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MATHEMATICAL KNOWLEDGE IN NUMBERING ACTIVITIES BY THE TAKPALA INDIGENOUS VILLAGE COMMUNITY

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ABSTRACT

Abstract: The counting activity carried out by the Takpala Indigenous Village community is their way of representing the quantity of a set of goods, counting days and other activities related to counting in daily activities. Activities carried out through the use of the Abui language and sticks. The purpose of this study was to describe the mathematical knowledge contained in counting activities by the Takpala Indigenous Village community. This research is an ethnographic research with the idea that in each region there is different knowledge based on the needs of the community. Based on the result of the study, it was found that in the use of Abui language there was mathematical knowledge in the from base 5 and base 10 sub base 5; and in the use of sticks there are base 10, multiplication 10 and number operation with concept of place values.

INTRODUCTION

There is a direct connection between culture and mathematics. On the one hand, mathematics is derived from culture, while on the other, mathematics serves as a tool for the growth of culture. Until today, technological advancement cannot be dissociated, directly or indirectly, from the application of mathematics. Consequently, mathematics is a component of human culture. This is consistent with Ernest's (1991) assertion that mathematics is a sociocultural construction that cannot be divorced from the history and daily existence of society.

Mathematics (mathematical knowledge) already exists in every culture, whether or not the cultural society is aware of it; this phenomenon became known as "frozen mathematics" (Bishop, 1988; Gerdes). Instinctively, this mathematical knowledge continues to be used and develops as a result of different people's ways of thinking in order to meet the demands of different living environments in each cultural group, long before mathematical knowledge is considered a scientific discipline (Millroy, 1992; Mukhopadhyay & Greer, 2011).

Ethnomathematics was introduced in the early 1980s (Ascher, 1986; D'Ambrosio, 1985) in reference to the primitive culture of society and the mathematical practices of illiterate people. Ascher and D'Ambrosio's ethnomathematical research was first limited because it involved mainly primitive populations. In addition, the definition of culture was broadened to encompass non-primitive societies, such that ethnomathematics is now considered a mathematical practice in culture (D'Ambrosio, 1985).

Ethnomathematics is derived from the Greek terms (ethno), (mathematics), and (tics). Where the term ethnho is interpreted as encompassing the sociocultural framework of a society, including its language, jargon, code of conduct, myths, and symbols. The term mathema often refers to actions such as decoding, measuring, classifying, inferring, and modeling that require explanation, knowledge, and comprehension. The origin of the term tics is techne, and it has the same meaning as technique.

According to Gerdes (2004), ethnomathematics is a branch of study that can expand our understanding of what mathematics is by examining what mathematical concepts and actions comprise in the social lives of particular ethnic groups. This is consistent with Rosa and Orey's (2011) assertion that ethnomathematics investigates the mathematical knowledge found in distinct cultures. Therefore, it may be stated that ethnomathematics relates to a form of mathematical knowledge or activity in various cultures.

In reality, cultures in practically every region of Indonesia are distinct. Consequently, the use of mathematics to satisfy environmental demands varies between locations as a result of variations in local knowledge. In daily life, human activities cannot be separated from the communication-based counting activity. The Takpala Indigenous Village community counts as a means of reflecting the number of a group of items, calculating the days, and engaging in other counting-related daily activities. (Aprilianti, 2017; Sudarwati, 2018) Counting is the mathematical act of calculating the number of items by stating them one by one in order.

Communication is the act of transmitting a message from one individual to another (Panuju, 2018; Rumono, Setyabudi, & Pradekso, 2014). There are two types of communication: verbal communication and nonverbal communication (Nur, 2020). Non-verbal communication is the process of providing communications through items (Wijaya, 2017). Verbal communication is the process of giving messages in writing (written) or verbally (oral).

This study refers to verbal and nonverbal communication in terms of the use of language and other items, respectively (sticks). Humans use spoken and written language to satisfy their social requirements in terms of communicating with others (Koentjaraningrat, 2015). Language is also a fundamental feature of culture because it is used in every area of culture (Devianty, 2017).

In doing ethnomathematical research, language plays a crucial role. This enables researchers to communicate with knowledge holders and study participants at a level and in a setting where they can express themselves in a language they can comprehend, allowing them to contribute their information more freely. This is consistent with Mosimege's (2017) assertion that the majority of cultural community members feel more comfortable expressing themselves in their native language or dialect.

The location of the Takpala Traditional Village is hamlet III Kamengtaha, West Overtime Village, North Central Alor District, Alor Regency, East Nusa Tenggara Province. The terrain is hilly and characterized by dry, arid conditions (Eky, Saragi, Manolas, and Lanata, 2019). This settlement is inhabited by three tribes: the Anweni Tribe, the Tamawat Tribe, and the Marang Tribe, who merged and became known as the Abui Tribe. Which still preserves cultural components such as livelihoods, regional languages, arts, socio-culture, and religious belief systems (Kusmayadi & Vindianingsih, 2018).

The Takpala Traditional Village community was formed with applicable standards and the language of unity was Alor Malay (Alor Dialeg) and Abui Language during the growth of civilization (Sunarti, 2018; Sunarti & Atisah, 2018). In the process of civilizing, the Takpala Traditional Village community generates cultural items with mathematical values and distinct characteristics from those of other regions in the Alor Regency.

Researchers conducted the preliminary investigation by conducting interviews and analyzing how harvested maize is stored based on farming activities. Based on the preliminary study, it was determined that 1 blek (ayakbalekinuku) of corn seeds produced 200 ears of corn (fat'hatangaisahaayouku). In measuring the amount of harvest, the corn bundle is merely a label; what the Takpala Traditional Village community genuinely means is a grouping of corn, as depicted in Figure 1. One bunch of corn includes 100 kernels and is referred to as fat'hatangnuku.

Figure 1. *fat'hatangnuku* (One bunch of corn)

On the basis of early research findings, it can be stated that there is mathematical knowledge in determining the amount of corn collected using the phrase fat'hatangnuku, which refers to a bunch of 100 corns. This knowledge has been practiced in the Takpala Traditional Village for decades. Thus, mathematics can be considered one of the foundations of the Takpala Indigenous Village community's culture. This has motivated academics to characterize mathematical understanding in counting activities in the Takpala Indigenous Village community's daily existence.

METHOD

This was an ethnographic study based on the premise that each location has a distinct body of knowledge that meets the needs of the community. Through interviews with indigenous peoples, researchers obtain data that meets their study requirements.

This investigation consists of three stages. First, prepare by determining the (1) focal point, (2) subject, and (3) place. The second phase of implementation includes (1) data gathering, (2) data reduction, (3) data classification, and (4) data coding. Third, the conclusion phase, which consists of (1) summing up the research findings and (2) offering suggestions for future research.

This study was conducted in the Takpala Traditional Village in the Alor Regency of East Nusa Tenggara. This study's data are derived from interviews concerning counting activities in the usage of regional languages in traditional villages and the use of sticks. The subjects of this study were a traditional leader, and two indigenous community, all of whom were proficient in the Abui native language. Each respondent was interviewed in accordance with the interview rules to obtain data. The data collection procedure started with the following steps: (1) establishing coordination with the local village to gain access to the destination traditional village; (2) observing the destination traditional village and building coordination with the traditional leader; (3) conducting interviews with the traditional leader regarding activities involving the Abui language; (4) making interview notes; and (5) conducting interviews with other indigenous peoples based on recommendations from the traditional leader.

In this study, the principal instrument was the researcher, who was equipped with a guide for conducting interviews and a voice recorder. In this study, the steps of data analysis include (1) interview data collecting, (2) identification of interview data by numbers, (3) classification of interview data by numbers, (4) data coding, (5) data presentation based on numbers, and (6) drawing conclusions.

Checking the validity of the data in this study involved triangulation: (1) theory by comparing the outcomes of data analysis with those of theoretical studies, and (2) specialists following the provided instructions.

RESULTS

The Takpala Indigenous Village community acquires knowledge of numbers from generation to generation based on the ways in which they represent the quantity of a set of goods, count days and other activities related to daily counting activities. The following is a numbering activity carried out by the Takpala Indigenous Village community.

Activities to Say Using the Abui Language

In the daily life of the organized Takpala Indigenous Village community, the unified language used is Abui (regional language) and Alor Malay (Alor dialeg). The use of this language has knowledge of numbers. The knowledge of numbers in question is the ways in which the Takpala Indigenous Village community represents the quantity of a set of goods, counts days and so on. The following table is the knowledge of numbers contained in the use of the Abui language.

Table 1. Knowledge of numbers in number activities using the Abui language

Number	Equivalent Abui language	Number	Equivalent Abui language	Number	Equivalent Abui language
0	taka'	11	karnuku wal-nuku	22	karayouku wal-ayouku
1	nuku	12	karnuku wal-ayouku	23	karayouku wal-sua
2	let's go	13	thanks wal-sua	24	karayouku wal-buti
3	sua	14	karnuku wal-buti	25	karayouku wal-yeting
4	boutique	15	karnuku wal-yeting	26	karayouku wal-talama / karayouku wal-yeting-nuku
5	yeting	16	karnuku wal-talama / karnuku wal-yeting-nuku	27	karayouku wal-yeting-ayouku
6	tala / yeting-nuku	17	karnuku wal-yeting-ayouku	28	karayouku wal-yeti-sua
7	yeting-ayouku	18	karnuku wal-yeti-sua	29	karayouku wal-yeting-buti
8	yeti-sua	19	karnuku wal-yeting-buti	30	karsua
9	yeting-buti	20	karayouku	40	karbuti
10	my love	21	Karayouku wal-nuku	50	karyeting

Numbering Activities Using "sticks"

In addition to using language in counting activities, the Takpala Indigenous Village community also uses sticks . This activity of counting using sticks is the method used by the ancestors to count the number of days that have passed in a month. This calculation is used because the total fingers on the hands and feet are only up to twenty. The following table is an illustration of how the Takpala Traditional Village community counts the days of the month using sticks.

Table 2. Knowledge of numbers in numbering activities using sticks

Illustration of sticks	Corresponding Abui	Number
I	Nuku	1
II	Ayooku	2
III	Sua	3
IIII	Buti	4
IIIIII	Yeting	5
IIIIII	Talama / yetingnuku	6
IIIIIII	Yetingayouku	7
IIIIIIII	Yetisua	8
IIIIIIII	Yetingbuti	9
IIIIIIII	my love	10
IIIIIIII I	Karnuku walnuku	11 = 10 + 1

Illustration of sticks	Corresponding Abui	Number
IIIIIIIII II	Karnuku walayoku	12 = 10 + 2
IIIIIIII III	Karnuku walsua	13 = 10 + 3
IIIIIIIII III	Karnuku walbuti	14 = 10 + 4
IIIIIIII IIIIII	Karnuku walyeting	15 = 10 + 5
IIIIIIII IIIIII	Karnuku waltalama / Karnuku walyetingnuku	16 = 10 + 6
IIIIIIIII IIIIII	Karnuku walyetingayouku	17 = 10 + 7
IIIIIIIII IIIIIIII	Karnuku walyetisua	18 = 10 + 8
IIIIIIIII IIIIIIII	Karnuku walyetingbuti	19 = 10 + 9
IIIIIIIII IIIIIIII	Karayouku	20 = 10 + 10
IIIIIIIII IIIIIIIII IIIIIIIII	Karsua	30 = 10 + 10 + 10
IIIIIIIII IIIIIIIII IIIIIIIII I	Karsua walnuku	31 = 10 + 10 + 10 + 1

DISCUSSION

Based on the results of the study, several findings were obtained related to mathematical knowledge in counting activities using the Abui language and counting activities using sticks. In this section, the findings related to mathematical knowledge in numeracy activities will be discussed.

Activities to Say Using the Abui Language

There is number knowledge in the usage of Abui as the unifying language for the Takpala Indigenous Village group. The figures derived from the use of language in various cultures are not usually identical. In numerous cultures in Central and Eastern Indonesia, for instance, two fundamental numbers are obtained when using the Marind language, whereas ten basic numbers are achieved when using the Lamaholot, Adang, East Makian, Ternate, and Muna languages (Dominikus, 2018; Malik, 2018; Winarti, 2017).

According to Table 1, the Takpala Indigenous Village community employs five fundamental numerals when speaking the Abui language. The numbers range from zero to four, with repetitions of the number occurring beyond five. Table 3 is a table listing the obtained fundamental numbers.

Table 3. List of Basic Numbers in Abui . Language

Abui	Number
taka'	0
nuku	1
let's go	2
sua	3
boutique	4

In addition to the basic numbers, there is also the development of basic numbers based on the mention of the numbers six to nine which is a repetition of one to four by adding the number five in front of it. Table 4 is a list of numbers from five to ten which are equipped with number-forming words and an illustration of the model obtained from number-forming words.

Table 4. Numbers 5 to 10 in Abui

Number	Abui	Forming Words	Model Illustration
5	yeting	yeting	a
6	talama / yeting-nuku	yeting numi nuku	a + 1
7	yeting-ayouku	yeting numi ayouku	a + 2
8	yeti-sua	yeting numi sua	a + 3
9	yeting-buti	yeting numi buti	a + 4
10	my love	my love	b

The terms yeting and karnuku in Table 3 which means five and ten are given the symbols a and b. This symbol is made to form a model illustration of the word forming and is not a base number. Talama or yeting-nuku comes from the words yeting and nuku where yeting means five and nuku means one. The term yeting-nuku means five over one and is symbolized by a + 1. Likewise, seven, eight, and nine are always followed by yeting and then end with ayouku, sua, and buti. Therefore, the numbers in Table 5 are base 5 numbers. Furthermore, the number 5 is symbolized by 10 base 5 and the number 10 can be symbolized by 20 base 5. So based on the existing pattern it is obtained that in the use of the Abui language there are base 5 numbers.

Table 5. Symbols of Numbers in Base Five

Base Number 10	Numbers in Abui	Base 5
0	taka'	0
1	nuku	1
2	let's go	2
3	sua	3
4	boutique	4
5	yeting	10
6	talama / yeting-nuku	11
7	yeting-ayouku	12
8	yeti-sua	13
9	yeting-buti	14
10	my love	20

Furthermore, the numbers after ten have the same denominator structure. Where the connector between tens and units uses the word "wal". The following table exposes the numbers ten to thirty-nine.

Table 6. Mention of Numbers 10 to 39

Number	Abui	Number	Abui	Number	Abui
10	my love	20	karayouku	30	karsua
11	karnuku wal-nuku	21	Karayouku wal-nuku	31	karsua wal-nuku
12	karnuku wal-ayouku	22	karayouku wal-ayouku	32	karsua wal-ayouku
13	thanks wal-sua	23	karayouku wal-sua	33	karsua wal-sua
14	karnuku wal-buti	24	karayouku wal-buti	34	karsua wal-buti
15	karnuku wal-yeting	25	karayouku wal-yeting	35	karsua wal-yeting
16	karnuku wal-talama / karnuku wal-yeting-nuku	26	karayouku wal-talama / karayouku wal-yeting-nuku	36	karsua wal-talama / karsua wal-yeting-nuku
17	karnuku wal-yeting-ayouku	27	karayouku wal-yeting-ayouku	37	karsua wal-yeting-ayouku
18	karnuku wal-yeti-sua	28	karayouku wal-yeti-sua	38	karsua wal-yeti-sua
19	karnuku wal-yeting-buti	29	karayouku wal-yeting-buti	39	karsua wal-yeting-buti

According to the sorts of numbers in the Abui language and the number bases, the Abui numbers have multiple bases. The number six in the Abui language is written as talama / yeting-nuku; it uses base 5 In addition to repetition in the number five, repetition also happens in the number ten, although not because of repetition in the number five; therefore, this number employs base 10 numbers. Due to the presence of both bases in the same number, it may be argued that this number employs base 10 subbase 5. This number is not utilized frequently in mathematics. In mathematics, natural numbers or whole numbers employ Hindu Arabic numbers with a base of 10.

The number base derived from language usage in many cultures is not necessarily the same. For instance, the use of language in a number of cultures in Indonesia is based on the use of the Lamaholot language, the Manggarai language, the Riau Malay language, the Adang language, the Eastern Makian language, the Ternate language, the Nuaulu tribal language, the Muna language and base 5 in the Kowai tribal language, and Tarfina (Dominikus, 2018; Hendrawati, Muttaqin, This diversity demonstrates that each region has a variable population size. As a result, numerous cultures employ numbers distinct from Hindu Arabic numerals.

Based on the basis, base 5 and base 10 differ from one another. In base 5 there are five base numbers, whereas in base 10 there are ten base numbers. The base 10 utilized by the Takpala Traditional Village is distinct from the base 10 utilized by Hindu Arabic numbers. The distinction is seen in the base number. In Hindu Arabic basic numbers, the digits 0 through 9 do not repeat, although the Takpala Traditional Village community numbers do. The following table illustrates the distinctions between Hindu-Arabic and Takpala Traditional Villages base 10 numbers.

Table 7. Differences in base 10 numbers between Hindu Arabic and Kampung Adat Takpala

Base Number 10	The base number of the Takpala Traditional Village is Base 10	
	Abui pronunciation	Model Illustration
0	taka'	0
1	nuku	1

Base Number 10	The base number of the Takpala Traditional Village is Base 10	
	Abui pronunciation	Model Illustration
2	let's go	2
3	sua	3
4	boutique	4
5	yeting	a
6	talama / yeting-nuku	a + 1
7	yeting-ayouku	a + 2
8	yeti-sua	a + 3
9	yeting-buti	a + 4

The base 10 number used by the Takpala Traditional Village community has repetitions that can be seen in the types of numbers 6 to 9. In addition, this number is the number of the Takpala Traditional Village community when the community still uses base 5 numbers. Therefore, in the number base there is another base. The base in question is base 5. This type of number with a double base is also used in other cultures in this world. The use of the dual basis in question is base 20 sub base 10 used by the Yoruba community in Nigeria, base 10 sub base 5 used by the Chinese, Japanese, Kaimana, Manam and Madau islands (Abady, 2013; Dwyer & Minnegal, 2016; Hendrawati et al. al., 2019; Hosking, Ogawa, & Morimoto, 2018; Huylebrouck, 2006; Ng & Rao, 2010; Zaslavsky, 1994).

Numbering Activities Using "sticks"

Based on Table 2, it can be said that this numbering activity using base 10 numbers can be seen based on the number of sticks in grouping multiples of ten. Generally the use of base 10 numbers in various cultures is based on the use of the ten fingers of the human hand (Boyer, 1968) . This corresponds to the use of base 10 by the San Blas Indians who use both hands (Conant, 1896) .

In addition to base 10 numbers, calculations using this stick also pay attention to place values. This is in accordance with the opinion of Sidi, Prabowo, & Subiyanto (2014) that in the use of base 10 numbers there is the use of the concept of place value. For example, the number 15 in the calculation using sticks contains two groups of sticks , where the first group contains 10 sticks as tens and the other group contains 5 sticks as units. Calculations using this stick have an impact on number operations by paying attention to place values. As an example of the method to solve the addition operation 18 + 26 using sticks as follows:

Calculation Using *a stick*

18	= **IIIIIIIII IIIIIIII**	
26	= **IIIIIIIII IIIIIIIII IIIIII**	+
18+26	= (**IIIIIIIII** + **IIIIIIIII IIIIIIIII**) + (**IIIIIIII** + **IIIIII**) = (**IIIIIIIII IIIIIIIII IIIIIIIII**) + (**IIIIIIIII + IIII**) = (**IIIIIIIII IIIIIIIII IIIIIIIII** + **IIIIIIIII**) + **IIII** = **IIIIIIIII IIIIIIIII IIIIIIIII IIIIIIIII IIII** = 44	

or

18	= 10 + 8	
26	= 20 + 6	+
18+26	= (10 + 20) + (8 + 6) = (30) + (10 + 4) = (30 + 10) + 4 = 40 + 4 = 44	

Furthermore, the meaning of the number ten in the calculation using sticks means one bundle consisting of ten sticks. While the meaning of the number one hundred in calculations using sticks means ten bundles with each bundle consisting of ten sticks so it can be said that in calculations using sticks there is also mathematical knowledge in the form of ten multiplication as in Table 8.

Table 8. List of ten times using *sticks* and illustrations

Illustration of sticks	Corresponding Abui	Sum Form	Multiplication Form	Product
IIIIIIIII	my love	10	1 × 10	10
IIIIIIIII IIIIIIIII	karayouku	10 + 10	2 × 10	20
IIIIIIIII IIIIIIIII IIIIIIIII	karsua	10+10+10	3 × 10	30
IIIIIIIII IIIIIIIII IIIIIIIII IIIIIIIII	karbuti	10+10+10+10	4 × 10	40

Illustration of sticks	Corresponding Abui	Sum Form	Multiplication Form	Product
IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII	karyeting	10+10+10+10+10	5×10	50
IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII	kartalama / karyetingnuku	10 + 10 + 10 + 10 + 10 + 10	6×10	60
IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII	karyetingayouku	10 + 10 + 10 + 10 + 10 + 10 + 10	7×10	70
IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII	karyetisua	10 + 10 + 10 + 10 + 10 + 10 + 10 + 10	8×10	80
IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII	karyetingbuti	10+10+10+10+10+10+10+10+10	9×10	90
IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII IIIIIIIIII	my aisahanu	10 + 10 + 10 + 10 + 10 + 10 + 10 + 10 + 10 + 10	10×10	100

CONCLUSION

Based on the results of the discussion as described, it can be concluded that in the counting activities carried out by the Takpala Indigenous Village community there is mathematical knowledge in the form of base 5 numbers, and base 10 sub base 5 in the use of the Abui language and base 10, multiplication 10 and number operations by paying attention to place values in the use of stick.

According to the results, discussion and conclusions, other researchers are advised to conduct in-depth research related to the ethnomathematics of the Takpala Traditional Village. This needs to be done because the mathematics that develops in the Takpala Traditional Village is very unique. This uniqueness can be seen from the findings of the number base and its number operations that pay attention to place values.

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