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Demystifying the Myth of Mathematics Learning At the Foundation Phase: The Role of Akan Indigenous Games (Challenges and Opportunities for Indigenous Knowledge Systems (IKS) in the Education System)

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ABSTRACT Despite the indispensability of Mathematics to development of human life there is a perception among some people that it is too difficult to learn. This negative perception put in the minds of school children makes most of them dislike the subject. To dispel this negative perception, teachers need to devise teaching methods that can make the learning of the subject enjoyable. This paper discusses how some selected Akan indigenous games can be used in teaching to demystify the myth surrounding the learning of mathematics at the foundation phase. It is believed that indigenous games such as *oware* and *dame* can be adopted as methods for teaching and learning mathematics. The objective of this paper is to project the value of indigenous games as a means of providing a strong foundation for the learning of mathematics. Through indigenous games basic mathematical concepts such as counting, addition, subtraction, division and multiplication could be learnt to make mathematics learning meaningful and culturally relevant.

INTRODUCTION

In the contemporary world, socio-economic and political life of people and their communities directly and indirectly involves mathematical applications. Despite this reality and apparent indispensability of mathematics to human and socio-economic development, there is a perception among some people including teachers, peers and parents that the subject is too difficult to learn. This negative perception puts in the minds of school children makes most of them dislike mathematics.To dispel this negative perception, teachers need to devise teaching methods that can make the learning of the subject more practical, less stressful and enjoyable. The Akan of Ghana have some indigenous cultural practices in the form of games that teachers can adopt as innovative teaching strategies to enhance the teaching of mathematics especially at the foundation phase to increase learners' interest and motivation in the subject. Savage et al. (2011) affirm that culturally responsive teachers contextualize instruction in cultural forms, behaviours and processes of learning familiar to students. Despite the important role indigenous knowledge can play in the school curriculum some teachers seem to ignore it. Semali (1999) points out that the interface between school and indigenous knowledge is rarely the focus of attention in science classroom in many post- colonial schools. The transfer of indigenous knowledge from the learners' everyday life to school work is not always valued or encouraged and indigenous ways of knowing may not be recognized by some teachers. These teachers might simply find indigenous knowledge unimportant. This paper, based on the experiences and observations of the authors discusses how some selected Akan indigenous games can be used in teaching mathematics to demystify the myth surrounding the learning of this important subject at the foundation phase. The researchers believe that when the foundation phase is strengthened the learning of mathematics could be enjoyable and less stressful. Through the use of indigenous games basic mathematical concepts could be learnt to make mathematics learning meaningful and culturally relevant.

The assumption of this paper is that indigenous games such as *oware* and *dame* can be adopted as methods for teaching and learning in the mathematics classroom. The objective of this paper is to project the value of indigenous

games as a means of providing a strong foundation for the learning of mathematics and also to project the importance of indigenous African cultural practices in the modern school curriculum.

Theoretical Framework

The Social Constructivist Theory

This paper is underpinned by the social constructivist theory which was propounded by Vygotsky (1978) and Bruner (1996)and later amplified by Derry (1999). The theory is based on the premise that education must engage with and expand experience and that those methods used to educate must provide for exploration, thinking and reflection. The major thesis of the theory is that reality is socially constructed through human activity. McMahon (1997) affirms that knowledge is derived from interactions between people and their environment and resides with cultures. The theory thus emphasises the importance of culture and context in understanding what occurs in society and constructing knowledge based on this understanding.

The social constructivists see as crucial both the context in which learning occurs and the social context that learners bring to the learning environment. Thus from the social constructivists point of view, it is important to take into account the background and culture of the learner throughout the learning process, as this background helps to shape the knowledge and truth that the learner creates, discovers and attains. In line with this stance it is argued here that in a teaching and learning situation the teacher should guide, support and lead but not to 'spoon feed' the learner. We construct our understanding through our experiences and the character of our experience is influenced profoundly by our cognitive lenses (Confrey 1990). The constructivists reject the assumption among some people that in teaching the teacher can simply pass on knowledge or information to students and expect them to understand. By merely providing learners with information or notes may not lead to effective learning. As Von Glaserfeld (1992) argues, if a student merely repeats what the teacher or the text book has said, this is of course no indication of a conceptual fit (Von Glaserfeld 1992: 190). To the constructivists, learning is much more than memory, hence the argument that for students to really understand and be able to apply knowledge they must be engaged in active tasks or be guided to solve problems. It is through the engagement of students in tasks that they can construct knowledge and meaning in their own minds and discover things for themselves. This theory encourages learner- centred teaching in which the teacher sees himself as a *'guide on the side'* and not the '*sage on the stage'*. The teacher's role in the classroom is to guide and assist the learner to discover and construct own meaning in his social context.

Indigenous Games as a Teaching Tool at the Foundation Phase Education

It is important that teachers distinguish between a 'game' and an 'activity' in the process of teaching. According to Gough (1999) a 'game' needs to have two or more players, who takes turns, each competing to achieve a winning situation of some kind, each able to exercise some choice about how to move at any time through the playing. This basically implies that in a game the player has a choice about what to do. The effective teaching and learning of mathematics for example requires the active involvement of the learner which is consistent with playing games where the involvement of the player is paramount. Incorporating games into the teaching and learning of mathematics is important for the following reasons. The games:

- give learners ways to apply mathematical ideas to problem-solving situations and develop strategic thinking.
- build students' interest in and appreciation for mathematics by engaging them in enjoyable activities and challenges
- support the idea that learning can be as fun as possible.

Games should also promote good will as well as competition, and offer support and fun to all. Games can be categorised into games of chance, games of strategy and games of both chance and strategy.

Through the use of indigenous games basic mathematical concepts could be learnt to make mathematics learning meaningful and culturally relevant. The study on the use of indigenous game, *morabaraba,* in mathematics by Nkopodi and Mosimege (2009), found that the use of indigenous games promote spontaneous interaction among learners as they communicate their activities to fellow participants. The study also

found that the enjoyment of the game was not restricted to a specific cultural group. This suggests that most indigenous games can be used in a multicultural setting.

Oware

Oware is a game that is normally played by two people, but can be played solo – or by as many as six participants. It is played using forty-eight marbles and a board containing twelve circular spaces. The spaces are set up in two rows, with six spaces in each row.An interesting feature about *oware* is that it does not even require the ownership of a board as village children are known to dig holes in the ground and play using dried palm nuts. The game begins with four marbles in each space and each player performs a turn by removing all marbles from one space on his/her own side of the board and placing all of these marbles into every space proceeding in a counter clockwise direction until all of the marbles have been used up. At such a juncture the player's turn is up and his/her opponent gets to play. The object of the game is to "capture" as many of the marbles as one can – as the player who is holding the most marbles in the end has won the game. Figure 1 shows the *oware* game being played by a young boy.

There are two methods of play that are popular in Ghana. The first method, *anenam*, is a game of chance in which a player's turn is not over until he/she "sows" his/her last marble into an empty hole. Until that time, a player continues his/her turn by taking all of the marbles existent in the space into which he/she places the last marble in his /her hand. As the turn progresses, all groups of exactly four marbles in one space are collected. Groups of four marbles are collected by the player on whose side the space containing the marbles is located. The only exception to this rule occurs when a player sows his/her last seed into a space on his/her opponent's side that already contains three marbles. Thus, the player is creating a group of four marbles within the space owned by his/her opponent. The player who sows this final marble is only allowed to take this group of four when it ends his/her turn. The final end to a game of *anenam* comes when eight marbles are left on the board. At that point, the player who went first in the game collects the remaining eight marbles.

The second popular method of play is called *abapa. Abapa* is considered more of a game of skill and calculation than *anenam* because it only allows one movement of marbles for each turn. Thus, 'moves' must be calculated and planned thoroughly.

Rules of the *Oware* Game

- Four marbles are placed into each of the 12 circular spaces.

Fig. 1. Picture taken by the researchers during field work in Ghana (December 15/2013)

- Each player moves in a counter clockwise direction, leaving the original hole empty.
- When the last marble is placed into an opponent's hole containing 1 or 2 marbles, the player captures those marbles as well as any adjacent hole containing 2 or 3 marbles on opponent's side.
- When the opponent's holes are empty, the player must feed the opponent holes if possible. If he/she cannot do this then he/she captures all the remaining marbles onhis/ her side.
- A player must not place any marbles into the original hole from where he/she removed the marbles, such as a heavily loaded hole that makes more than one revolution on the board.
- Each player gains the remaining marbles in his/her territory when they cannot be 'captured'. (Except for beginners all calculations on strategy should be performed mentally).
- The object of the game is to 'capture' more marbles than one's opponent. Since the game has only 48 marbles, capturing 25 is sufficient to accomplish this. Since there is an even number of marbles, it is possible for the game to end in a draw, where each player has 'captured' 24.

The *Dame* Game

Two participants, on a board made up of one hundred squares – fifty dark squares and fifty light squares, play *dame*. The design is identical to the design of chess or checkers board. Each player begins the game with twenty pieces set up in four rows of five pieces each, leaving one space between each piece. The shape or colour of their pieces distinguishes players – one set is square and the other is circular or both sets could be circular but different colours.

Figure 2 shows the game of *dame* being played.

The object of a game of *dame* is to 'capture' one's opponent's pieces. This capturing is done when one 'jumps' his opponent's piece. Jumping is done in a diagonal manner, as all moves are made on a diagonal line. One is able to jump on opponent's piece when the space behind that piece is left open. Multiple 'jumps', in which a player captures more than one of his opponent's pieces in a single manoeuvre, are possible when coinciding pieces are left unprotected from an opponent's 'jump'. When a piece reaches the side of the board opposite from its origin it becomes 'kinged' and is able to move continuously on a diagonal. Pieces that have not been 'kinged' can only move on space for each turn.

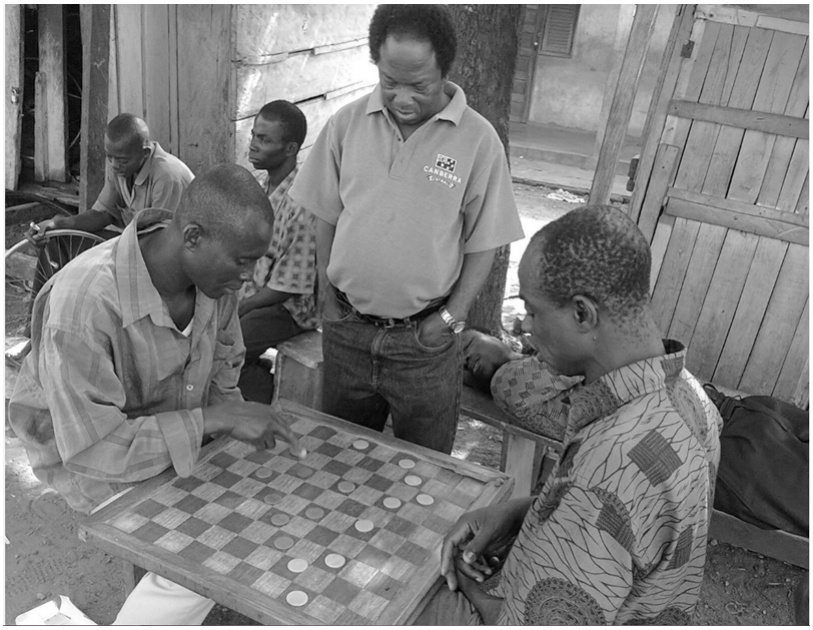

Fig. 2. Picture taken by the researchers during field work in Ghana (December 15/2013). Standing: Co-author of the article, Prof K.P. Quan-Baffour.

Mathematical Analysis of the Indigenous Games

The *oware* board contains 12 circular spaces and that the number of people who can play at any time must be a factor of 12, thus 1, 2, 3, 4, and 6. Also there are a total of 48 marbles used, four ineach space at the start of the game. The game is played by removing all the marbles in one space and placing each marble in each space, this involves counting. The *oware* game improves learners' counting skills. This game allows children to count at least up to forty-eight, since the *oware* game is played with forty-eight marbles. These marbles are initially placed in twelve circular spaces, thus two rows of six, which means each space should have four marbles. Learners who play this game will therefore realise that twelve groups of four will give you forty- eight. Here multiplication is being interpreted as repeated addition. The concept of anti-clockwise is used when playing the *oware* game since players move anti-clockwise direction when it is their turn to play.

The *oware* and *dame* games involve some mental calculation, where arithmetic skills, such as addition, subtraction and multiplication are employed. During these games, participants need to strategize in order to capture as many of opponents' marbles as possible. In some instances there is an element of estimation. Players therefore need to estimate properly in order to increase their chances of capturing as many marbles as possible.

The *dame* game in particular demands good reasoning and critical thinking. Thus before making any "move" a player must make sure that such a "move" does not give the opponent an advantage to capture his marble. The game also introduces players to some geometric shapes such as square and circular shapes. Other geometric concepts such as diagonal and linear are learned during the game.

Application of *Oware* and *Dame* to the Teaching of Mathematics

The *oware* game can be played by two or as many as six people. The number who can play at any given time should be a factor of 12. This means at any given time 2, 3, 4 or 6 people can play the *oware* game. In the *dame* game only two people can play at any time; however each player could have a number of "supporters" who may advice the player on the "moves" to make.

Both *oware* and *dame* games involve numbers and strategy and thus stimulate children's mathematical imagination and thinking. Salvadori and Wright (1998) affirm that developmental psychologists and mathematics educators have noted that children are intellectually motivated to learn through games and other thinking activities. These indigenous games do not require a deep knowledge of mathematics to play. Often the arithmetic core of the games is not readily apparent to players. Teachers therefore need to highlight some of the mathematical concepts as learners play these games.

The application of these games in teaching mathematics will help learners to develop some mathematical ideas.Considering the fact that both games involve number and strategy, they are likely to help improve learners' arithmetic operations, such as addition, subtraction, multiplication and division when used in teaching and learning.They will also improve learners' techniques of counting. Other aspects of mathematics that the *oware* and dame games can help to develop in learners include decision making, strategic thinking and estimation.

The Importance of these Games in Mathematics Classroom

The *oware* and *dame* games offer an opportunity for teachers to highlight some mathematical concepts such as counting, shapes and logical reasoning to learners. These games also encourage communication among learners. During the game, learners will make some "moves" of which they should be able to explain the reason why they do that. The explanation of the "move" gives learners the confidence to express themselves in the classroom. These games are usually played in groups with two (or more participants). The games can be played within a class or as inter class competition. The games therefore encourage group work and cooperation. When learners have developed the attitude of playing these games together, it is expected that they will be able to work or study together in a group. It therefore makes it easier for the teacher when organising group work in the classroom. These games have the value of instilling co-operation and tolerance in learners. In the situation where the views of others are respected and tolerated, learners will be encouraged to contribute to class discussion without

being intimidated. The *oware* and *dame* games have sets of rules which must be known and followed by all players. The adherence to the rules of these games could be transferred to the study of mathematics. Thus learners should be familiar with some of the rules governing the study of arithmetic and follow them at all times.

CONCLUSION

As we learn by doing, which is consistent with the constructivist learning theory, the teacher needs to guide and support the learners to discover information in their cultural context. In line with the constructivist stance, the paper concludes that in this era of African renaissance, indigenous knowledge must be incorporated into the school curriculum and the classroom activities to make teaching and learning of mathematics culturally responsive, practical and enjoyable.

RECOMMENDATIONS

In considering the importance of Indigenous Knowledge Systems (IKS) in the modern classroom, this paper recommends the following:

- That African indigenous knowledge system must be incorporated into the school curriculum to make teaching and learning of mathematics real and comprehensible to learners.
- In the era of African rebirth, educators, must reflect and make use of indigenous cultural practices that can enhance learning and also project African identity.

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