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Ethnomathematics in Mamanwa's Cultural Sik'lut Game

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Abstract

Every people in every culture are engaged in different activities exhibiting Mathematical ideas and concepts. A culture-based Mathematics is a salient component to pedagogical practices because it affords educators real-life practices with cultural implications embedded with Mathematical concepts. This in turn contextualizes Mathematics teaching and learning. This study aims to explore the Sik'lut game played by the Mamanwas residing in Dinarawan, San Pablo, Jabonga, Agusan del Sur. This employs a case study utilizing interviews, participant and non-participant observations. Findings revealed that the game reflects mathematical concepts which include; combinatorics, probability and permutation.

Keywords: combinatorics, cultural game, Mamanwa, permutation, probability

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1.0 Introduction

Mathematics is infused in human life, both explicitly and implicitly (Francois & Van Kerkhove, 2010). Every people in every culture are engaged in different activities exhibiting mathematical ideas and concepts (Dewah & Van Wyk, 2014). It is known that games play an important role in the teaching-learning processes. One of the principles of teaching emphasizes the need of active involvements of the students in the learning processes, and games ensure that need. Games provide meaningful situations where applications of certain mathematical skills can be seen and apparently reveal to the teacher how a student thinks through his/her actions and decisions employed during the game (Way, 2011). According to Torres-Velasquez and Lobo (2004), mathematics must be culture-based because it purports that teachers contextualize mathematics teaching by relating mathematical content to students' culture and real-life experiences.

Ethnomathematics, according to Snipes and Moses (2001), involves fascinating and informative cultural issues as well as mathematical information. Zaslavsky (1998) noted that to integrate Ethnomathematics in the mathematics classroom is to use cultural games which can, at the same time, be regarded as mathematical activity (as cited in Snipes & Moses, 2001). As Selling (2016) mentioned, "To learn mathematical practices, students need opportunities to engage themselves in the learning process. Moreover, Willoughby (1990) said that excellent problem-solving opportunities can be offered through games. Gilmer (1990) has stressed that games are an aid to the teaching and learning of school mathematics. Furthermore, Bishop (1991) stated that education is truly effective if it is intelligently based on the indigenous culture and games that children play are part of their culture, and have mathematical ideas embedded in them.

In consonance, Rosa and Orey (2006) remarked that culturally relevant mathematics should focus on the role of mathematics in a socio-cultural context that involves the ideas and concepts associated with mathematics using an enthnomathematical perspective for solving contextualized problems. This idea supports that of Barton (1996) stating that ethnomathematics is a program that investigates the ways in which different cultural groups comprehend, articulate and apply concepts and practices that can be identified as mathematical practices. This way of observing mathematics validates and affirms all people's experiences of mathematics because it demonstrates that mathematical thinking is inherent in the lives of the tribesmen.

This study is designed to explore the mathematics embedded in the Ethnogame Sik'lut played by the Mamanwa people in Caraga. Our task as researchers involved observing and determining the Mathematical concepts entrenched in the game understudy. The study further aims to contribute to the K-12 program of the Department of Education on contextualized teaching and learning.

2.0 Theoretical Framework

Ethnomathematics as a field of discipline is interdisciplinary by nature as it covers culture, anthropology and mathematics. Theoretically, this study leans on Ladson-Billing's (1995) Culturally Relevant Theory of Education describing Ethnomathematics as "a pedagogy that empowers students intellectually, socially, emotionally, and politically by using cultural referents to impart knowledge, skills, and attitudes."

Within Ethnomathematics education, two aspects are highlighted. Foremost is the curriculum's content which according to Powell and Frankenstein (1997) that this Ethnomathematics practices can offer the opportunity to gain a better perception of the role and place of mathematics in the society. The term "Ethnomathematics" was coined by D' Ambrosio (2007) who philosophized that Mathematical literacy

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is an individual's capacity to identify and understand the role that mathematics plays in the world for them to come up with well-founded decisions and meet their needs as constructive and reflective citizens. The second aspect within Ethnomathematics is the didactics or the way that the learning process is set up. This aspect incorporates the traditional practices within the academic context. The everyday practices embedded with mathematical concepts bring the social environment closer to academic mathematics. This study looks into the Sik'lut game played by the Mamanwa community which requires from them traditional Mathematical practices. Implicitly, these traditional practices bring the Mamanwa community closer to Mathematics education.

3.0 Research Methodology

In this study, we employed the qualitative type of research underscoring the case study method. In this study, we documented the game Sik'lut utilizing both observations and interviews in gathering salient aspects of the said game. We also had the task of uncovering mathematical concepts embedded in the traditional game Sik'lut.

To give us the vantage point about the game, interviews with the learned and skilled members of the tribe were employed. Elders of the tribe were tapped as they have the rich knowledge regarding the mechanics of the game. However, prior to the actual documentation, we sought permission from the National Commission on Indigenous Peoples (NCIP), Caraga Region. A Free and Prior Informed Consent (FPIC) was obtained with the assistance of the Agusan del Norte's Indigenous Knowledge System and Practices (IKSP) Team. The Datu of the Mamanwa community in Dinarawan, San Pablo, Jabonga, Agusan del Norte was approached as he is the notable individual in the community to give us the permission to introduce and present our study to the said community.

When the presentation was done, the NCIP and the Council Leaders scheduled the Consensus Building as a salient component of the data collection process. When the group reached a consensus, the signing of the Memorandum of Agreement followed. During the ceremonial activity, the Council notified us the requirements for the conduct of the documentation. To ensure credibility of the study, we employed member checking wherein we returned to the site and asked the participants to review the data so that they can verify their statements and fill the gaps of the transcriptions. The purpose of member checking is to eliminate the biases of the researchers; thus, we also employed this technique (Schwandt et al., 2007).

4.0 Results and Discussion

During the seven-day-immersion in the Mamanwa community residing in Dinarawan, San Pablo, Jabonga, Agusan del Norte, we were able to observe several cultural games which are still played by their children today as their past time which include; BatiKubri, Bingo-bingo, Kadang, Mu'ug, Sud'sud, Bula-bula, and Sik'lut. Among these games, the Sik'lut game has the most complex mechanics. In order to understand its complexity, one needs to participate in the said game to learn and understand the said game.

Sik'lut Game

Sik'lut is played by two or more players using small stones. The players will position themselves around the stones forming a circle. The players must start the game by playing kulub-hayang (downward-upward position of the palm) as shown in Figure 1a below to determine the order of the players who will play Sik'lut; but if there are only two players to play the game, they will only do the sampayang (rock, paper, scissors). Each player has an equal number of stones. The first player put his/her stones on his/her palms, toss these and catch using the back of the hand as shown in Figure 1b, and toss them allowing the player this time to grasp the stones using his/her palm while the stones moved through the air again. The process of flipping the stones with the palm facing downward and flipping them again with the palm facing upward while catching the flipped stones is coined by the Mamanwa people as Siklut. The player keeps the stones he/she catches and utilizing the gathered stone as the tool for flicking using the thumb with the goal of hitting the stones which fell on the ground while they were flipped on air. The player needs to hit another stone as shown in Figure 1c to Figure 1d. The stone being flicked must hit one stone only. If several stones are moved during the flicking, the turn is over, and this will give the second player the opportunity to start his or her round of the game. But, if he/she successfully flicks the stones he/she did not catch, then he/she will earn a babuy (a stone from the opponent). Each adversary has to surrender a stone to the winning player. The winning player continues to flick the remaining stones until he will be able to gather all the stones from his opponents declaring him as the victor of the game.

This is a game of skill as players need to strategize how they will be able to catch as many stones as they can during the quick switching position of the palm. Furthermore, they also need to develop a sharp movement during the flicking of the stone with the thumb so as to target only one stone during its release. The goal of this game is to earn as many stones as you can to win the game. The earned stone is coined as Babuy by the Mamanwa community. The player can only earn this stone if he can successfully flick a stone using his thumb one at a time. The game usually takes a long time to play depending on the number of stones used.

Figure 1. Sik'lut as played by the skilled members of the community featuring (a) kulub-hayang (downward, upward position of the hands), (b) downward position of the hand in preparation for the upward switching position of the hand, (c) flicking of the thumb to hit a stone, (d) flicking and gathering of stones hit.

Mathematical Ideas in Sik'lut

Composition (Combinatorics)

Sik'lut game is dependent on the number of players in the game, who will compete to earn a babuy (a stone from the opponent). This means that there is no specified number of players to play the game. This suggests that k is any integer. For instance, there are three players with two stones each, thus having six stones. As such, there is a possibility that a player may get no stones at all throughout the game, and this composition remains a weak composition because it involves a value of zero (0). For instance, if player A has six stones, it means that both players B & C do not have stones. If player A has five stones, either players B & C has one stone, and if player A has four stones, it is either players B & C has one stone each or either one of them has two stones and the other has no stone, and so on. Thus, the notation $\binom{n+k-1}{k-1}$ which is a weak composition since it involves a value of zero (0) will be used to determine the number of ways that six stones will be distributed to three players, where k is the number of players and n is the number of stones in the game (n/k every player). To simplify, substituting the number of players which is three (k=3), we have $\binom{n+3-1}{3-1} = \binom{n+2}{2}$ ways in distributing the 6 stones among the three players. Now, if we substitute the number of stones which is six (n=6), we have $\binom{6+2}{2} = \binom{8}{2} = \frac{8!}{2!(8-2)!} = \frac{8x7}{2} = 28$ ways. Therefore, there are 28 ways that the 6 stones will be distributed among three players.

Probability

When a player has successfully played the Siklut and gathered all n stones during the game, a babuy must be taken from the stones. Then the cycle of Sik'lut continues using the remaining (n-1) stones until one player will earn all the stones from the other players. The probability that a player wins a stone from owned by another player can be calculated.

Considering the example stated earlier, the first *stone* to be taken by either of the players is one (1) out of six (6) stones. Thus, the probability of getting the first *stone* is 1/6. The second *stone* from another player, on the other hand, will be taken from the remaining five stones since the first *stone* taken will not be replaced and is to be kept by the player. Consequently, the probability of getting the second *stone* is 1/5 . The third *stone* will be taken from the 4 remaining stones, having the probability of 1/4. The fourth one will be taken from the remaining 3 stones, with the probability of 1/3 taking it. The fifth will be taken from the last two stones, with the probability of taking it is 1/2. The last stone will be taken with the probability of one (1).

As the number of stones diminishes during the game, there is a greater probability of taking the stone as *babuy* (stone earned from the opponent). The probability of an event, denoted by P(E), is a measure of the likelihood that the event will occur, expressed as P(E)= $\frac{n(E)}{n(S)}$ (Ona, Oronce, & Santos, 1996).

Let P(A) be the probability of getting the first stone, n(A) be the first *babuy*, which is 1, and *n*(S) be the total number of stones in the game, which is 6. Thus, the probability is P(A) = $\frac{n(A)}{n(S)}$ = 1/6. When one of the players gets the first *babuy*, the probability now of getting the second *babuy* demonstrates a conditional probability, the dependent events, because the first *babuy* taken will no longer be replaced in the set of stones in play. Thus, the probability of getting the second *stone from the opponent* is affected by the previous event, and changes in effect. The probability of getting the second *stone* given that the first *stone* is already taken out of the game will be $\frac{1}{n-1}=\frac{1}{6-1}=\frac{1}{5}$. The probability of getting the third *stone* is $\frac{1}{n-2}=\frac{1}{6-2}=\frac{1}{4}$, and so on, until the last *stone* which is $\frac{1}{n-(n-1)}=\frac{1}{6-(6-1)}=\frac{1}{6-5}=\frac{1}{1}=1$.

In general, determining the probability of earning a stone from the opponent's keeping can be expressed as P(E)= $\frac{1}{n-(k-1)}$.

Mathematical Ideas in the Arrangement of Players

Permutations

The order of players that will play the game is a permutation. If there are three players, then there are three number of ways to choose the first player; 3-1=2 ways to choose the second player; and 3-2=1 way to choose the third player. Therefore, there are 3(2)(1)=6 ways of arranging the three players.

During the game, the players form a circle around the stones. The number of ways of arrangement in a circle is a circular permutation and is determined by (*n*-1)! (Walpole, et al., 1993). Thus, (*n*-1)! = (3-1)! = 2! = 2(1) = 2.

5.0 Conclusion

It is fascinating to see Mathematics of different levels in the academic realm embedded in the indigenous games. By exploring the mathematics in the Siklut game played by the Mamanwa and uncovering several mathematics such as counting, adding, multiplying, dividing, statistics, permutations, probabilities and many others opens up new ways of contextualization Mathematics inside the math classrooms. What is even fascinating is that the study may be able highlight the significance of the Mamanwa culture to the academic sphere. This denotes that indigenous games such that of Sik'lut can be useful in contextualizing Math education by bringing Math concepts to local learners in social contexts that have meaning for them.

Mathematics teachers are suggested to integrate *Siklut* game especially in those places where there are Mamanwa community when they introduce concepts in Math involving Permutation, Probability, and Composition (Combinatorics) to motivate the learners more to study mathematics. They must, if possible, get themselves acquainted with the games of the local communities and of those other indigenous games of Filipinos so that they can easily contextualize or use the cultural games located in their area in teaching Mathematics. This will make learning fun for they will be able to understand concepts which they have already experienced most especially if these concepts are introduced in a more interactive and collaborative way such as through local games. This study conforms to the theoretical lens of this study using D' Ambrosio's concept on Ethnomathematics which purports that the everyday practices such as that of *Sik'lut* game embedded with mathematical concepts bring the social environment closer to academic mathematics.

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