Exploring Ethnomathematics in Maldives: Counting

by

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Ethnomathematics is the study of mathematics that takes into consideration the culture in which mathematics arises. It is a subject that values and recognises the contributions of non-European cultures to the development of mathematics. Ethnomathematicians attempt to describe and understand the mathematical world as others see it, to give mathematics a more global perspective. This paper, based on research conducted for my masters thesis reports on mathematical ideas related to counting that are found in Maldivian society and are related to traditional and cultural contexts, so that these ideas can be considered for inclusion in future primary mathematics curricula in Maldives.

1. INTRODUCTION

Ethnomathematics is a field of study that values and recognises the contributions of different cultures to the development of mathematics. Studies in this area probe the roots of mathematical thinking in different cultures, roots that are being ignored or in danger of being lost (Ascher, 1991).

This research was conducted in my homeland - Maldives. Maldives is an island nation comprising about 1190 small coral islands of which 200 are inhabited. The islands are very small, low lying, widely dispersed over an area of 90 000 square kilometres including land and sea, and have a population of about 260 000.

Maldives has a rich heritage of mathematical thought because of the connections with the traditions of India, South Asia, the Muslim (Arabic) world, and Great Britain. In recent years, the dependence on the British education system, particularly the University of London examinations and the quest for modernisation have created a situation in which traditional Maldivian mathematical thinking is in danger of being lost, and contemporary mathematical practices in Maldives being under-valued. One of the contributing factors for this might be the lack of emphasis in mathematics teaching on local contexts. This study seeks to explore the nature of indigenous mathematics thinking in Maldives, so that future curricula can consider the inclusion of these indigenous ideas and practices.

2. PURPOSES AND RESEARCH QUESTIONS

The purposes of this study are to:

- investigate the mathematical ideas found in Maldivian society that are related to traditional and current cultural contexts
- explore the nature of indigenous mathematics thinking in the Maldives so that future curriculum development can consider the inclusion of such material
- make suggestions to the development of future curriculum for the teaching and learning of mathematics

The main research questions addressed in this study are:

- what is the nature and scope of mathematical thinking in Maldivian culture?
- how might these ideas influence the curriculum for mathematics?

The aspects considered in this paper are Maldivian mathematical ideas related to counting, using three contextual examples – fishing, agriculture and money.

3. WHAT IS ETHNOMATHEMATICS?

The literature does not concur on the definition of ethnomathematics except that it concerns mathematics and culture (Barton, 1995; 1996). The word ethnomathematics has been used since 1984, mostly with respect to mathematics practised in different cultures, and cultures which have often been called primitive (Bakalevu, 1997; D'Ambrosio, 1997). D'Ambrosio, who is regarded as the father of ethnomathematics, described ethnomathematics as a human invention that comes from inside one's culture - where culture is understood (Ascher, 1991) as the customs, civilisations and achievements of a particular group of people. Further, D'Ambrosio (1991, p.18) goes on to suggest that:

Ethno includes all culturally identifiable groups with jargons, codes, myths, symbols, and specific ways of reasoning and inferencing. These things are inherent in our species.

Ethnomathematics is the study of mathematics that takes into consideration the culture in which the mathematics arises. It was

forged into the experiences, reflections, delusions, and hopes of the uses of modern science, particularly mathematics, for a better quality of life for the entire human species. (D'Ambrosio, 1997, pp. xvi)

As Bishop (1988), Boaler (1993) and Shan and Bailey (1991) have stated, counting, measuring, locating, designing, playing, explaining, classifying, ordering and inferring are specific mathematical practices which are in essence different from formalised ways of mathematical knowledge. Ethnomathematics explores these aspects of mathematics.

The goal of ethnomathematics is to broaden the general view and historical appreciation of mathematics to include the contributions of all cultures, thereby giving mathematics a more global perspective (Ascher, 1991; Gerdes, 1994). Hence, learning mathematics should involve the study and presentation of mathematical ideas found in all cultures, that is, mathematics should not be thought of as being culture free (Ascher, 1991; D'Ambrosio, 1997).

4. METHODOLOGY

Twelve weeks of data collection were carried out in Maldives. During this research, the emphasis was on people who do practical work in order to identify the scope of mathematical thinking in the Maldives. People who do practical work as part of their everyday lives were selected. Practical work included fishing, boat building, building and construction, housework, navigation, mat and rope making, and agriculture.

To identify the sources of ethnomathematics or influences of other cultures to Maldivian mathematical thinking, archival records were analysed and informal discussions were held with historians and mathematicians.

To investigate whether future curriculum might consider the inclusion of ethnomathematics, informal interviews and discussions were held with mathematics teachers (primary mostly), teacher educators and mathematics students (secondary).

5. DATA ANALYSIS

The data from interviews, discussions and documents were analysed for mathematical content. Interview, discussions and document analysis were recorded either Dhivehi (the Maldivian language) or in English. Translations from Dhivehi are my interpretation of what was said and what I understood from the records that I analysed.

6. SCOPE OF THE STUDY

Given the time constraints and this being a masters thesis, the research was limited to two of the six activities that Bishop (1988) perceived as pre-mathematical and as pre-conditions for the development of mathematics in any culture. Of the six categories: counting, measuring, locating, designing, playing and explaining; counting and measuring were selected as the categories for this research because I believe that these two activities are most commonly used in everyday life situations and represent important areas of study in primary schools. This paper only looks at the Maldivian mathematical ideas related to counting using three contextual examples – fishing, agriculture and money.

7. COUNTING

When Maldivians started counting is not known. However, there is evidence to suggest that the need for counting has been important in the Maldivian culture since at least the Christian era. The duodecimal system used traditionally, since the medieval centuries of Christian era (Maloney, 1980) and at present is evidence for this.

7.1 The Traditional Maldivian Counting System

Traditionally Maldivians used base twelve to count and today there are many older people who still do. This is the oldest counting system of Maldivians, which is documented. Ibn Batuta (A.D. 1325-1354), an Arab traveller who visited Maldives around 1344, wrote about bundles of 12 000 cowries and mentioned that 100 cowries make one hiya, 700 a fau and 12 000 a kottey (Gibb, 1994). This was in existence until silver fishhook money was imported into Maldives in the 16th century. Further, until recently one Maldivian Rufiyaa consisted of 120 laari. It was during the reign of Mohamed Fareed (1954 -1968) that a Maldivian Rufiyaa was changed to 100 laari, as it is used at present (Browder, 1969; Maldives Monetary Authority, 1983).

How base twelve appeared in the Maldives is a mystery. Counting by twelves is not known in the two neighbouring countries, Sri Lanka or India (Maloney, 1980). The origin of base twelve supposedly goes back to Mesopotamia. The base number six, often multiplied by ten was used for counting by Mesopotamians even in ancient times and was later enlarged to twelve as six was too

small (Boyer & Merzbach, 1991). Base twelve was most probably transmitted to Maldives by Persians who might have settled there or by Arab traders.

At present, the decimal system is generally used throughout the Maldives. This is related to the growing influence of Indo-Aryan speech in South Asia. Arabs and then the Europeans who came to Maldives reinforced its use. The Dhivehi names used for numbers in the decimal system closely relate to Sinhalese (Sri Lankan language) and Hindi (an Indian language) (Maloney, 1980).

It is interesting to note, however, that the decimal system did not fully displace the duodecimal system. Even today, when enumerating, Maldivians use the duodecimal term for sixty which is fas dholhas (meaning five twelves) and not the decimal term hatti. Also, for fast counting of coconut, fish or shells, some people still use the duodecimal system

7.2 Counting in the Maldivian Society

The Dhivehi word for number is numbaru, which presumably came from the English word number and the Dhivehi word for counting is gunun. Counting, especially rapid counting has always been important in the Maldives to count fish and coconuts. The right hand is always used to count and the left hand for tallying. Counting is done two at a time starting with the small finger and fingers are closed as each is said. For 10 the thumb is closed and those who count in base 12, the thumb is opened for 12. A finger is closed on the left hand for each unit of 12 or 10 and if there are more than five units of 12 or 10 the fingers are opened again beginning with the thumb. This method of counting two at a time is also evident in other South Asian countries, but keeping tallies on the left hand seems to be a Maldivian innovation (Maloney, 1980).

The concept of counting also differs between generations. The concept of specific date is not important to the older generation because they always relate events to other important events that are meaningful to them.

I am about 100 years old. I remember King Shamsuddeen's regime. So I must be 100 years old? [F9]

This fisherman [F9] is probably in his early nineties and he is relating his age to something significant that he remembers.

The middle aged and the younger generations count in twos and fives using fingers or in their heads. When asked how they count, some of the responses were:

I count using one two in the Maldivian way. I add and subtract in my head. I look at the number of tens and then calculate [MIS2]

If it is a lot then I count in fours and when it is 25 I know it is 100. If it is fish I count in twos and then multiply the total by two [MIS3]

The young generation, because the medium of instruction at schools is English, probably thinks and counts in English and uses the decimal system. When asked how they count, the responses of some of the students were:

Using a calculator (sometimes) or when adding numbers or subtracting, I try to break the numbers so that I can deal with them more easily. (I break these numbers to which I am very familiar with) eg to multiply 18x5 first break 18 to 2x9, now multiply 9x5 then 45x2 because it is much easier and quicker to multiply 9x5 which is very familiar and 2x45 is also a multiplication which we come across very often [S1]

In my head using English numerals [S25]

The counting techniques and the language used above seem to reflect an influence of the West, probably because of British examinations.

In addition to the British influence, words from Dhivehi in Maldivian mathematics are very similar to Hindi words. For example, for three plus one equals four, we say theen eku saari in Dhivehi while it is theen eku chaaru in Hindi.

Further, in the Maldivian counting system, a million is dhiha lakka, which means ten lakka. A lakka is equal to 100 000 (hundred thousand). Similarly, a kroadu is 10,000,000 (ten million). These words are also very similar to Hindi. For example, a lakka is laak and a kroadu is kroalhu in Hindi.

7.3 Cultural Contexts where Counting is used

As with any culture, there are contexts in the Maldivian culture where counting is applied, even though people may not identify these aspects as mathematics or counting. Contextual examples include fishing, agriculture and money.

Fishing

Counting is evident in the system of sharing fish. Sharing is a joint venture where the owner and crews share the day's catch. Because of this system of sharing, precision in counting has been very important for the Maldivian fishermen.

Traditionally, when the catch was shared, it was up to the individual fisherman to sell his share. At present, most fishermen sell their fish to the fish canning factory or big fishing boats that are located in different parts of the Maldives or to the capital island Male', and share the money among themselves, instead of the catch. The sharing system is similar to the traditional system. The catch is divided among the owner of the boat and the crew daily. For example, if 100 fish of a kind are caught in a day's fishing, then the owner gets 25 percent of it which is 25 fish and the remaining 75 fish will be sold by a crew member and the cash is divided as follows. 1 share for each crew for a crew of eight, 1 extra share for the skipper, 1 extra share for the chummer, 1 extra share for the each of two bailers, 1 share for sail owner, 1 share for net owner and 1 share for gear owner. So, altogether 15 shares and each share would be worth the cash of five fish (Ministry of Fisheries and Agriculture, 1960). I did not find any evidence in the literature or from the discussions that this system of sharing is used in other cultures. It seems to be a Maldivian invention.

Agriculture

Until 1976, coconut and breadfruit trees were stamped to keep tally of the number of these trees outside people homes that belong to the government and the locals. It is called thah jehun. A cylindrical tube with a handle on one end and the other end sharpened, was used for stamping trees. The criteria used for stamping were:

Trees owned by individual people : 1 thah (stamp)

Trees owned by a group of people (people in that island): 2 thah

Trees owned by the government : 3 thah

Trees owned by both the government and people of that island: 4 thah

Trees planted for special shrines: 5 thah (Ministry of Fisheries and Agriculture, 1998).

This shows that Maldivians developed means of keeping tally or counting depending on the context.

At present, it is the responsibility of each island office to keep a tally of these trees and report to the Ministry of Fisheries and Agriculture. And it is the responsibility of individuals who own trees outside their home, to register the number of trees they own, at the Ministry (Ministry of Fisheries and Agriculture, 1998).

Money

Traditionally, small shells of certain molluscs were used as money in Maldives. When Maldivians started using shells as money is not known (Browder, 1969; Maldives Monetory Authority, 1983). However, Ibn Batuta (1344) mentioned that Maldivians used cowry shells as money (Gibb, 1994). The shells were counted as follows:

5 boli (shells) = 1 agi

25 agi (125 boli) = 1 hiya

8 hiya (1000 boli) = 1 fau

12 fau (12000 boli) = 1 kottey

Notice that duodecimal terms with decimal multipliers were used to count shells.

During the 16th and 17th century silver wire, or silver fish hook money was imported into the Maldives. These coins were probably imported into the islands in exchange for the cowry shells, because during this time these coins were used in the Persian Gulf, India and Sri Lanka. The name of these coins was laari. Laari, seem to have originated from a town in Persia where they were originally minted in the name of the Shah of Persia (Browder, 1969; Maldives Monetory Authority, 1983). The laari was also known to be minted in Hormuz (Oman) and Basara (Iraq) in later times (Browder, 1969).

It was also during the 17th century that Maldivian money became round coins. And until very recently, even though the shape and sizes of the coins differ from time to time, one Maldivian

Rufiya had 120 laari. It was during the reign of Mohamed Fareed (1954-1968) that one, two, five, ten, twentyfive and fifty cents (laari) coins were made and thus, the decimal system is used for Maldivian money at present. These coins were made in the United Kingdom (Maldives Monetory Authority, 1983). This seems to be an influence of the British because Maldives was a British protectorate from 1887-1965.

8. CONCLUSION

Quantifying is important for a society like Maldives where natural resources are scarce and fishing is one of the main occupations. When Maldivians started counting or developed a traditional counting system is not known. However, there is evidence to suggest that initially Arabia and South Asia (mainly India) influenced our counting system. Later the British influence was felt.

Ethnomathematics has important implications for curricula. The mathematical ideas related to counting can be used in curricula so that students can make connections between formalised ways of counting and their everyday life. Further, this would enable students to make sense of formal mathematics. The importance of students' own mathematical ideas is now recognised in many curriculums (for example: New Zealand Mathematics Curriculum, Ministry of Education, 1992), and so it is perhaps timely that the traditional Maldivian ways of counting be studied in schools in the Maldives.

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