ME – 40

Ethnomathematics in Marriage Tradition in Adonara Island-East Flores

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Abstract - This paper describes the mathematical knowledges of Adonara society in the marriage tradition known as ethnomathematics. Collecting data were conducted using unstructured interviews and documentation. Interviews were conducted with several informants selected based on the consideration of researcher and suggestion by previous informant. Documentation was done using video recordings and photos. The data were analyzed refers to the characteristics of ethnomathematics that include: *Counting, Locating, Measuring, Play, Designing and Explaining* - CLMPDE. Result shows that there are a number of mathematical knowledges in the marriage tradition in Adonara island called as ethnomathematics such as: counting, measuring, estimating, comparing, sorting, and various geometry concepts. These is found in all process from giving dowry until custom party.

Keywords: *counting, dowry, ethnomathematics, marriage, measuring*

I. INTRODUCTION

One of the students' capitals brought to school is the cultural capital. Teachers should develop learning mathematics based on the student cultural capital to motivate and arouse students' interest in learning mathematics. The use of student' culture as an illustration of concept of mathematics is expected to help students understand the concepts being studied. Exploration charge a mathematical concept in view of culture to foster knowledge and awareness of students that they can contribute to the discoveries of mathematics, because mathematics is not the dominance of a particular culture. Besides, the student culture can be used as context and learning problems in learning the appropriate mathematics concepts. Teachers in teaching mathematics is expected to utilize culture as a context, the media, and also as a learning resources.

But the facts show that the mathematics learning in schools may not use culture as a context of learning. Mathematics learning just focus on textbooks rather than use what was available in the neighborhood including an cultural environment. Cultural environment that involved educational value is not used as a media and learning resources. Teachers are stuck on the notion that learning media and learning resources should be purchased or only from teachers and textbooks. Teachers have difficulty associating specific mathematical concepts with appropriate cultural context. Even teachers are not aware that in the cultural activities contained various mathematical concepts.

Mathematics as a social-culture construction where mathematics is contained in history and in human activity, so it is said that mathematics is a human activity, either already or not yet published ([1] Ernest, 1993, [2] Freudenthal, 2002; [3] Romberg, 2004; [4] Mukhopadhyay and Greer, 2011). It means that the human activities directly or indirectly related to mathematics.

The above description indicates that there are various mathematical knowledge called as ethnomathematics in the marriage tradition in Adonara society. It is based on the fact that the marriage tradition is one of the Adonara community's culture inherited the previous generation and still maintained to the present time. Indepth study was needed to reveal and describe ethnomathematics or mathematical knowledges in the marriage culture of Adonara society and create a mapping concept to show the

relationship between ehtnomathematics and school mathematics so that it can become a reference for teachers in developing teaching materials and based-culture learning.

II. LITERATUR REVIEW

A. Mathematics and Culture

Mathematics and culture are related each others. Mathematics on the one hand shaped by culture and mathematics on the other hand is used as a tool for the advancement of culture. In other words, mathematics is not free from the culture but the mathematics as a part of the culture and as a form of human culture.

Mathematics is a socio-cultural construction in which mathematics is contained in history and in human activities. Thus mathematics can not be separated from the humanities and social sciences, or from what is expressed as human culture in general, so it is influenced by the values of humanity as well as other fields of knowledge ([1] Ernest, 1993). Knowingly or not that a lot of human daily activity is always associated with mathematics, so it is said that mathematics is a *human activity,* either already or not yet published ([2] Freudenthal, 2002; [3] Romberg, 2004; [4] Mukhopadhyay and Greer, 2011).

Mathematics as we know is a phenomenon tied to the culture, and every culture has created ideas where clearly labeled as "other mathematics". Also mathematics is a cultural phenomenon, and mathematics as a *pan-human activity* ([5] Bishop, 1988; [6] Dowling, 1998). Furthermore, mathematics (mathematical knowledge) already exists in every culture, embodied in each culture, which, as a " frozen mathematics" ([7] Gerdes, 1997; [6] Dowling, 1998). Mukhopadhyay and Greer defines mathematics embedded in all cultures, much of mathematics as an academic discipline. Raju said that mathematics is a cultural formation, influenced by special philosophy culturally ([4] Mukhopadhyay and Greer (2011). Also Milroy said that all cultures develop their own mathematical forms depending on the needs of their neighborhoods and communities of interest ([8] Milroy, 1992).

Mathematics is a cultural phenomenon, present in every culture, embedded in culture, shaped by every culture, influenced by the culture, and has its own form in accordance with the needs of environmental and community objectives ([9] Dominikus, 2014). This means any different cultures will have different mathematics. In particular it can be said that there is any ***hidden mathematics*** in the Adonara culture while Adonara people never say that they have the mathematics ([10] Dominikus, 2015). In general mathematics in culture is known as ethnomathematics.

B. Ethnomathematics

The meaning of ethnomathematics always change and evolve since it was first introduced by D'Ambrosio in the early 1980s to the present time. The changes associated with cultural significance or cultural groups into ethnomathematics research areas, from ethnomathematics as a research subject heading ethnomathematics as a field of research. It appears in a variety of senses of ethnomathematics as described in this section.

Initially, ethnomathematics related to mathematics practice of illiterate people, and mathematics practice in a culture without written expression of a society which is seen as a primitive society ([11] Ascher, 1997: 26; [12] D'Ambrosio, 1997: xv;). Here Ascher and D'Ambrosio emphasized that the focus ethnomathematics limited to cultural communities that are less or never learned school mathematics.

Further, ethnomathematics referred to a form of mathematics or mathematics contained in the cultural activities of various cultural groups such as ethnic communities, labor groups, children of certain age groups, professional groups, and others ([13] Nunes, 1992; [12] D'Ambrosio, 1997: 16). Milroy (1992) put ethnomathematics deals with the study of different types of mathematics that arise or exist in a variety of cultural groups. Furthermore ethnomathematics relates to a form of cultural knowledge or characteristics of the social activities of a social group or culture, which can be recognized other groups such as west anthropologist , but not necessarily known by the origin, as knowledge of mathematics or mathematical activity ([14] Presmeg, 2007: 440). Mathematical knowledge of a cultural group may be known in the jargon, symbols, myths, and in certain ways people use for calculating, concluding, sorting, and grouping ([15] François, 2012: 1; [16] Meaney, 2008: 52). Previous meanings of ethnomathematics illustrate that ethnomathematics related to mathematics or mathematical practice or mathematical knowledge or mathematical activity in the cultural activities of a particular cultural group. It can be said that we can find a variety of mathematical practice or mathematical knowledge in a certain community groups that can then be said as ethnomathematics.

Currently, ethnomathematics has become the field of research on mathematics in culture ([17] Gerdes, 2014), the relationship between culture and mathematics ([18] Barton, 1996; [19] Alangui, 2006), and the role and influence of ethnomathematics in mathematics and mathematics education ([20] Begg,

2006: 1; [21] D 'Ambrosio, 2001: 1, [22] D 'Ambrosio, 2001: 1; [23] Horsthemke, 2006: 4). In this context, ethnomathematics will enrich mathematics that are commonly known and learned in formal educational institutions during the time and will also affect the mathematics education.

This study describes the practice of mathematics or mathematical knowledge of Adonara society in the marriage tradition. The results of this research can be used as a reference in developing culture-based mathematics learning.

III. RESEARCH METHOD

This research is a qualitative descriptive study with the aim to describe the mathematical knowledge of Adonara society in the marriage tradition. Data were collected with unstructured interview and documentation methods. Interviews were conducted to 5 people custom figure as a subject of study with all aged over 60 years. The data collected related to dowry agreement and its return, giving dowry, and traditional wedding party. Selection of the number of research subjects at the top as well as to ensure the validity of research data. Analysis of data using interactive methods Miles and Huberman which consists of reducing the data, presenting data, and making inferences ([24] Sugiyono, 2007). Data was analyzed descriptively with reference to the characteristics of ethnomathematics comprising: *counting, locating, measuring, play, designing,*and *explaining* ([5] Bishop: 1988).

IV. RESULTS AND DISCUSSION

The marriage for Adonara people be understood not only unite a man and a woman who later became husband and wife, but also unite families on both sides. The mating process consists of a series of rituals associated with the provision of a dowry (bride price) or *welin* and other processes before and after giving dowry. The dowry of Adonara women is ivory together with goats and pigs within a certain amount as a pair of ivory. Replies should be given the woman's family in the form of woven fabric *(kewatek)* and shirts by an amount deemed feasible and commensurate with ivory and how many goats and pigs received.

The highlight of the mating process is to strengthen marriage by a religious institution. In Adonara society the dowry is not an absolute requirement to obtain confirmation of marriage by religious institutions. Giving dowry be implemented before marriage or after marriage in a religious suspended depending on the chosen form of marriage and the agreement of both families. There are several activities that illustrate mathematical knowledges in the marriage tradition as described below.

A. Counting

Counting activities in the marriage tradition found in counting the number of animals as a pair of ivory that would be handed over to the family of the boy female family. It also calculates the number of woven fabrics *(kewatek)* and shirts in reply by the woman's family to the men's family. Counting Activities also performed to determine the number of animals to be cut and the number of participants plate in custom party. All of these will be described below.

The number of animals as a pair of ivory is usually odd. If the number of animals are 3 that it consists of two goats and one pig. If the number of animals are 7 then at least two pigs and five goats. Usually the number of pigs are less than goats. No matter how many pigs were given to men's family and women's family will be cut out for the traditional feast. Otherwise not all goats are cut. Goat called as *bala talin* to be maintained.

When given animal as a pair of ivory is 7 animals consisting of 2 pigs and 5 goats, then in the Lamaholot language expressed as follows, w*awe rua* ***noon*** *Witi lema ke ewan* ***mupune*** *pito* (2 pigs with five goats so the total animals is 7). It can be written in mathematical sentence as follows: **2 pigs + 5 goats = 7 animals.** In this contex, addition process is done for two subset (pig and goat) from the same set (animal). It shows that concepts of set and subset are hidden within the marriage tradition.

Similarly, in calculating the woven cloth and shirts in retaliation for ivory and animals that have been received. Usually woven fabric *(kewatek)* wrapped in another cloth called *kenabu.* The number of woven fabric *(kewatek)* in each bundle *(kenabu)* between 50-80 pieces. If at the time of the conducting brought 4 packs of woven fabric and 2 packs of shirt then the total is six packs of fabric. In the Lamaholot language spoken in the following, *kewatek kenabu paat* ***noon*** *labu kenabu rua* ***mupune*** *ale kenabu neme* (4 packs of woven fabric with 2 packs of shirt so altogether there are 6 packs of fabric). The corresponding mathematical sentence can be written as follows, **4 packs of woven fabric + 2 packs of shirt = 6 packs of fabric.** In this contex, addition process is done for two subset (woven fabric and shirt fabric) from the same set (fabric). It shows that concepts of set and subset are hidden within the marriage tradition.

Both of the above illustrates that the addition operation performed by summing the numbers that appear regardless of the attributes associated with that number. It shows that concepts of set and subset are hidden within the marriage tradition. Here counting process or action taken is *pupu* (collect) and the outcome of its actions are *mupune (overall).*

At the time of giving woven fabric and shirts to men's families , if the mother of the girls also come together then when the group back home should be given another three goats. This goat is called *ina umene* or *Witi dese bola'.* If when giving ivory time has brought five goats, then the number of goats were given by men's family entirely 8 tails. In the language of Lamaholot expressed as follows, *Witi lema tali' Witi Telo mu* ***mupune*** *witi Buto* (five goats plus three goats more then totally 8 goats). It can be written in the form of the following mathematical sentence, **5 goats + 3 goats = 8 goats.**

Similarly, if initially brought the number of woven fabric there are 4 packs, but by men's family deemed it is not enough then through good communication between two families, the families of women will add it again. Suppose it is delivered again 2 packs of woven fabric, then the total number is 6 packs of woven fabric. In the language of Lamaholot expressed as follows, *kewatek kenabu Paat* ***tali*** *kenabu rua mu* ***mupune*** *kenabu neme* (four packs of woven plus two packs more so altogether become 6 packs of woven fabric). Corresponding mathematics sentence is, **4 packs of woven fabric + 2 packs of woven fabric = 6 packs of woven fabric.**

The last two mathematics sentences illustrate the process of adding two same set. The addition process is accordance with the usual procedure. In the context of this action to add so-called ***tali*** (add more) and the result of the actions referred to ***mupune*** (overall)). It can be said that in everyday life of Adonara people known 2 activity associated with the arithmetic operation of addition in which the action ***pupu*** and ***tali.*** *Pupu* and ***tali*** actions are often found in other activities of custom party.

The number of animals to be cut firstly discussed by family taking into account the number of animals donated to families of men and the number of woven fabric (*kewatek*) donated to the family of women. Subsequently converted into the number of plate as allotments for each contributor to both animal and *kewatek*. Usually one animal was allotted 15 dishes and one sheet of woven fabric or shirt armor allotted 10 plates. Moreover calculated the number of boy of another family were invited to follow the traditional feast.

After a number of dishes entirely known, discussed hereinafter also how many pieces of meat eligible for each plate. Generally, three pieces of meat on each plate is said to have good *(kererhan me'la),* and more than 3 that is 4 or 5 pieces of it have been the best once *(kerehna mela'-mela ').* With the helping of certain commonly estimated the size of the animal and the amount of meat, then it is certain how many animals will be cut.

Counting the number of animals raised in the family of the boy known that a total of 40 animals (goats and pigs), then the number plate of a total of 600 plates. From the calculation of the boys family are invited to know the number of plate is 150 then the traditional party that there will be 750 dishes. Taking into account the remaining animals for traditional party, it was agreed each dish to share as much as 5 pieces of meat. 1 piece of meat the size of approximately 5 cm x 5 cm x thick meat based meat posture itself (about 3-5 cm). A big pig was estimated to be up for 150 plates, and for a big goat was estimated to be up for 60 plates, then for the traditional feast that will cut the animal at least 7 animals consisting of 4 pigs and 3 goats.

In this process found their arithmetic operations as addition, subtraction, multiplication, and division. The number of dishes that in line with the number of animals can be obtained from the summing 15 as much as 40 times or in the form of multiplication written **40 x 15 = 600.** The total plate in a traditional feast was derived from the number plate in accordance with the number of animals and the number of plate in accordance with the number of boys invited then **600 plates + 150 plates = 750 plates .**

Related to the number of pigs and goats to be cut, it was calculated as follows, 1 pig for 150 plates, then two pigs for 300 plates. If the two times of the pig is 4 then it can be for 600 plates. The rest of the plate is 150 so it can be cut three goats. Here it is understood that the three goats for 180 plates so that it can meet even exceed 150 dishes were leftovers. It can be written as:

1 pigs for 150 plates
2 pigs = (1 + 1) pigs for (150 +150) = 300 plate
4 = (2x2) pigs for (2 x 300) = 600 plate
The rest of the plate = 750-600 = 150
1 goats for 60 plates, then 150-60 - 60 = 30, then the goat could be cut as much as three.

From the mathematical sentence as described above, it is clear that there are some arithmetic operations such as addition, subtraction, multiplication, and division.

B. Measuring

Activities associated with measuring especially the length and the large of ivory. The length of ivory measured by fathoms, while large of ivory measured by the great circle formed by the left and right hand span. Measuring instruments used is not a standard measuring tool but uses a part of the body length and span fathoms.

There are three types of length ivory, those are longer than one fathom, ivory length exactly one fathom, and ivory that is less than one fathom. Here, the unit of measurement is the length of fathoms. The Large of ivory can be classified into three groups, namely the ivory more than one circle formed by the left and right span, the ivory magnitude of exactly one circle formed by left and right span, and the ivory is less than one circle formed by the left and right span. Here, the unit of measurement is the length of the span.

The length of ivory is measured by a spokesman or *pehen koda.* By the length, there are some names of ivory in Lamaholot language as follows.

1. *Bala Raine:* ivory length more than one fathom, (1 fathom = length of the tip of right forefinger to the tip of forefinger of the left hand).
2. *Bala Huut:* ivory length exactly one fathom.
3. *Bala Urat Tukan:* ivory length from the tip of right forefinger into the middle of the palm of left hand.
4. *Bala Beeda' Wua':* ivory-length from the tip of right forefinger into the middle part between the wrist and the middle of the palm of left hand.
5. *Bala Meke Nile / Hayon taa ':* ivory-length from the tip of the forefinger right hand to the left wrist.
6. *Bala Kala U 'lin:* ivory length of the forefinger right hand to the left hand in the right place to have a bracelet or a watch.
7. *Bala Kala keteka:* Ivory length of the forefinger right hand to the left hand is approximately 10 cm from the left elbow to the wrist.
8. *Bala sue lodon:* ivory length of the the forefinger right hand to the left hand approximately 5 cm from the left elbow to the wrist or the left elbow and *kala keteke.*
9. *Bala Leku:* ivory length of the forefinger right hand to the left elbow.
10. *Bala Sue:* ivory length from the tip of the right forefinger to the left arm approximately 10 cm above the left elbow
11. *Bala Soru Nabit:* ivory length from the tip of the right forefinger into the base of the left arm.
12. *Bala Tuho Tukan/korok :* ivory length of the right forefinger to the left breast.
13. *Bala Lega korok:* Ivory length from the tip of the right forefinger to mid-chest.
14. *Bala Lima Papa / kepali papa:* ivory length along one arm.

Based on the large of ivory, it is known that some types of ivory size in Lamaholot language known as:

1. *Higi' telo:* ivory size of one circle formed by the left and right hand span plus three fingers ie index finger, middle finger, and ring finger.
2. *Higi' rua:* ivory size of one circle formed by the left and right hand span plus two fingers, namely the index finger and middle finger.
3. *Higi ' kuluk:* ivory size of one circle formed by the left and right hand span plus index finger.
4. *Suda ':* ivory magnitude of exactly one circle formed by the left and right hand span.
5. *Pesok raru:* ivory magnitude of the circle formed by the thumb and the top segment of the index finger of the left and right hand.
6. *Pesok raru rua:* ivory magnitude of the circle formed by the thumb and middle segment of index finger of the left and right hand.
7. *Darap lema:* ivory magnitude of the width of 5 fingers.
8. *Darap Paat:* ivory magnitude of the width of four fingers.

C. Comparing and Sorting

By measuring the length and large of ivory as described previously, there is comparing activity. The length and the large of ivory are determined according to the name in accordance with the measurement results based on the length of fathoms. In general, the length is divided into three namely ivory that are more than one fathom *(bala raine),* exactly one fathom *(bala huut),* and less than one fathom (ranging from *bala urat tukan to bala kepali papa).*

Likewise with the large and the small ivory is determined in accordance with its name after measured by the great of circle formed by the left and right hand span. In general, the large of ivory is distinguished

on 3 ivory namely the large of more than one circle formed by the left and right hand spans *(Higi')*, exactly one circle *(suda')*, and less than one circle *(pesok)*.

Another activity that follows the measurement results is the sorting activity. Giving the name of the appropriate length of ivory sequentially ranging from the longest to the shortest ivory or otherwise. Similarly, the naming of ivory corresponding to the large or magnitude in the order from the biggest to the smallest ivory or vice versa.

V. CONCLUTION

From the above description it can be concluded: *first*, although the Adonara do not have any words to mathematics in their lives, but they have a variety of mathematical knowledge used in the whole process of marriage such as counting, measuring, comparing, estimating, and sorting, which refers to the characteristics of ethnomathematics (Bishop: 1988) all of the above is a mathematical knowledge in the mating process, known as **ethnomathematics in the marriage tradition.** *Second*, in the marriage tradition there are also arithmetic operations such as addition, substraction, multiplication, and division. Related to the addition operations there are two action or activity *pupu* (add up of 2 different subsets) and *tali'* (add up of 2 same subsets). *Third*, the used measuring devices are not standard form those are the length of fathoms and hand span. The measurement results such as the length and the large of ivory are not expressed in numbers quantitatively.

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