Ethnomathematics Approach of Learning Mathematics among the Upper Primary Level Students of West Bengal
A Case Study

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Abstract

Ethnomathematics, as a line of study and research of mathematics education, investigates the roots of mathematical ideas and practices that exist within different cultural groups. The aim of the study is to identify the ethnomathematics approach used by students and teachers for learning mathematics at upper primary level. A Descriptive Survey method was adopted for the study. Sample teachers and students were selected randomly from the upper primary schools of North 24 PGS district of West Bengal. Interview and classroom observation schedule was used for data collection. The study found that teachers motivate students to use cultural games and artefacts which promote mathematical knowledge and belief. The majority of students have learned their elementary arithmetic operations like addition, subtraction and basic geometrical concepts using local culture specific methods, artefacts and games like Kathi Khela and Sholo Guti (Sixteen Soldiers).

INTRODUCTION

Mathematics provides a powerful and universal language and it is considered as one of the most important subjects in the school curriculum. It is the backbone

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of all the scientific technological investigations and the activities of human development. Mathematics is indispensable because of its universal use in all areas (Eraikhuemen, 2003). Mathematics provides the basics of logic and skills that enable a person to deal with day-to-day life problems. The National Curriculum Framework (NCF 2005) for school education in India recommends that the knowledge gained from outside the school be seen as a resource for learning in the classroom. Learners need to feel that each one of these—homes, communities, languages and cultures, is valuable as a resource for experience that leads to nurturing of the capabilities of analysis and inquiry. Experience and prior knowledge could act as tools for the formulation of mathematical ideas in school mathematics. Hence, in order to enhance learning, it is necessary to correlate children's learning of mathematics in the classroom to outside classroom experiences.

Ethnomathematics is a branch of mathematics education which investigates the mathematical ideas that are linked to an individual or cultural groups. More specifically, D'Ambrósio (2002) considers ethnomathematics as an area of mathematics which is practised by various cultural groups such as indigenous groups, people of a particular community (rural or urban), professional workers (like masons, carpenters, etc.), children within a certain age range and many other groups that identify themselves with common goals and traditions. D'Ambrosio (1985) describes the term ethnomathematics: "The prefix "ethno" refers to sociocultural contexts and, therefore, includes language, jargon, and codes of behaviour, myths, and symbols. The derivation of "mathema" means to explain, to know, to understand, and to perform activities such as ciphering, measuring, classifying, ordering, inferring, and modelling. The suffix "tics" is derived from "techné" and has the same root as art and technique".

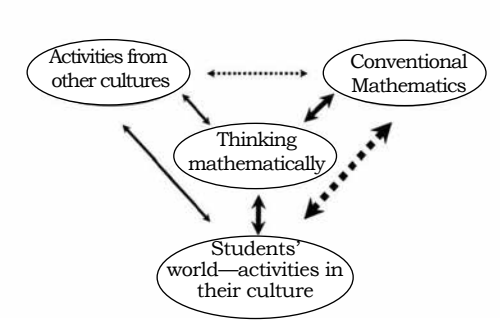


Figure 1: Framework for ethnomathematical curriculum model
Source: W.V.Alangui (2017, p. 202).

Ethnomathematics is practised by cultural groups (D'Ambrósio, 2002). Furuto (2014) defined ethnomathematics as the intersection of culture, historical traditions, sociocultural roots and mathematics. Again D' Ambrosio (1993) said that ethnomathematics should find and try to recognise various ways of doing mathematics within various cultural groups. Thus, ethnomathematics has

evolved as a new area of mathematics education, which deals with the interaction between mathematics and the cultural aspects of peoples and their habitats.

Many studies in India and around the world focused upon how mathematics ideas and thoughts exist among the professional groups, cultural groups, games, and indigenous societies which assists in creating a linkage between socio-economic status of children and their mathematics learning. Pradhan (2019) studied symbiosis between mathematics and cultural games. The study revealed that mathematical knowledge is hidden in the various sectors of gameplay, found as an effective tool to develop mathematical concepts and explore the ideas and practices: Santra and Mukhopadhyay (2019) emphasised on interest and cognitive ability of the learners rather than the universally imposed methods of learning, to consider the importance of situational perspectives (natural environment, socio-political environment) and to consider the input of cultural groups. Supiyati, et al. (2019) found that the evidence of sensitivity on the use of numbers practised by '*sasak*' ancestors long ago in terms of measurement using their anthropometric ability (ethnomathematics). Muhtadi, et al. (2017) reported that Sundanese students used mathematical activities based on the inherent cultural values in performing everyday practical tasks. Pradhan (2017) mentioned that the '*Chundara*' wooden artefacts involve a high level of mathematics knowledge and skills. Sharma and Orey (2017) discussed how the use of culturally contextualised mathematics found in drums may help students to connect school mathematics with their own home cultures by elaborating ethno models. Bose and Subramaniam (2015) mentioned how in India, the archaeological exploration resists the processes of dematematisation and stresses on the comprehension of the hidden underlying concepts. Mukhopadhyay (2013) mentioned the implications for alternative ways of conceptualising mathematical knowledge. Bose and Subramaniam (2011) found that students prefer to calculate orally instead of using the method they have learnt in the classroom. As seen in various studies, mathematical knowledge used for making cultural artefacts like wooden artefacts, drums, etc., is being used in mathematics classrooms. The teachers were using ethnomathematics approach in teaching in his/her research (Pradhan, 2017). Though these studies underlined how different culture specific mathematical ideas exist in different professional groups, cultural groups, cultural games in India and across the world, the ethnomathematical approaches of learning mathematics among upper primary students remain inadequate.

Rationale of the Study

There will be a higher demand for mathematics and computational thinking abilities in various professions in future. Thus, these abilities need to be nurtured among the students from the foundational and preparatory stages. More importantly, a variety of 'innovative methods, including the regular use of puzzles and games that make mathematical thinking more enjoyable and engaging, need to be practised at school level' (NEP 2020). Connections between 'classroom mathematics' and 'real-life mathematics' need to be fostered. One of the major objectives of National Mission on Foundational Literacy and Numeracy (NIPUN Bharat, 2020) is to inculcate play and activity-based pedagogies in the classroom which are linked with children's daily life circumstances. Further, the position paper National Focus Group (NFG) on Teaching of Mathematics (NCF 2005) emphasised the need of local mathematics, in particular those concepts of mathematics which are found embedded in the community and culture. These cultural and contextual resources need to be focused by mathematics teachers to stimulate the learning of mathematics.

Despite the concern on figuring out the mathematical steps and processes to aid the students in solving the contextualised problems, few studies are available which tried to explore the ethnomathematics approach of learning mathematics among students. There is not much evidence of studies on the ethnomathematics approach of learning mathematics among upper primary students in West Bengal. Thus, in the present study, the researcher attempted to explore the experiences of both students and teachers with regards to ethnomathematics and sought to find the answers to the following questions:

- What are the various ethnomathematics approaches to learning mathematics among the students?
- How do mathematics teachers use ethnomathematics approaches for teaching mathematics?
- How do ethnomathematics approaches of learning mathematics vary among students with respect to gender?

Objectives of the Study

- To identify the ethnomathematics approach of learning mathematics among students.
- To find out the teacher's use of ethnomathematics approaches for teaching mathematics.
- To study the ethnomathematics approach of learning mathematics used by upper primary level students with reference to gender.

Methodology

The researcher focuses on ethnomathematics as mathematics practised by upper primary students

belonging to a particular community or cultural groups in the form of indigenous games, activities or cultural practice. Descriptive Survey method was adopted for the study. Purposively, four schools were selected from Bagda block of West Bengal (WB). The population consisted of upper primary students and its teachers. The sample was four mathematics teachers and 40 students of upper primary schools which were selected randomly. The investigator selected 10 students from each school, out of which five students were boys and five were girls. All students were from Class VII. Out of four schools, three were government schools affiliated to West Bengal Board of Secondary Education and one was a private school affiliated to ICSE. The government schools were Naldugari Parmadan Chandrakant Vidyalaya, Charmondal CMPPBK Fulmohan High school and Sindrani Sabitri Vidyalaya. The one private school was St. John's School, Pathuria.

In order to collect data, tools like interview schedule for students and teachers, and classroom observation schedule to observe the teaching learning process were used. Each interview schedule consisted of seven open ended questions related to how they are learning mathematics apart from classroom teaching. The responses were written in the field notes and the whole conversation was recorded in a smartphone and later on, it was transcribed. Interview schedule for teachers consisted of nine open ended questions related to their profession, age of culture specific TLMs, professional training related with ethnomathematics approach of learning, etc. The responses were written in the field notes and the whole conversation was recorded – a smartphone.

The classroom observation schedule consisted of five-point scale. Total 18 questions were taken into consideration under the broad criteria of content knowledge and relevance, pedagogical strategies, teaching-learning resources and evaluation. The five-point scale included choices, like (advanced), (satisfactory), (progressive), relevant and not relevant for the respondents to answer.

Analysis

Data were mostly analysed as per the research questions. After collection, the data were transcribed on a chart paper and it was themed and coded. Part of the students' interview schedules were analysed quantitatively and scored by using frequency and percentage. Plotted bar graphs were used to enable the analysis of data in a meaningful way. The data received from teachers' interview schedule and classroom observation were analysed descriptively. For the third objective (i.e., study of ethnomathematical approach of learning mathematics among boys and girls), graphical interpretation was done based upon the scored frequency and percentage.

Table 1
Students' ethnomathematics approach of learning mathematics

S.No.	Major Items	Yes (%)	No (%)
1.	Arithmetic operations learned from local (culture specific) methods	33 (82.5)	7 (17.5)
2.	Played indigenous games like *Bag Bondi, Kathi Khela, Rangoli,* etc.	11 (27.5)	29 (72.5)
3.	Knows examples of local artefacts connected with classroom geometrical shape	27 (67.5)	13 (32.5)
4.	Played culture specific games having the idea of mathematics	23 (57.5)	17 (42.5)
5.	Students engaged in daily earning activities	13 (32.5)	27 (67.5)

Research Objective 1

To identify the ethnomathematics approach of learning mathematics among students.

To fulfil this objective, the researcher has used an interview schedule for the students. Questions were related to how they are learning mathematics apart from classroom teaching. In particular, how learning of arithmetic operations is related with their culture and daily life activities. The researcher identified various culture specific methods, games and practices among the upper primary students who seam different elementary and secondary mathematical concepts.

- Students were asked the question: Do you know any other ways of doing arithmetic operations (addition, subtraction, multiplication and division) apart from the procedure taught in the classroom? Majority of upper primary students (82.5 %) responded that they have learned their elementary arithmetic operations like addition, subtraction, multiplication and division using local culture specific methods, which are different from classroom learning methods. Most of the students learned basic counting of natural numbers using finger counting method. Apart from counting natural numbers, fingers are used for mathematical operations also Games like '*Kathi Khela'* (stick game) are played by children to learn basic arithmetic operations like addition, subtraction and the concept of greater and smaller numbers.
- A few indigenous games and practices were highlighted to find out students' knowledge of indigenous games or artefacts related to their culture where the concept of mathematics is being used. In this regard when students were asked whether they had any experience of sketching *alpona* (a cultural practice), many of the students responded positively. In addition, students

having an experience of sketching *alpona* (rangoli) are mostly girls as females at homes are used to sketching *alpona* during festivals. Further, on interacting with girl students, it was found that most of them are aware about the geometrical concepts used in the *alpona*. Interestingly, a girl student of Sindrani Shabitri Vidyalaya said that she can figure out various geometrical shapes and concepts through *alpona,* which are similar to classroom mathematics. For example, she said shapes like circle, square, straight line, triangle and various curves are used in alpona.

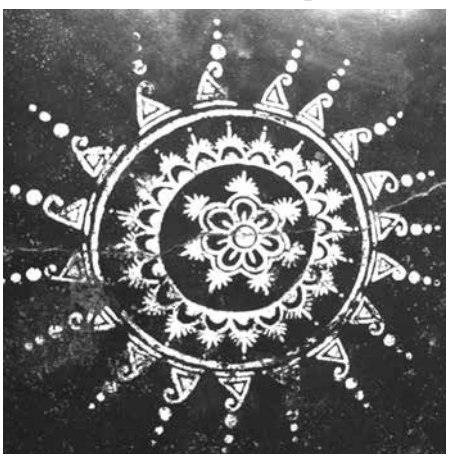


Figure 2: Alpona (Rangoli), mostly drawn by females in a house.
Source: Researchers' personal collection

Figure 2 shows a sample of *alpona,* that is being sketched as a part of the festival and which is related with mathematical concepts.

Mathematical ideas related with *Alpona*:

It involves closed curves, circles, semi circles, triangles, squares, rectangles and many more geometrical dimensions along with the concept of symmetry.

While sketching these artefacts, following steps are followed:

1. An initial point is taken to draw a small circle with the help of rope.
2. Then another bigger circle is drawn with reference to the same point.
3. Then, small circles were made on the circumference of the small circle.
4. Rest of the curves are drawn with symmetry.

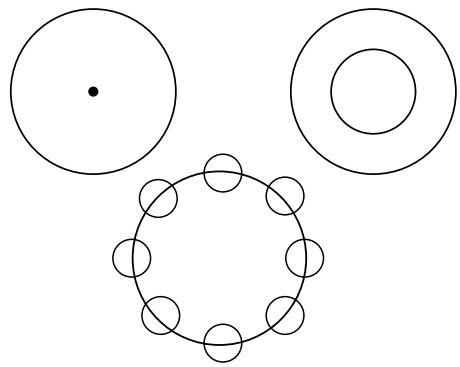


Figure 3: Initial steps involved in drawing an Alpona

In a real sense, *alpona is* a cultural practice followed by local people. The example of this artefact with detailed explanation can be a useful teaching- learning resource for an upper primary mathematics teacher, which is also emphasised in NCF (2005).

- Nearly 57.5 per cent of the students from the four schools

informed that they have played culture specific games that involved the idea of mathematics, while 42.5 per cent of students never played such types of games. Based upon interaction with the students, the researcher identified a few indoor or outdoor games which are discussed hearby.

Indoor Game

Few of the students share their experience with the game *Sholo Guti* (Sixteen Soldiers), a two player abstract strategy board indoor game. In India, it is known as Cows and Leopards. A similar type of game in Bangladesh is known as *Sholo Guti*, the same name researcher also came to know about from the students.

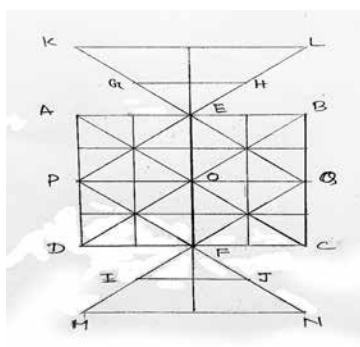
The structure of game:

The game consists of one square shaped board and two triangle boards attached to its two opposite sides, but the student stated that they draw the framework of the game in soil or on a smooth surface with coloured chalk, wherein two players used to play the game at a time. There are a total of 32 pieces of stones used in this game, 16 with each player with distinguishable colour or size. Stone pieces are placed on the intersections of the board, specifically on the half of the square board and the nearest triangular board.

Rules of the game

1. Like the chess game, two players are required to play this game.
2. Upon one's turn, a player can use one piece of stone at a time to move it up to one place in the forward direction (straight line) or capture any stone of the opponent. The move can made only be in forward vacant places or one step ahead of the opposite stone to capture that stone.
3. Capturing the stones is not mandatory. If a player does not wish to capture the opposite, he/

(a)



(b)

Figure 4: (a) A student from Class VII explaining the game ষ ল গুটি (Sholo Guti). (b) A geometrical view of the cardboard.

she can move in vacant places. A piece can continue to be captured within the same turn, and may stop capturing any time. The captured piece (or pieces) is removed from the board.

4. The main target is to capture all the stones of the opponent and the one who accomplish this first, will be the winner.

Mathematical Ideas Present within this Game

The structure of the game *Sholo Guti* is based on the concept of geometrical shapes. Those are:

1. The main board consists of squares: ABCD, AEOP, EBQO, POFD, OQCF, PEQF and many more. Fig. 4 (b)
2. It also consists of different rectangles, for example, ABQP, PQCD, AEFD, EBCF and many more.
3. FMN, EKL, APO, ARO, BOQ, BOE and many more can be the examples of triangles.

Activity Tools

This game board can be used as an activity tool to learn the initial concepts of geometry. Students can be asked to identify the number of triangles, squares and rectangles in the game board. Thus, this activity will help the students in organising and analysing information.

Use in Teaching

The middle board which is square in shape and similar to that of the board of *Bagha Chal* (see Pradhan, 2019) enables the teacher follow to mathematical theorems or verify the concepts.

- Teaching in the verification of the Pythagorean Theorem
- Teaching centroid of triangle
- Teaching of infinite series

Research Objective 2

To find out mathematics teacher's use of ethnomathematics approaches for teaching mathematics.

For this research objective, the researcher used an interview and classroom observation schedule. It is targeted for the teachers. Four teachers (titled as Teacher 1, 2, 3 and 4) have been selected. The responses from the teachers about their use of ethnomathematical approaches for teaching mathematics are:

- Only one out of four teachers is aware about NCF 2005 and its recommendation regarding the pedagogical practices related with mathematical teaching.
- All the four teachers teaching at upper primary level agreed that textbook teaching is necessary but not sufficient.
- It was found that 100 per cent of the teachers used prior knowledge of the students to connect with the present classroom teaching.

- Further, all the four teachers during their classroom teaching, motivate students to use cultural games which promote their mathematical knowledge and beliefs.
- Interlinking of classroom teaching with the local culture of students was supported by all.

Teacher 1 said that classroom teaching needs to be linked with students' daily life activities.

Teacher 2 narrated that culture specific examples of artefacts, which include the concept or application of mathematics, need to be demonstrated during the teaching-learning process.

Teacher 3 shared from his experience, that different locally available objects can be used for understanding geometrical concepts.

How can the knowledge of professional groups or cultural groups or games can be used to teach mathematics? To answer this question, Teacher 1 said that during the introduction of any mathematics chapter, for instance, while teaching the concepts of measurement or geometrical shapes, examples of a carpenter or a mason's work can be cited on how they are using different concepts of measurement and geometry to explain the concepts. Teacher 3 were the example of a shopkeeper in the market using the concept of addition and subtraction, as an for teaching in the class. Further, the teacher said that this example of a shopkeeper can be planned out in the form of classroom activity as role play by the learner, wherein a student can act as shopkeeper and others can be the customers. Teacher 4 precisely and meaningfully explained how the local artefacts like *Dhaner Gola* (a place where raw rice is stored

Figure 5: Dhaner Gola, the structure where raw rice is stored

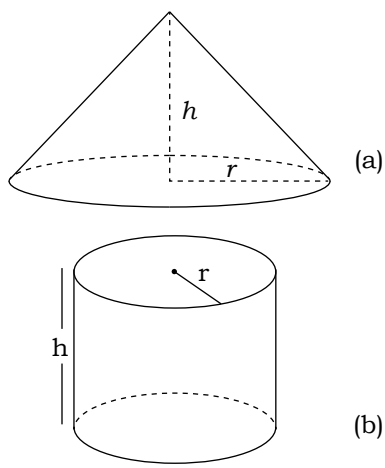


Figure 6: Geometrical shapes— (a) Cone and (b) Cylinder

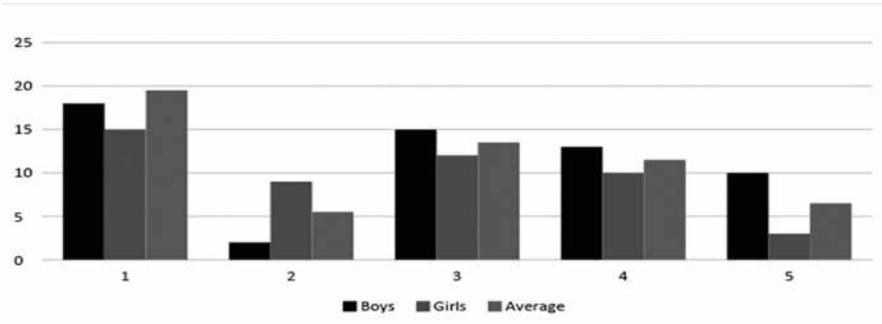


Figure 7: Ethnomathematical approach of learning mathematics among boys and girls

in a village) structure resembles geometrical structures.

Geometrical Concept in Dhaner Gola

The top portion of *Dhaner Gola* is similar to that of a geometrical figure *cone,* which has a height (*h)* and radius (*r),* the bottom portion, of cone has the shape of a circle. Like the top portion, the middle portion of the *Dhaner Gola* is similar to that of the right circular cylinder having height (*h)* and radius (*r).*

Research Objective 3

To study the ethnomathematics approach of learning mathematics used by upper primary level students with reference to gender.

To find out the awareness of the boys and girls on ethnomathematics and how they use culture specific activities in their daily life, the researcher conducted interviews.

In the above bar graph, 1 to 5 depict: 1. Arithmetic operations learned from local (culture specific) methods; 2. Played indigenous games like *Bag Bondi*, *Kathi Khela*, Sketching Rangoli; 3. Knows examples of artefacts, which are connected with mathematics geometrical shapes; 4. Played culture specific games having the ideas of mathematics, and 5. Students engage in daily earning activities.

Based upon the interaction with the students after observation of the class, the following points emerged:

- Both the boys and girls learned their basic mathematical operations like addition, subtraction using local culture
- Girls students narrated that they are familiar with rangoli (*alpona*) and the mathematical concepts, in particular, geometrical concepts that were present in it. In comparison to that, only a few boys played *Kathi Khela* and had experience related to making *Rangoli*.
- Majority of the boys and girls were aware about the various examples of cultural artefacts that are related to mathematical geometrical figures. In this context, it is interesting to know

that this may be because they were familiar with the locally available objects and resources.

Discussion of the Result

The aim of the study is to identify the ethnomathematics approach used by students and teachers for learning mathematics at upper primary level. The result indicated that the students were quite aware and have experienced different culture specific methods of mathematical operations, indigenous games or local artefacts, wherein the concepts of mathematics were encompassed. It is learnt that indoor games, like *Sholo Guti* (Sixteen Soldiers), can be used as TLMs by the teachers as the structure of the game is based upon the concepts of geometrical shapes. This game can be used as an activity tool to teach the initial concepts of geometry, which will help the students to organise and analyse any information. Thus, it is revealed from the study that students have a good amount of knowledge related to culture specific games and artefacts pertinent for building the concepts of mathematics. Further, teachers were aware about local artefacts and used them during the teaching-learning processes. In addition, based upon the finding of the study it can be inferred that there is a slight variation in gender in terms of their experiences with different cultural practices or indigenous games (overall boys were found to be more familiar with the artefacts and indigenous games).

Educational Implications

The results of the study are not only beneficial to the student community, but also have a prospect in giving awareness to the teachers, curriculum developers and policymakers in the following ways:

1. Indigenous games or culture specific practices will help the students to understand various geometrical concepts. For example, games like *Sholo Guti* (Sixteen Soldiers) may help the students to understand the concepts of symmetry and different geometrical shapes that exist in our daily life.
2. Further, understanding of classroom mathematics with the help of local or culture specific resources that students are familiar with, will encourage students to learn maths more easily and in interesting way
3. Various indigenous games, i.e, *Kathi Khela, Sholo Guti,* and artefacts like rangoli can be used as TLMs by the teachers.
4. For the curriculum developers, it will give ideas about framing innovative, effective and inclusive mathematics curriculum. Lastly, the idea of ethnomathematics will be useful in constructing cost effective teaching-material using easily available culture specific resources.

Conclusion

To concluede, it can be mentioned that ethnomathematics is all about the interaction between mathematics and culture, more specifically the concepts of mathematics practised among an identified cultural group. NCF 2005 and its position paper on teaching mathematics also highlight the need and importance of culture, language, and community in learning mathematics. Thus, ethnomathematics acts as a way in which people use certain cultures to explain mathematical concepts, in dealing with relational and spatial aspects in their lives. The study also highlighted a handful of material resources that have the concepts of mathematics, and a number of games based on the principles of geometry. A crucial implication of offering cultural specific to learning mathematics lies in the use of a multiplicity of approaches and procedures, procedures solutions. This gives a clear pathway to liberating school mathematics from teacher-centric approach and enable students' participation, engagement in learning and a joyful learning.

References

Bose, A. and K. Subramaniam. 2015. Archaeology of Measurement Knowledge: Implications for School Math Learning. In S. Mukhopadhyay and B. Greer (Eds.), *In Proceedings of the 8th Annual Conference of Mathematics Education and Societ*y (MES). Vol. 2, pp. 340–354. Portland, USA: MES. ISSN: 2077-9933.

———. 2011. Exploring School Children's Out of School Mathematics Knowledge. In Ubuz B. (Ed.), *Proceedings of the 35th Conference of the International Group for the Psychology of Mathematics Education*. Vol. 2, pp. 177–184. Ankara, Turkey: PME. (Poster).

D'AMBROSIO, U. 1985. Ethnomathematics and its Place in the History and Pedagogy of Mathematics. *For the Learning of Mathematics*. Vol. 5, No. 1. pp. 44–48.

———.1993. *Etnomatemática: Um programa* [Ethnomathematics: A program] *A Educação Matemática em Revista*. Vol. 1, No. 1. pp. 5–11.

———. 2002. *Etnomatemática: elo entre as tradições e a modernidade*. Belo Horizonte: Autêntica.

Eraikhuemen, L. 2003. The Influence of Gender and School Location and Students' Academic Achievement in Senior Secondary School Mathematics. *The Journal of Theory and Research in Education*. Vol. 7, No. 2. pp. 99–119.

Furuto, L. 2014. Pacific Ethnomathematics: Pedagogy and Practices in Mathematics Education. *Teaching Mathematics and Its Applications*. Vol. 33, No. 2. pp. 110–121.

Muhtadi, D., W. Sukirwan and R. Prahmana. 2017. Sundanese Ethnomathematics: Mathematical Activities in Estimating, Measuring, and Making Patterns. *Journal on Mathematics Education*. Vol. 8, No. 2. pp. 185–198. Jul 2017.

Mukhopadhyay, S. 2013. The Mathematical Practices of Those Without Power. In M.Berger, K. Brodie, V. Frith, and K. le Roux (Eds.), *Proceedings of the Seventh International*

Mathematics Education and Society Conference, pp. 94–102. MES7. Cape Town, South Africa.

Ministry of Human Resource Development. 2005. *National Curriculum Framework for School Education 2005*. National Council of Educational Research and Training (NCERT), New Delhi.

Ministry of Human Resource Development National Education Policy. 2020. Government of India, New Delhi.

National Mission on Foundational Literacy and Numeracy (NIPUN Bharat).

Ministry of Education. 2021. Government of India, New Delhi.

Pradhan, B. 2019. Symbiosis between Mathematics and Cultural Game: A Nepalese Experience. *Proceedings of the Tenth International Mathematics Education and Society Conference*. MES 10. Hyderabad, India

———. 2017. Mathematical ideas in Chundara culture: Unfolding Nepalese teaching and learning system. In M. Rosa, L. Shirley, M. E. Gavarrete and W. V. Alangui (Eds.), *Ethnomathematics and Its Diverse Approaches for Mathematics Education* pp. 125–152. Springer Cham, Switzerland.

Santra, I. And S. Mukhopadhyay. 2019. The Role of Mathematical Thinking Plays in Mansons' Workplace in West Bengal: A Preliminary Examination. *Proceedings of the Tenth International Mathematics Education and Society Conference*. MES 10. Hyderabad, India.

Sharma, T. and D. Orey Clark. 2017. Meaningful Mathematics Through the Use of Cultural Artefacts. In M. Rosa, L. Shirley, M. E. Gavarrete and W. V. Alangui (Eds.), *Ethnomathematics and its Diverse Approaches for Mathematics Education* pp. 153–182. Springer Cham, Switzerland.

Supiyati, S. Farida Hanum, Jailani, 2019. Ethnomathematics in Sasaknese Architecture. *Journal On Mathematics Education*, Vol. 10, No. 1. pp. 47–58, Jan 2019.

W. V. Alangui. 2017. Ethnomathematics and Culturally Relevant Mathematics Education in the Philippines. In M. Rosa, L. Shirley, M. E. Gavarrete and W. V. Alangui (Eds.), *Ethnomathematics and Its Diverse Approaches for Mathematics Education,* pp. 183–208. Springer Cham, Switzerland.