

# Ethnomathematics In Arfak (West Papua-Indonesia): Numeracy Of Arfak

Haryanto, Toto Nusantara, Subanji, Swasono Rahardjo

**Abstract:** This article discusses ethnomathematics in Arfak indigenous communities. The focus of this research is how to calculate Arfak society in the form of the language of the hatam. The purpose of this study is to know the type of numbers in the language hatam by people in everyday life in the calculation and then look for the addition of algorithms according to the type of number. The method used in this research is ethnography. Next searched the addition of algorithms that match the type of numbers used by the community. The results obtained in this study are the numbers in the language hatam using base number 5-10. Of the numbers obtained, the appropriate summation algorithm is Abacus 4.1.

**Keyword:** ethnomathematics, arfak, numeracy, abacus.

## 1 Introduction

Ethnomathematics is the practice of mathematics in cultural groups. The cultural group referred to them are urban or rural communities, working groups, professional grade, students in groups, indigenous peoples, and other specific groups [1]. Whether consciously or unconsciously, all of the human activities in the world are done based on an appropriate calculation that is suitable to the condition of nature where they live. The research is related to ethnomathematics such as, mathematics in patterned creation in Congo [2], Mathematics in traditional games in Nigeria [3]; calendar system of Indian also has mathematics science that is similar with Mayan ethnic [4]; African mathematics facilitates mathematical concepts [5]. The relation of art and symmetry of geometry in Africa [6], Mathematics science in basket handicraft of muzambi in Southern Africa [7], and Mathematics science in a puzzle game in Nigeria [8]. ethnomathematics is very effective. It can be proved by many studies, such as Orey and Rosa [9], Muzangwa [10], Fyhn [11], Narayanan [12], and Achor [13]. Indonesia is one country in Asia with a population that is multi-cultural. Of the various cultures that exist in Indonesia, the islands of Papua region is an area with many cultures. Papua region is made up of two provinces with more than 200 tribes. This is because the areas in Papua, especially in the interior hinterland is still difficult to reach. Isolation of this area led to the unique insights that develop in any area or inland. One of the unique knowledge is knowledge of math. Arfak Mountains Regency is a division of the district of Manokwari, West Papua Province.

This district includes the rural areas and mountains in West Papua. Because this area is largely mountainous, it is difficult to access by land vehicles. In fact, there are many villages that are only accessible by air or on foot. Limitations that causes areas still isolated from the outside world. Therefore, the cultures of the Mountains Arfak much remains contaminated from the outside world. Ethnomathematics in Papua island has many unique. The following ethnomathematics studies in the area, elasticity token bag due to changes or shifts knot - a knot of yarn cross sections with one another [13]. Arfak society in the determination of the nodes in the framework of the floor and wall frame house centipede own use properties - properties of triangles, these properties are used to calculate the strength, endurance, stability of home [14]. System numeracy Arfak society in hatam language using the base number-5-10 it is different from the mathematics school which uses a base 10 [15]. Aside from the hatam language communities in the count finger motion using only three fingers of one hand [16]. In this article will be explore ethnomathematics of Arfak community about algorithms addition and subtraction of natural numbers that correspond to the type of society Arfak numbers. This needs to be researched for different types Arfak numbers with mathematics in school, especially in Indonesia and the world at large is using Hindu-Arabic numbers. Hindu-Arabic numbers using the base number 10.

## 2 METHODS

The method used in this research is by way of exploration, interviews and literature studies. Exploration and interviews were conducted to obtain numeracy used by the public Arfak. The literature study done by finding numeracy-numeracy which have similarities with numeracy Arfak were then determined how or algorithms in resolving the binary operation. The algorithm searches done by looking at the culture of other regions that have the properties - properties of the same number.

## 3 RESULTS

### 3.1. The number system Arfak on hatam language.

Hatam language is used by people Arfak. The mention of numbers is as follows:

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**TABLE 1. NUMBER IN LANGUAGE HATAM**

Munber	Language Hatam	Ilustrasi Model
0	-	-
1	Kom	1
2	Can	2
3	Mengain	3
4	Betain	4
5	Mui	5
6	Muin da kom	5+1
7	Muin da can	5+2
8	Muin da mengain	5+3
9	Muin da betain	5+4
10	Komnaik	10
11	Komnaik da Kom	10+1
12	Komnaik da Can	10+2
13	Komnaik da Mengain	10+3
14	Komnaik da Betain	10+4
15	Komnaik da Mui	10+5
16	Komnaik da Muin da kom	10+5+1
17	Komnaik da Muin da can	10+5+2
18	Komnaik da Muin da mengain	10+5+3
19	Komnaik da Muin da betain	10+5+4
20	Cannaik	20
21	Cannaik da Kom	20+1
22	Cannaik da Can	20+2
23	Cannaik da Mengain	20+3
24	Cannaik da Betain	20+4
25	Cannaik da Mui	20+5
26	Cannaik da Muin da kom	20+5+1
27	Cannaik da Muin da can	20+5+2
28	Cannaik da Muin da mengain	20+5+3
29	Cannaik da Muin da betain	20+5+4
30	Mengain naik	30
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60	Muinda kom naik	(5+1)10
61	Muin da kom naik da Kom	(5+1)10+1
62	Muin da kom naik da Can	(5+1)10+2
63	Muin da kom naik da Mengain	(5+1)10+3
64	Muin da kom naik da Betain	(5+1)10+4
65	Muin da kom naik da Mui	(5+1)10+5
66	Muin da kom naik da Muin da kom	(5+1)10+5+1
67	Muin da kom naik da Muin da can	(5+1)10+5+2
68	Muin da kom naik da Muin da mengain	(5+1)10+5+3
69	Muin da kom naik da Muin da betain	(5+1)10+5+4

Sources of Haryanto, et.al [16]

Numbers in hatam language above, according to Haryanto et al [15] called numbers with base-5-10. Base-5-10 is the base number with the number 5 with a looping base in 5 and 10. This number is very different from the Hindu-Arabic numbers that use the base-10, the language of Britain as an international language is also using a base-10, and Indonesian as the national language in Indonesia also use base-10.

**3.2 Summation algorithm base 5-10**

Numeracy is not the same as that of the mathematics in general (school mathematics). Consequently Arfak students in performing binary operations experiencing difficulties. As an example:

67+81=....

If using base-5-10 can be written as follows:

67= (5+1)10+5+2  
 81 = (5+3)10+1

horizontally as follows:

67+81 = ((5+1)10+5+2) +((5+3)10+1) =....

Summation vertical algorithm also experienced a long step than using a base-10

67                      (5+1)10+5+2  
 81 +                    (5+3)10+1 +  
 -----  
 .....

Because of these difficulties, addition and subtraction algorithms that can be used in base-5-10 is abacus. Abacus is a calculating tool used by the people of China or Japan (Figure 2). Abacus is a calculating tool-based 5-10.

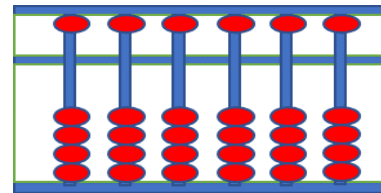


Fig.2. Abacus Haryanto, et.al [15]

Figure 2 below how to count Arfak people using hatam language in the model abacus. In the abacus pieces divided into two groups, namely the upper and lower group. Group on to mention a number five and a lower group to mention a numbers one through four. Figure 3 below how to count people using hatam language in the model abacus. In the abacus pieces divided into two groups, namely the upper and lower group. Group on to mention a number five and a lower group to mention a numbers one through four.

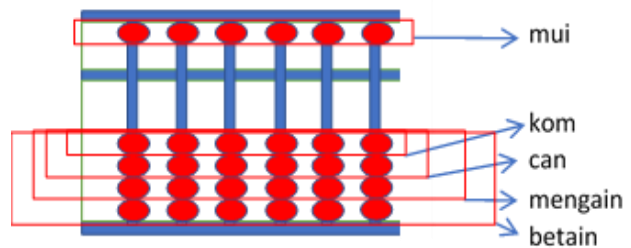


Fig.3. Model numeracy Arfak With Abacus 4.1 [15]

The mention of 67 and 81, and the sum can be seen in Figure 4, Figure 5 and Figure 6 below.

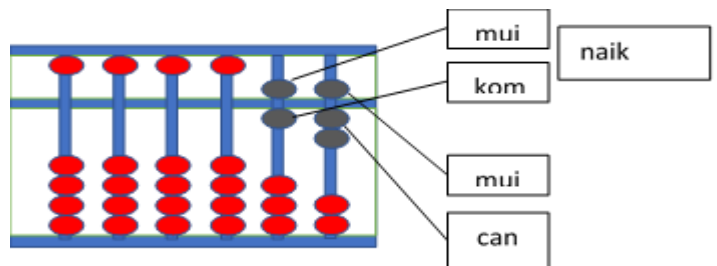


Fig.4. Abacus 4.1 for Number 67 [15]

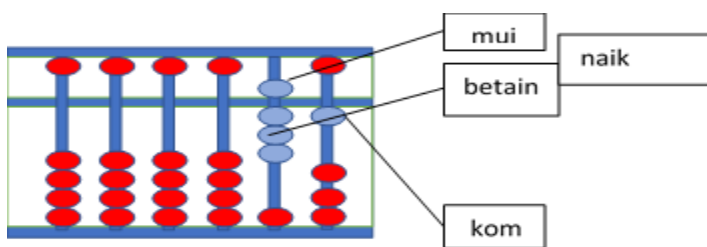


Fig.5. Abacus 4.1 for Number 81 [15]

$$\begin{aligned} 67+81 &= (5+1)10+5+2+(5+3)10+1 \\ &= (10)10+(4)10+5+3 \\ &= 100+40+5+3 \\ &= 148 \end{aligned}$$

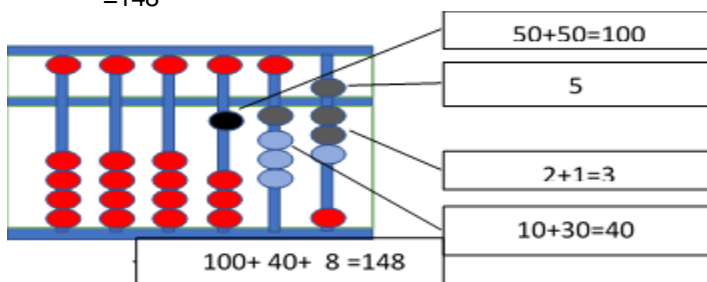


Fig.6. The summation using the abacus 4.1. [15]

## 5. CONCLUSION

The number used by Arfak is very unique, it can be seen that the language of hatam (the language of Arfak region) using base number 5-10. This type of number is different from the hindu-arabic number used in schools. Types of numbers with base 5-10 are also used in Japanese culture. In Japanese culture that uses that number on the abacus. Because the abacus is a tool for counting (for example, addition and subtraction), the use of abacus in number operations and less suitable for Arfak children. In this article the use of Abacus 4-1 in Arfak's children has not been tested. Therefore, further research is required to test the abacus in Arfak - West Papua - Indonesia.

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