own frames of reference inner worlds of memory experience and response (CORD, 1999). He further maintained that, in a history augmented learning environments, students, discover meaningful relationships between abstract ideas and practical applications in the context of the real world.

Interestingly, experiential learning theory blends with the *Toor Kyo la nam* and *Ishiva-dar*. *Tôôr Kyo la nam* game involves selection of stones (six stone of the same size), drawing of circles, vertical and horizontal straight lines, for the game to begins, the rule are set and each player knows his or her objectives or aims and then the actual game begins. The selection of stones, drawing of cycles and lines could be seen as planning or preparation for the game, the players explore ways of winning their opponent without violating the rules of the game so as to achieve their objectives. We may agree that this same helps develop metacognition in children who are involved and on a general note this could be of great help to students during mathematics classes.

The *Ishiva-dar* also involves drawing of a square, vertical and horizontal lines, and selection of stones. The four stages as mentioned in the theory also apply here in the sense that, drawing of a square, lines and selection of stones are preparatory stages that can develop schemas in students to function very well in mathematics classes such as menstruation, geometry, and arithmetic. Playing with the strong aim of winning while keeping to the rules of the game, this game contains elements of logic and if integrated into mathematics can be of great help both to the teacher and students especially in areas such as logic, arithmetic, mensuration and so on.

The Apos Theory (Dubinsky & McDonald, 2001)

The indigenous games, children's play and local crafts play important roles in mathematics instruction delivery which can best be described by the Apos theory. Apos theory proposes that an individual has to have appropriate mental structures refer to make sense of a given mathematical concept. The mental structure refers to the likely actions, processes, objects and schema required to learn the concept (Maharaj, 2010). The Apos theory begins with action and moves through processes to encapsulated objects. These objects are then integrated into schema consisting of action, process and objects, which themselves can be encapsulated as objects. Apos theory assumed that mathematical knowledge which is passed by someone is the result of interaction with people and the result of his/her mental constructions in comprehending mathematical ideas. Comprehending of mathematical concept begins by manipulating existing mental construction or manipulating physical objects to form action. When action is done repeatedly, and the individual reflects on it, the outcome is interiorized to become a process, which in turn develops into cognitive objects. The collection of action, process, object and other scheme which is connected integrally and organized structurally in the individual's thinking is called the shcema (Syaiful *et al.*, 2014). The theory makes testable predictions that if a particular collection of actions, processes, objects and schemes are constructed in a certain manner by a student, then this individual will likely be successful using certain mathematical concept and in certain problem situations.

Some of the indigenous local games, in this case, *Tôôr Kyo la nam* and *Ishiva-dar* local games of the Tiv people of Mbayom have some mathematical aspects that can awaken reasoning in children, in

the classroom and the society at large. The selection of stones, drawing of circles, lines (vertical & horizontal) in the case of *Tôôr Kyo la nam* and the selection of objects of different colours, drawing of square with lines running both vertical, horizontal and diagonals in the case of *Ishiva-dar* blends with the collection of actions, processes, objects and schemas, in the Apos theory. Selection of stones or objects of objects of different colors, drawing of circles, squares and lines in both *Ishiva-dar and Tôôr Kyo la nam* could be integrated into many topics covered in the mathematics curriculum. Appropriate, constant and frequent use and interaction with these games, processes, actions and objects could develop schemas in children which will be of tremendous effect in the mathematics class.

The Mathematics Curriculum

Mathematics is the chief among disciples in terms of rich cultural and historical roots in the practice of ordinary people (Abah, Iji, Abakpa & Anyagh, 2021). Mathematics as a field of study has other subfields ranging from number theory, game probability theories, fractals, spherical and spatial geometry, trigonometry, arithmetic, algebra, calculus, statistics, indices, and so on. These various aspects of mathematics are so important that students should not take them for granted.

Curriculum is the combination of instructional practices, learning experiences, and students' performances assessment that are designed to bring out and evaluate the target learning outcomes of a particular course or subject. The mathematics curriculum is designed in such a way that the three domains namely, cognitive domain, affective domain and psychomotor domain are covered in order to build an individual completely, ranging from the level of reasoning, emotions and skills. This enables the curriculum and syllables implementers to meet the individual needs of different students. The curriculum has an important part known as the foundation which stresses the basic concepts, knowledge, properties and simple real life applications.

The Tiv people of Mbayom village have some local games and plays that are suitable for mathematics teaching and learning, owing to the fact that teachers may include some enrichment topics at their discretion, the games involve drawing of circles and straight lines, selection of stones in case of *Tôôr Kyo la nam* and drawing of a square with horizontal and diagonal lines, selection of object in case of *Ishiva-dar* could help stimulate learning in students. As the structure of mathematics is carefully designed in interdependent concepts, that is, one concept especially the lower one leads to the understanding of another concept may be a higher one, the students will align quickly when higher concepts are introduced.

The Tiv People of Mbayom Village

The people of Mbayom village of Gwer-East Local Government Area of Benue State, Nigeria are of the Tiv speaking ethnic group. Gwer is the home of the Masev people with headquarter is in Aliade and is made of three districts which include; Ngyohov, Njiriv, and Yonov. The mbayom people are of the Ngyohov district located along Aliade-Otukpo Expressway sharing boundaries with Ikyonov in the North, Ikyogbajir in the South, Mbakine in the East and Howe in the west. The Mbayom people are pre-dominantly farmers. Apart from farming they are also known for salt production, mill stone production, crafts activities such as making of baskets, construction of hoes, and making of local chairs among others. The agricultural produce and other products are traded in Aliade market which holds in five (5) days interval. Mbayom people as a result of modernization, are mostly Christians and are known for their honesty, hospitality, generosity,

hard work and humility. Their lifestyle is guided by the Holy Bible and fear of God. However, some still hold strongly and believe strongly in Swem (gods or deified ancestors which dictate how the people should conduct themselves morally, honestly and be faithfully in everything they do.) Swen also judges between disagreeing parties and strikes the offender with incurable infirmities.

The *Toor kyo la nam*

The *Tôôr kyo la nam* (meaning “pick that stone and give me”) is a game that is played by two people (players) per time. The game requires six (6) stones of the same sizes, six (6) lairds of equal sizes drawn on the floor on straight file three straight lines would also be drawn, the first two vertical and the least on horizontal. The first two vertical lines are called Rivers and the third and least horizontal lines are called a valley. The two players seat on the floor with one facing the system or game and the other backing the system, a referee or observers if any also take (s) his/their position.

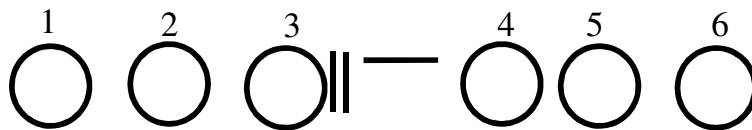


Figure 1: A typical diagram of Tyoor kyo la nam game

The player backing the system starts the game with a song: *yaya oh yaya ooh tôôr wan kyo la nama* (yaya is the name given to the player that is facing the system, *tôôr wan kyo la nama* means implies pick that stone and give me) which says yaya pick up that stone and give me. Then yaya demands to know which of that stones he is to pick by asking *ngunu* (this one?) yes the singer replies; if the circle has a stone inside, it will be given to him else he will be told he is wrong, if the singer fails then he becomes the yaya and the former yaya becomes the singer and the game continues in that order. For example, two players are to play the game say Terna and Terfa. Terna is the singer that would back the system while Terfa is yaya that would face the system. Terna starts, *yaya ooh yaya ooh Tôôr wan kyo la nama* (yaya pickup that stone and give me) yaya (Terfa) points at the first circles and asked this one? (*ngunu*). *Oon nama se* (yes give me) Terna replies, yaya now gives him the stone which he must not look at it or turn to look at the system. Terna sing again and yaya points the first empty circle again and asked this one? Terna replies No, yaya now points the seconds circle and Terna would accept and the stone would be given to him. Terna sings again and yaya (Terfa) points the first empty, Terna said No, he points the second empty Terna also said no then he pointed the third circle and Terna accepted. Now when he sing for the fourth time (remember the first three circles one the left are empty, in between the six circles are two rivers and one valley that must be crossed by calling their names respectively) *yaya ooh yaya ooh tôôr wan kyo la nama, ngunun, nvende ye, ngunun, nvende ye, ngula ka wuala, ngunun. Gula kpaa wuala, ngunun, ka akpa je la, ngunun oon nama se*. yaya wanted to know which stone Terna wanted him to give him this time around knowing fully well that the first three circles on the left are empty, Terna also noted that he has been given three stones so definitely, the first three cycles on the left must be empty. In the song above, Terna asked yaya (Terfa) to pick up a stone and give him, yaya, now

pointed at the first empty cycle which Terna said no, he pointed the second and the third and got a no respectively. He then continued by pointing at the second river got the same answer, he pointed at the valley and he was also told that, that's a valley, then he pointed at the fourth circle and Terna successfully completed his turn without failing Terna would have failed if he had and that earns him a point. Please note, if said yes give me that stone when Terna pointed an empty circle or when he pointed a river or valley. The selection of stones, drawing of circles, drawing of straight line, answering yes or no appropriately and so on reflects mathematical concepts such as arithmetic maturation Geometry, logic, number and numeration, probability, every day statistics and trigonometry. If integrated into the mathematics curriculum, the students may quickly and easily understand the topics.

The *Ishiva-Dar*

This is another richly mathematically endowed local game. The game also involves two players per time. A square is drawn on the floor or any surface with lines in the middle running from top to the bottom (vertical) and left to right (horizontal) and the diagonals. Six objects are needed and these could be stones, seeds or anything depending on the player's choice. But of course, the first three objects for one player must be different from that of his/her opponent. The two players would sit in opposite directions both facing the *Ishiva-dar*. Object (stones) would be placed in front of each player at the points where the earlier drawn lines meet with the square.

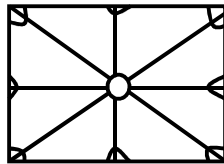


Figure 2: A typical diagram of the *Ishiva-dar* game.

The centre of the square is usually empty, the aim of each player is to get his/her stones on a straight line including the centre. For example, if Terna and Terfa are playing this game; when Terna's stones in course of the game happens to be on straight line being it vertical, horizontal or any of the diagonals then he wins. The players can touch each other's stones. That is when Terna places his stones in between Terfa's stones, then Terna's stones are locked and he can't move it until when it is unlocked by his opponent. The game demands that an object be moved only when there is an empty space next to it, that player takes a division no going back and finally spectators or observers must not give due to any player.

The *tôôr kyo la nam* and *Ishiva-dat* has rich mathematical concepts ranging from selection of six (6) stones, drawing of circles, lines, and square could leave the children with great experience relating to Geometry, mensuration, probability, arithmetic, logic and measure of central tendency. These games if incorporated or integrated into the mathematics curriculum may tremendously help for instruction, understanding and better comprehension for better results in mathematics performances.

Empirical Studies

Abah (2018) in a study provided insights into the educational relevance of the P'tche game of the Orokam people of Idoma land of Benue State of Nigeria. The "P'tche game of the Orokam people is the ancient mancala game, so common or popular among the Orokam people of Idoma that the term "P'tche" means to play since it can easily replicate on the hard ground by digging little holes and filling them with the required number of stones "P'tches" in the Idoma language means "game" It is obviously the first game every Orokam child learnt to play. The P'tche game had many names across Nigeria and much of Africa. The P'tche game is an abstract strategy game involving little amount of change. It ensures observational skills, critical thinking, planning ahead spatial perception and number sense. Likewise, the present study seeks to identify the mathematical aspects or ethno mathematics of the *tôôr kyo la nam* and *Ishiva-dar* indigenous games of the Tiv people of Gwer-East Local Government Area of Benue State, Nigeria.

Mase (2019) in his study of the first Tiv computing system maintained that the Tiv people invented *Azenga* to reduce the stress in counting and the *Azenga* counting system virtually took over the position of stones, which were very heavy to carry about and at the same time very difficult to come by. *Azenga* are stick-like structures gotten from reed. The device was used in counting bigger numbers of Tens, hundreds and thousands. It was used to perform mathematical educations like addition, subtraction, multiplication and division. The use of this device become famous following, its introduction in the infancy (primary) and college (secondary) schools to teach mathematics. The device provides its efficiency owing to the fact that it did not require electricity for its operations. It is light to carry about and had colours to differentiate from the varying numbers it represents. The *Azenga* mechanism was popularly used in Nigerian primary and nursery (kindergartens) schools to perform arithmetical especially in the rural areas of Benue state. Similarly, the present study desires to pin point the mathematical aspects of the *Tôôr Kyo la nam* and *Ishiva-dar* indigenous games to the Tiv people of Mbayom village of Gwer-East local government Area of Benue state, Nigeria, and also suggest ways in which their local games could be of help to the teaching and learning of mathematics if integrated into the mathematics curriculum.

Fouz and Amit (2009) embarked on a study to mainly offer an ethnomathematics analysis of Bedioun embroidery samples taken from traditional dresses made by Bedoiun women from Negev area in south of Isreal. In the work "Ethnomathematics and geometrical shapes in Bedoiun women`s traditional dress", Fouz and Amit (2019) described how ethno mathematical elements are incorporated in the teaching of mathematics for Bedouin students in the Negev, and how this contributes to their learning of mathematics. This study developed teaching units based on integrated ethno mathematical elements within the Bedouin society into the mathematics curriculum and evaluated its influence on the students. The study comprised of five stages; the first stage identified ethno mathematical elements in the life of the Bedouins in the Negev through interviews with community elders; the second stage analysed these elements according to formal mathematical categories. In the third stage, the researchers created teaching units incorporating the ethno mathematical elements identified in the initial stages into the standard mathematics curriculum and the fourth stage saw the application of the combinational teaching units in two Bedouin high schools. Finally, in the fifth stage, tests were administered and data compiled in order to evaluate and compare the students` performance in solving mathematical problems as well as the influence of the new teaching units of the new teaching units on the self-confidence and attitudes of the students control group. The results were the compared. The findings clearly

demonstrated an increase in the motivation, self-confidence and enthusiasm of the research group students perceived their homes, families, schools and the study of mathematics was transformed. However, Fouz and Amit (2019) focused on the local lives of Bedouin Israelis. This present work intends to explore the richness of some indigenous games of the Tiv people of Mbayom village of Gwer-East Local Government Area of Benue State, Nigeria. The focus of the current study will be on the mathematical aspects of indigenous games such as *Toor kyo la nam* and *ishiva-dar*.

Purpose of the Study

The main purpose of this is to determine the ethnomathematics endowed in some games played by both adults and children of Mbayom people of Benue State, Nigeria, Specifically the seeks to:

- i. Determine the rules of *Toor Kyo la Nam* and its mathematical aspects.
- ii. Determine the rules of *Ishiva-dar* and its mathematical aspects.
- iii. Find out the patterns involved in making *Toor Kyo la Nam* and *ishiva-dar* floors respectively.
- iv. Find out the Mbayom people`s experience of *Toor Kyo la Nam* and *Ishiva-dar*.

Research Questions

- i. What are the rules of *Toor Kyo la Nam* indigenous games of the Tiv people of Mbayom village of Gwer-East LGA of Benue State, Nigeria?
- ii. What are the rules of *Ishiva-dar* indigenous game of the Tiv people of Mbayom village of Gwer-East LGA of Benue State, Nigeria?
- iii. What are the mathematical aspects of *Toor Kyo la Nam* indigenous game of the Tiv people of Mbayom village of Gwer-East LGA of Benue State, Nigeria?
- iv. What are the mathematical aspects of *Ishiva-adr* indigenous game of the Tiv people of mbayom village of Gwer-East LGA of Benue State, Nigeria?
- v. What are the Mbayom people`s experience with the *Toor Kyo la Nam*?
- vi. What are the mbayom people`s experience with the *Ishiva-dar*?

Methodology

This study adopted a phenomenological design method since its aim is to develop a rich, accurate, precise, complete and clear description and understanding of a particular human experience or experiential moment. Specifically, this work seeks to rally round interpretive phenomenology in the course of the research. In the current research, the concern is to understand lived experience of the people and how they make sense of these experiences with *Toor kyo la nam* and *Ishiva-dar* indigenous games of the Tiv people of Mbayom village. Interpretive phenomenology aims to capture and explore the meanings that participants assign to their experiences (Reid et al, 2005).

The research was carried out in Mbayom village, Gwer-East Local Government Area of Benue State, Nigeria. Mbayom is located along Aliade-Otukpo express way. It is a village in Ngyohov district of Gwer East L.G.A, Benue State, Nigeria. Mbayom people are of the Tiv speaking ethnic group living in clustered extended family compounds. Mbayom is made up of five (5) kindreds namely Mbaiov kindred, Onmbagwe kindred, Mbaagbanor kindred and Mbagba/Asase kindred.

The population of the study will consist of the entire people of Mbayom but especially those living at Tse-Akputu in Mbagba/Asase kindred.

The study used a sample of fifteen (15) Mbayom people both males and females, young and old who volunteered to participate in the study. The sampling Technique used is purposive sampling. The volunteer was also considered based on their wealth of experience and knowledge about the games under investigation. The volunteers were also grouped into players, observers and referee(s) respectively for both *Toor Kyo la Nam* and *Ishiva-dar*. Both games can only be played by two players per time, a referee and any number of spectators or observers.

A semi-structured in-depth interview rubric and video recorder were the two (2) instruments used for data collection for both *Toor Kyo la Nam* and *Ishiva-dar* indigenous games of the Tiv people of Mbayom village of Gwer-East LGA of Benue State, Nigeria. The semi-structured interview consisted a number of planned questions, however the researcher exercised more freedom in modifying the working and order of the questions in the course of the interview. In-depth interview made the whole process less formal in the set of questions making the interview or respondents to be free and relieved during the session. The researcher was able to collect complex information with a higher proportion of opinion-based information with the help of the interview, the questions were more focused on the lived experience of the Mbayom people with *Toor Kyo la Nam* and *Ishiva-dar* indigenous games of Tiv people. Pictures and video coverage of the games in actions were taken/captured all through the process and also a video coverage of the interview session was also captured.

The instruments, semi-structured in-depth interview and rubric video for both *Toor Kyo la Nam* and *Ishiva-dar* were validated by an expert in Ethnomathematics.

Semi-structured in-depth interview rubric and video recorder were the two instruments used in the collection of the data for both *Toor Kyo la Nam* and *Ishiva-dar* indigenous games of the Tiv people of Mbayom village of Gwer-East LGA of Benue State, Nigeria. The video recorder was used for coverage of the games sessions and interview session respectively. Also, observations were made, notes taken and a diligent and careful watch on the participants (players) gesture were put into serious consideration at each moment of the process and noted down.

The research used a narrative analysis method for analyzing the data. This analytic method was adopted and used to interpret the shared experience of the Tiv people of Mbayom village of Gwer-East Local Government Area of Benue State, Nigeria, in their everyday lives in relation to the *Toor Kyo la nam* and *Ishiva-dar* indigenous games of the Tiv people of Mbayom.

Results

The data of this study is presented according to the research questions.

Research question one

What are the rules of the *Toor Kyo La Nam*? Indigenous game of the Tiv people of Mbayom Village of Gwer-East LGA of Benue State, Nigeria?

The following are the rules of the game according to respondent 1 (Mr. Azonge Gafa)

Rule 1: The referee decides by lot who play first

Rule 2: The first player must sit backing the *Toor Kyo La Nam* game with his/her hands behind him/her.

Rule 3: Observers are not allowed to talk or assist any player directly or indirectly.

Rule 4: The first player must not look at the stones give to him while the game is still in progress

Rule 5: The first must not count the stones in his/her hands.

Rule 6: A demand of stone from an empty circle, a river or a valley means he has failed

Rule 7: The first player continuous until he or she fails then he becomes the *yaya* and the second player takes over.

Rule 8: The game is over when the stones are successfully taken from the circles.

The referee decides by lot who players first, but in a situation where there is no referee the players decide themselves who plays first to avoid partiality, the first player must sit and back the *Toor Kyo La Nam* game with his/her hands behind him/her to prevent him from counting and subtracting directly but to encourage him to do that in his mind logically. Observers are not allowed to talk or assist any player directly or indirectly. This is to enable players to depend strictly on their abilities and not joint efforts. The first player to whom the stones are given to him while the game is still in progress this is to prevent him from him from counting directly as he looks at the stones but should logically do the calculations without looking at the stones. While holding the stones behind the first player is not allowed to count them rather he is encouraged to keep record of the stones in his hands right from the first stone that was given to him upon his demand.

A demand of a stone from an empty circle a river or the valley means the player has failed this implies that when the first player demands for a stone through a song (*yaya ooh yaya ooh toor wan wan kyo la nama*, which means *yaya* give me that stone) *yaya* must start his enquiry of which stone he has be asked to pick by pointing at the first circle the second, third, the rivers and the valley and so on and it is the duty of the first player to decide which circle he is demanding a stone from, if *yaya* points an empty circle a river or the valley and the first player accepts then he fails and hence becomes the *yaya*, if the first player is able to keep records of the stones given to him, the number of empty circles the number of stones left in the circles and the positions of the rivers and the valley and correctly answer *yaya* then he wins otherwise he fails and becomes the next *yaya*.

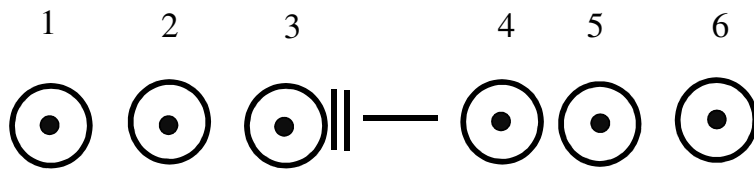
The game is over only when all the stones have been successfully taken and the circles becomes empty the first player continues and the *yaya* remains the *yaya* until the first player fails.

Figure 3: A typical play of the *Toor kyo la nam* is illustrated here between *Terkimbi* and *Lubem*.



Terkimbi: First Player

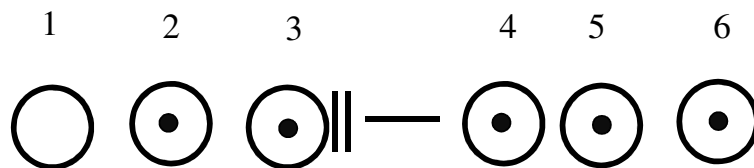
Lubem: Yaya



Terkimbi sings: *yaya oob yaya oob toor wan kyo la nama* (yaya pick that stone and give me)

Lubem response: *Ngunu?* (This one, Pointing at 1)

Terkimbi Accepts: *een nam a se* (yes give me) Lubem gives him the stone in the first circle



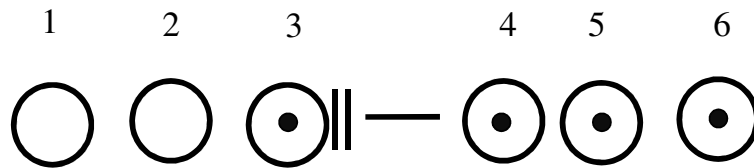
Terkimbi sings again: *yaya oob yayatoorwakyo la nama*

Lubem: *Ngunu?* (This one? pointing at 1)

Terkimbi: *Mvende ye* (no)

Lubem: *Ngunu?* (Pointing at 2)

Terkimbi: *eem nam a se* (yes give me) Lubem gives Terkimbi the second stone



Terkimbi sings again: *yaya oob yaya oob Toor kyo la nama*

Lubem: *Ngunu?* (This one? Pointing at 1)

Terkimbi: *mvende ye* (not that one)

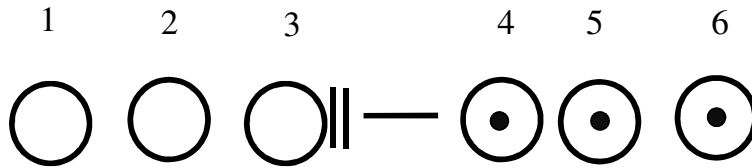
Lubem: *Ngunun?* (pointing at 2)

Terkimbi: *mvende ye* (no)

Lubem: *Ngunun?* (This one, pointing at 3)

Terkimbi: *eem nam a se* (yes give me)

Lubem gives Terkimbi the third stone.



Terkimbi: *yaya ooh yaya ooh toor wam kyo la nama*

Lubem: *Ngunu?* (This one? Pointing at 1)

Terkimbi: *mvende ye* (no)

Lubem: *Ngunu?* (This one? Pointing at 2)

Terkimbi: *Mvende ye* (no)

Lubem: *Ngunu?* Pointing at 3

Terkimbi: *Mvende ye* (no)

Lubem: *Ngunu?* Pointing at the first river

Terkimbi: *Ngunu la kawua la* (that is a river)

Lubem: *Ngunu?* Pointing at the second river

Terkimbi: *Ngula ka wua la* (That is another river)

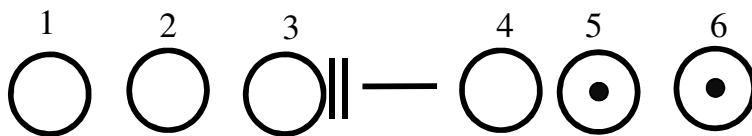
Lubem: *Ngunu?* Pointing at the valley

Terkimbi: *kaa akpa je la* (that is a valley)

Lubem: *Ngunu?* Pointing at the fourth circle

Terkimbi: *eem nam a se* (yes give me)

Lubem gives Terkimbi the fourth stone



Terkimbi: *yaya ooh yaya ooh toor wan kyo la nama* (yaya pick that stone and give me)

Lubem: *Ngunu?* Pionting at 1, 2, 3, 1st river 2nd river & the Valley

Terkimbi: *Mvende ye* (no)

Lubem: *Ngunu?* Pointing at four.

Terkimbi: *eem nam a se*

Referee: you have failed.

Research question two

What are the rules of *Ishiva-dar* indigenous game of the Tiv people of Mbayom village of Gwer-East LGA of Benue State, Nigeria?

MrAdeeUja also known as papa Uja responding to this question said the rules are as follows:

Rule 1: Observers are not allowed to suggest moves to any of the players

Rule 2: One must move one's object to the next available space either left or right or diagonally.

Rule 3: You must not retreat your movements

Rule 4: The winner's seed must be on a straight line either vertical horizontal or on the diagonals with the centre inclusive.

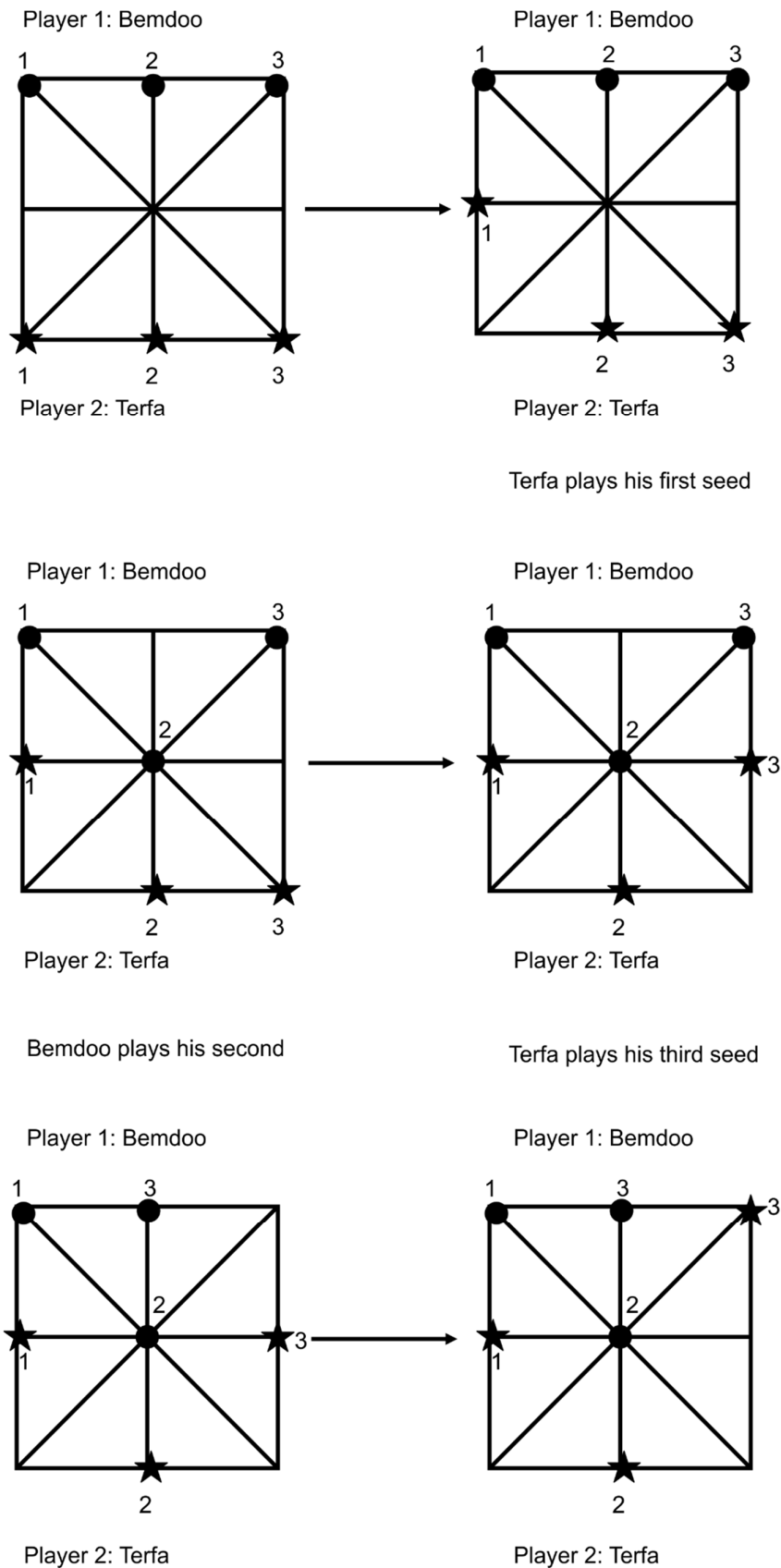
Observers are not allowed to suggest moves to any player if it happens then the game will be cancelled and the players will have to start afresh. They are not allowed to contribute so that the players involved will think critically and take decisions on their own bearing in mind that they are responsible for their actions. One must move one's object to the next available space either left or right, this implies that one is not permitted to jump over his/her opponent's objects. You move your seed left or right to the next available space only, and if there is no space you are allowed to move such an object or seed.

You must not retreat your movement once you have moved a seed you can't bring it back and claim you made a mistake, no you cannot bring it back no matter what as far as the game is concerned.

The seed at the centre can be moved to any available space. This implies that the seed at the centre is not restricted in its movement except to an occupied space otherwise it can be moved to any available space the player decides.

The winner's seed must be on a straight line either vertical, horizontal (left to right with centre inclusive) or the diagonals with centre inclusive

Figure 4 depicts a typical Ishiva-dar game between Bemdoo and Terfa

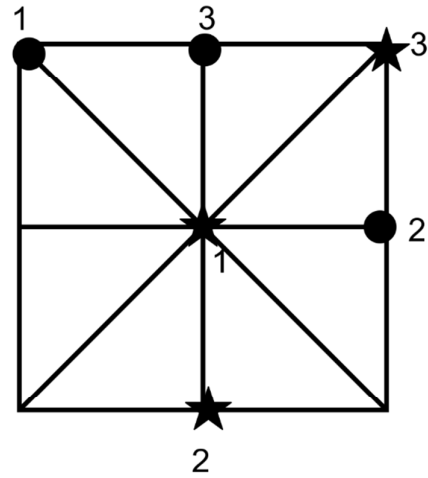
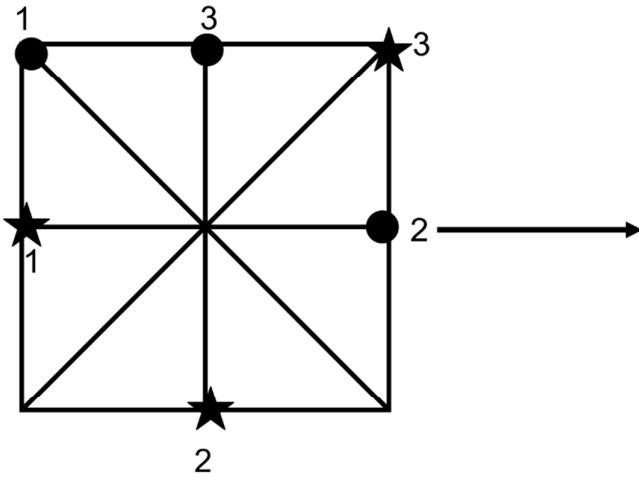


Bemdoo plays his third seed

Terfa plays his third seed

Player 1: Bemdoo

Player 1: Bemdoo



Player 2: Terfa

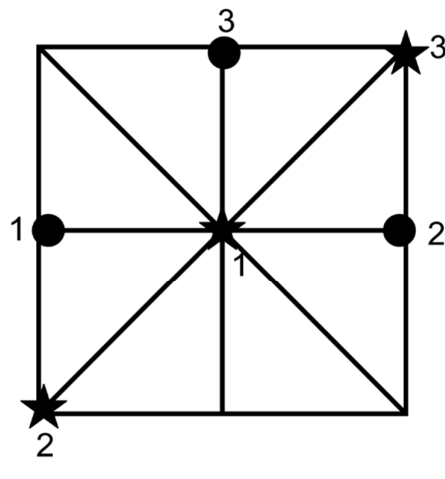
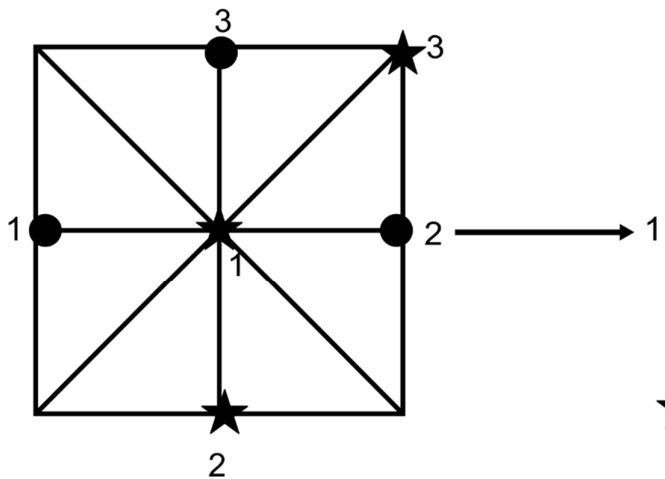
Player 2: Terfa

Bemdoo moves his second seed

Terfa plays his first seed

Player 1: Bemdoo

Player 1: Bemdoo



Player 2: Terfa

Player 2: Terfa

Bemdoo plays his first seed

Terfa moves his second seed

Observe that Terfa seed are on a diagonal line. This implies Terfa is the winner

Research question three

What are the mathematical aspects of *Toor kyo la nam* indigenous game of the Tiv people of Mbayom Gwer LGA of Benue State Nigeria?

The mathematical aspects of the *Toor Kyo La Nam* include the following;

Everyday statistics Geometry and mensuration Arithmetic, and Logic.

Everyday statistics; *Toor kyo La Nam* can be seen in everyday statistics in the selection of stones and counting of the stones. Grouping the stones such that three are in the first three circles before the rivers and the valley and the second three stones in the second three circles after the rivers and the valley, the number of stones corresponds with the number of times the stones are demanded for and this demonstrates frequency which can be used in forming frequency distribution table.

Geometry and mensuration. The drawing of six (6) circles and three (3) straight lines illustrates geometry and mensuration of shapes in mathematics.

Arithmetic could be observed in the *Toor Kyo La Nam* when the selection of stones, counting of the stones from each circle upon demand is in progress. The division of circles such that three on the left hand side before the rivers and the valley is also another aspect of mathematics that is hidden in ToorKyo La Nam game of Tiv people of Mbayom

Logic; logic is displayed in the *Toor Kyo La Nam* or can be observed when the first player who usually sits backing the *Toor Kyo La Nam* game is not allowed or permitted to count the stones in his hands or even look at them but is mandate to keep record of the number of stones given to him the number of empty circles and the number of circles still containing stones in them, the careful record keeping of the numbers of stones given to him, the number of empty circles and the numbers of circles still containing or holding stones without looking at the game is strictly logic which is also hidden in the *Toor Kyo La Nam* game of the Mbayom people of the Tiv nation.

Research questions four

What are the mathematical aspects of *Ishiva-dar* indigenous game of the Tiv people of Mbayom Gwer LGA of Benue State Nigeria?

Based on the reports form respondents, the mathematical aspects of Ishivadar includes Geometry, Measure of Central Tendency, Logical and Trigonometry.

Geometry; this aspect can be seen in *Ishiva-dar* when the square is drawn with lines running through it in the vertical, horizontal and the diagonals. Different sizes of triangle can be extracted from the square and their areas calculated.

Measure of central tendency; measure of central tendency deals with mode, mean and median, the number of moves a particular player makes to win can be tabulate and used in finding mode mean and median respectively.

Logic; the careful calculation and moves of the stones involve critical thinking which an aspect of logic in mathematics is.

Research question five

What are the Mbayom people's experiences of *Toor Kyo La Nam*?

The experience of Mbayom people about *Toor kyo la nam* according to papa Uja (Mr. Adee Uja) are as follows;

- i. It enables the people to identify intelligent children who can be entrusted with valuable items and even money. Those children that can deliver if sent on errands or to the market to either sell or buy.
- ii. It enables the people to also identify children who can be trusted when it comes to record keeping of items such as farm products and information.
- iii. They also predict those children that can perform excellently when it comes to academics if given the opportunity.
- iv. It fosters peace unity and love among the children adults and the entire community at large.
- v. It also enables the people to the accurate thinking ability of the aged and their ability keep records correctly so as be trusted with certain responsibilities.

Research question six

What are the Mbayom people's experiences of the *Ishiva-dar*?

Experience of *Ishiva-dar* is not far from that of *Toor kyo la nam* as can be seen below.

- i. It helps identify smart and intelligent children who can be responsible for their actions or inactions both at home, the school and the community at large.
- ii. It also enables the peoples to assume those children who can think correctly and take right decisions if they are under pressure or in a very critical situation.
- iii. It is also used to foretell or predict those children that can do well academically given the opportunity to learn in a former classroom.
- iv. The game also fosters place, unity love and joy among the people.

Discussion of Finding

There are eight (8) rules in the play of the *Toor kyo la nam* and five (5) rules in the *Ishiva-dar* indigenous game of the Tiv people of Mbayom village of Gwer-East Local Government Area of Benue State Nigeria. The people of Mbayom village are not given any special training about the games (*Toor kyo la nam and ishiva-dar*). The children simply learn this games by observation and gradually they begin to practice and before the ages of five (5) or six (6) they start drawing and playing the games. That is to say, the *Toor kyo la nam* and *Ishiva-dar* enhances observational skills in children and adults. This study aligns with that of Abah (2018) who stated that indigenous game enhances observation skills critical thinking planning and spatial perception and number sense. These indigenous historic and cultural games present a more interesting approach to the teaching and learning of mathematics for children. Howbeit Abah (2016) pinpointed that there is the indication that every little element of history is being embedded in classroom instruction considered how general history as a subject has fared in the development of curriculum in Nigeria.

The children by the help the game *Toor kyo la nam and ishiva-dar* are well grounded in arithmetic such as counting, recording addition and subtraction, geometry such as drawing of circles lines squares so on and forth. The study is consistent with that of Thomaskutly and Geometry (2017) who has highlighted that local game develops in the individual a proper attitude as there is no space for prejudicial feelings, biased outlook, discrimination and irrational thinking and aids him in objective analysis, correct reasoning, valid conclusion and impartial judgment. Abah (2018) observed that mathematics learnt this way helps an individual in his character formation in many ways. The United Nations Education, Social and Cultural Organization (UNESCO) in 1951 agreed that the best medium for teaching a child is his mother tongue (MT). This implies that, if local indigenous games are included in mathematics curriculum especially at Basic Education level, the student learning ability will be greatly enhanced in how the Mother Tongue was fostered as Nigeria's language for instruction Anyogh (2019) confirms that the teaching and learning in indigenous received much genuine attention in those early days of western education in the country.

ToorKyo la nam and *Ishiva-dar* can enhance better performance in mathematics if integrated into the mathematics curriculum especially that of the basic education level and beyond the classroom, the significant or important aspects of the *ToorKyo la nam* and *Ishiva-dar* is that, peace, joy, love and unity among students will be greatly encouraged. This study also aligns with Fouze & Amit (2018) who observe that, the use of stories from the within the students learning process, help them to better understand the study material, raise their motivation and ultimately, improve their achievement in mathematics. The study agrees with that Anyagh (2019) who stated that the Tiv people have their own form of mathematics which is as old as the language itself. Tiv people are predominantly farmers and counting of their farm products shows the introduction of the concept of numbers and numeration. To exclude these indigenous local games which the children are familiar with during the teaching and learning of mathematics is like introducing a concept from complex to simple which is not the best practice as a good leader or Educationist.

The current study aligns with that of Abah (2018) who opined that attention has been drawn to the need to incorporate elements of mathematics found in the student's immediate socio-cultural environment into classroom activities to reduce the perceived abstracted of the subject (mathematics). For instance, the *Toor kyo la nam* which contains six (6) stones can be used in arithmetic thus; the teacher can ask the student the number of stones remaining in the circles if four (4) stones have been given to the first player, which is a very good example of word problem in subtraction of whole numbers. And also if six (6) different boys played the game by taking turns the boys who has the highest scores could be used in representation of information using a bar and pie chart respectively. In the case of *Ishiva-dar* the teacher can ask the students "If two (2) players are to share 6 objects equally among them, what will be the share of each player? With the above few out of many examples given above, indigenous games will tremendously and immensely enhance the teaching and learning of mathematics if integrated into the mathematics curriculum.

Conclusion

The findings of this study revealed that traditional games such as *Toor kyo la nam* and *ishiva-dar* could be a perfect enhancement of mathematics instruction to most schools at Basic Education level in Nigeria who cannot afford powerful computer games equipment to aid the teaching and

learning of mathematics. The pleasurable and conversant or familiar experience may stimulate interest in children to continue their mathematics learning and there by become useful members of the community. Constructive theory of learning as was propounded by Jerome Burner, submits that, learning is an active process in which learners construct new ideals or concepts on their current or past knowledge. That is to say, when learners encounter something new, they reconcile it with previous knowledge and experience. The implication of this study was that, students' prior knowledge of mathematical games can lead to success in the subject. Hence local games could be of help to academic performance of students.

Recommendations

Based on the findings of this study, the following recommendations are made.

- i. The Government at all levels should create awareness and support the inclusion of indigenous games into the mathematics curriculum especially at the elementary and Basic Education Level.
- ii. Curriculum developers should carefully consider these local indigenous games and consider their mathematic curriculum.
- iii. Mathematics teachers who are the curriculum implementers should as a matter of fact appreciate the mathematical aspects of indigenous games and should relate them with topics in mathematics for easier understanding for example, the ishiva-dar diagram can be used in Pythagoras theory and Area of a square and Triangle respectively.
- iv. Students of the Basic Education level should value their cultural heritage and should not take them for granted when instructed in the classroom using their local indigenous plays.

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