

Ethnomathematics in Javanese death commemoration

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ABSTRACT

In Java, there is a tradition called death commemoration. In Javanese society, death commemoration consists of *geblag* (commemoration after funeral), commemoration at 3rd day of the death, 40th day of the death, 100th day of the death, 1 year, 2 years, and 1000th day of the death. This research is a descriptive research. It used ethnography method. The data was collected by interview, observation, and literature study. The result said that to decide the day and *pasar* of death commemoration, it is need to use modulo concept. We used modulo 7 to decide the day, because there are seven days in a week and to decide the *pasar* we used modulo 5 because there are five *pasars*. It means that death commemoration tradition in Javanese society applied mathematical concept. Then, death commemoration tradition in Javanese is a part of ethnomathematics.

Keywords: ethnomathematics, death commemoration, modulo, arithmetica

INTRODUCTION

Indonesia is a nation that is rich in culture. It is because Indonesia consists of various ethnic groups. One of the ethnic groups in Indonesia is the Javanese. What is meant by "Javanese" are: 1) People who speak Javanese, who are still rooted in the culture and way of thinking as found in the interior of Java, from the west of Yogyakarta to the Kediri area to the east; and 2) which at the same time does not explicitly seek to live on the basis of the Islamic religion (Magnis-Suseno, 1984). Javanese society is a living unit of Javanese people who interact according to a system of customs, norms, and Javanese cultural systems that are continuous, and which are bound by a shared identity, namely the Javanese (Siswanto, 2010).

Javanese society is rich in various kinds of culture. One form of Javanese culture is the death commemoration tradition. This tradition has been mixed with Islamic values and called this

tradition as *tahlilan*. The Javanese calendar uses the day and also *pasaran*. *Pasaran* is a Javanese day which consists of only 5 days, namely *kliwon*, *legi*, *pahing*, *pon*, and *wage*. The term used is *pasaran* (market) because each of these names is used as a name to determine the opening of the market (Rizaluddin et al., 2021). Death commemoration time uses days and *pasaran*. Determination of the day and *pasaran* for the death commemoration event is using arithmetic concepts.

The description shows that culture has a relationship with mathematics. The relationship between mathematics and culture is referred to as ethnomathematics. Ethnomathematics was introduced by D'Ambrosio, a Brazilian mathematician in 1977 (Zayyadi & Durroh, 2019). Ethnomathematics is mathematics that is practiced by certain identifiable cultural groups, such as ethnic groups, labor groups, children of certain age groups and professional classes (D'Ambrosio, 1985). Furthermore, D'Ambrosio stated that the aim of ethnomathematics is to recognize that there are different ways of doing mathematics taking into account academic mathematics developed by different walks of life and taking into account the different steps in which different cultures negotiate their mathematical practice (how to classify, counting, measuring, designing buildings or other play equipment). Determination of the day and the market for the death commemoration event by using mathematical concepts is an example of ethnomathematics. Therefore, it is necessary to discuss how to calculate the day and market determination for the death commemoration by using mathematical concepts.

METHOD

The method used in this research is an ethnographic method. This study uses an ethnographic method because this research is related to a certain culture, namely the culture of the Javanese people. Ethnographic research methods are considered capable of digging in-depth information with broad sources. Data was collected by interview and literature study. Observation and interviews were conducted with the people of Sumurjomblangbogo village in Pekalongan Regency. Interviews were conducted in depth. Based on Alangui, there are four generic questions in ethnomathematical research. They are where to look, how to look, what it is, and what it means. The framework is presented in Table 1.

RESULTS AND DISCUSSION

One form of Javanese culture is the tradition of death commemoration. Tradition is the process of inheriting or passing on norms, customs, rules, assets (van Paursen, 1988). The passing

can be changed, lifted, rejected and combined with a variety of human actions. The tradition of commemoration is carried out every time someone dies and is carried out by the bereaved family.

Table 1. The Framework of Ethnomathematics Study

Generic questions	Initial Answers	Critical Construct	Specific Activity
Where to look	Cultural practices in determining the days dan <i>pasaran</i> for death commemoration	Culture	Analysis of document and conduct interviews with elder
How to look	Investigating qualitative and relational aspects of the determining the days and <i>pasaran</i> for death commemoration	Alternative thinking	Determine what ideas are contained in determining the days dan <i>pasaran</i> for death commemoration
What it is	Proof of alternative concept	Philosophical mathematics	Identifying criteria to justify the rules of determining the days and <i>pasaran</i> for death commemoration
What it means	Important for culture and mathematics	Anthropology	Describing the relationship between mathematics and culture by writing mathematical model of the day and <i>pasaran</i>

According to Sholikhin (Sholikhin, 2010), the tradition of commemorating death in Java comes from the socio-religious tradition of the Muslim Campa people (inhabiting the South Vietnam area until they were expelled around 1446 and 1471 AD). Bratawdjaja stated that broadly speaking, the death commemoration procession consists of eight activities, namely (1) *geblag* or commemoration after burial, (2) *nelung dina* or 3rd day death commemoration, (3) *mitung dina* or 7th day death commemoration, (4) *matang puluh* or 40th day death commemoration, (5) *nyatus dina* or 100th day death commemoration, (6) *mendak sepisan* or commemoration after one year of death, (7) *mendhak pindho* or commemoration after two years of death, and (8) *nyewu* or 1000th day death commemoration (Aufa, 2017).

The calculation of the day of commemoration starts from the moment the deceased dies, not from the time he is buried. Therefore, the seven-day salvation is carried out on the seventh day of death or six days after the day of death, the 40-day salvation is carried out 39 days after the day of

death, the 100-day salvation is carried out 99 days after the death day, the 1000-day salvation is carried out 999 days after the death day.

Based on the results of an interview with one of the people in the village of Sumurjomblangbogo, the death celebration is usually filled with reading prayers and verses from the Koran which is commonly referred to *tahlilan*. The funeral ceremony began with the bereaved family inviting neighbors and relatives to attend the funeral. Neighbors and relatives who were invited to take part in the commemoration event were male. Meanwhile, female neighbors or relatives can help in the kitchen. The event ended with the distribution of blessings (food) for the invitees who took part in the salvation event.

In the Javanese calendar, *pasaran* consists of *legi*, *pahing*, *pon*, *wage*, and *kliwon*. Meanwhile, in a week there are seven days, namely Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday. In mathematics, there is a concept namely modulo. If a and b are integers, then $a \equiv b \pmod{m}$ if and only if there is an integer k such that $a = b + km$ (Rosen, 2011). In division algorithm, we called b as remainder with $0 \leq b < m$. There are five *pasaran*, so modulo 5 is used to determine the *pasaran*. Therefore, to determine the day of commemoration, modulo 7, is used. The order of the day and *pasaran* must be considered. The order is always the same and rotates according to the order. The form of the calendar that contains the day as well as the *pasaran* can be seen in Figure 1.



Figure 1. Calendar
(source: kumparan.com)

The 7th day of the death

The 7th day death commemoration is held on the seventh day of death or on the 6th day after death. Therefore, the determination of the 7th day of death commemoration is $6 \equiv 6 \pmod{7} \equiv -1 \pmod{7}$. This result means that the 7th day death commemoration falls on 6 days after the day of death or on one day before the day of death. Meanwhile, the determination of the 7th day in *pasaran* is $6 \equiv 1 \times 5 + 1 \pmod{5} \equiv 1 \pmod{5}$. The 7-day salvation falls on 1 *pasaran* after the *pasaran* at the time of death. For example, if someone dies on *pahing* Thursday, the 7th day death commemoration will be held 1 day before Thursday, namely Wednesday and on 1 *pasaran* after *pahing*, namely *pon*. So, if someone dies on *pahing* Thursday then the 7th day death commemoration will be carried out on *pon* Wednesday.

The 40th day of the death

The 40th day death commemoration is held on 39 days after death. Days and *pasaran* for 40th day death commemoration consecutively are $39 \equiv 7 \times 5 + 4 \pmod{7} \equiv 4 \pmod{7}$ and $39 \equiv 5 \times 7 + 4 \pmod{5} \equiv 4 \pmod{5} \equiv -1 \pmod{5}$. This means that the 40th day death commemoration will fall on 4 days after the day of death and 4 *pasaran* after the death *pasaran* or 1 *pasaran* before the death *pasaran*. For example, if someone dies on *pon* monday then the 40th day death commemoration will be held on Friday, which is 4 days after Monday and on the *pahing*, which is 1 *pasaran* before the death *pasaran*.

Nyatus (The 100th day of the death)

The 100th day death commemoration is held on 99 days after death. The determination of the day and *pasaran* of *nyatus* respectively are $99 \equiv 7 \times 14 + 1 \pmod{7} \equiv 1 \pmod{7}$ and $99 \equiv 5 \times 19 + 4 \pmod{5} \equiv 4 \pmod{5} \equiv -1 \pmod{5}$. These mean that the commemoration will fall on one day after the day of death and on one *pasaran* before the *pasaran* death. For example, if someone dies on *kliwon* Thursday then *nyatus* will be held on Friday, which is one day after Thursday and on the *wage*, which is one *pasaran* before the *kliwon*.

Mendak pisan (one year after death)

In the Javanese calendar, one year consists of 354 days or 355 days. Therefore, the determination of the day in *mendak pisan* is $353 \equiv 7 \times 50 + 3 \pmod{7} \equiv 3 \pmod{7}$ or $354 \equiv 7 \times 50 + 4 \pmod{7} \equiv 4 \pmod{7}$. Meanwhile, the *pasaran* determination for *mendak pisan* is $353 \equiv 5 \times 70 + 3 \pmod{5} \equiv 3 \pmod{5} \equiv -2 \pmod{5}$ or $354 \equiv 4 \times 71 + 4 \pmod{5} \equiv 4 \pmod{5} \equiv -1 \pmod{5}$. These results mean that *mendak pisan* will fall on 3 days after the day of death or 4 days after the day of death and in three *pasaran* after the death *pasaran* or in one *pasaran* before the death *pasaran*. For example, if

someone dies on *pahing* thursday then *mendak pisan* will be held three days after Thursday, that is sunday and on three *pasar* after *pahing*, that is *kliwon*. If in that year there are 355 days, then *mendak pisan* will be held on four days after Thursday, that is monday and on one *pasar* before *pahing*, that is *legi*. So if someone dies on *pahing* Thursday *mendak pisan* will be carried out on *kliwon* Sunday or *legi* monday.

Mendak pindho (two years after death)

Since one year in javanese calender consists of 354 or 355 days, then *mendak pindho* commemoration is carried out on 707 days of death or 708 days of death if it passes a leap year. The determination of the day for *mendak pindho* commemoration is $707=7\times 101(\text{mod } 7)=0(\text{mod } 7)$ or $708=7\times 101+1(\text{mod } 7)=1(\text{mod } 7)$. Meanwhile, the *pasar* determination for *mendak pindho* commemoration is $707=5\times 141+2(\text{mod } 5)=2(\text{mod } 5)$ or $708=5\times 141+3(\text{mod } 5)=3(\text{mod } 5)=-2(\text{mod } 5)$. These results mean that the salvation *mendak pindho* will fall on the same day as the day of the death or one day after the day of death and on two *pasarans* after the *pasar* death or on three *pasarans* after the *pasar* death. For example, if someone dies on *kliwon* Thursday then *mendak pindho* will be held on Thursday because it is the same day as the death day and on two *pasarans* after *kliwon* that is *pahing*, then *mendak pindho* will be held on *pahing* thursday. If it passes a year that have 355 days, then *mendak pindho* will be held on Friday because it is one day after the death day and on three *pasarans* after *kliwon* that is *pon*, then *mendak pindho* will be held on *pon* friday.



Figure 2. Death Commemoration

Nyewu (The 1000th day of the death)

Determination of the day and *pasaran* for the *nyewu* salvation respectively are $999=7 \times 142+5 \pmod{7}=5 \pmod{7}=-2 \pmod{7}$ and $999=5 \times 199+4 \pmod{5}=4 \pmod{5}=-1 \pmod{5}$. Based on these results, *nyewu* will be held on 5 days after the day of death or on two days before the day of death and on four *pasarans* after the death *pasaran* or one *pasaran* before the death *pasaran*. For example, if someone dies on *legi* Wednesday, *nyewu* will be held on Monday, which is two days before Wednesday and at the *kliwon*, which is one *pasaran* before *legi*.

The following is an example of determining the day and *pasaran* for each death commemoration if someone dies on *kliwon* Friday.

Table 2. Example of Determining the Day of Commemoration

Type	Commemoration day
The 7 th day of the death	<i>Legi</i> Thursday
The 40 th day of the death	<i>Wage</i> Tuesday
The 100 th day of the death	<i>Wage</i> Saturday
<i>Mendhak pisan</i>	<i>Pon</i> Monday or <i>wage</i> Tuesday
<i>Mendhak pindho</i>	<i>Pahing</i> Friday or <i>pon</i> Saturday
<i>Nyewu</i>	<i>Wage</i> Wednesday

In summary, the formula for the day of death commemoration can be seen in Table 3.

Table 3. Formula for Death Commemoration Day

Type	Calculation	Commemoration day
The 7 th day of the death	$6=6 \pmod{7}=-1 \pmod{7}$	Day-1=day+6
The 40 th day of the death	$39=7 \times 5+4 \pmod{7}=4 \pmod{7}$	Day+4
The 100 th day of the death	$99=7 \times 14+1 \pmod{7}=1 \pmod{7}$	Day+1
<i>Mendhak pisan</i>	$353=7 \times 50+3 \pmod{7}=3 \pmod{7}$ or $354=7 \times 50+4 \pmod{7}=4 \pmod{7}$	Day+3 or Day+4
<i>Mendhak pindho</i>	$707=7 \times 101 \pmod{7}=0 \pmod{7}$ or $708=7 \times 101+1 \pmod{7}=1 \pmod{7}$.	Day or Day+1
<i>Nyewu</i>	$999=7 \times 142+5 \pmod{7}=5 \pmod{7}=-2 \pmod{7}$	Day+5=Day-2

Meanwhile, the formula for *pasaran* of death commemoration can be seen in Table 4.

Table 4. Formula for Death Commemoration *Pasaran*

Type	Calculation	Commemoration day
The 7 th day of the death	$6=1 \times 5+1 \pmod{5}=1 \pmod{5}$	<i>Pasaran</i> +1
The 40 th day of the death	$39=5 \times 7+4 \pmod{5}=4 \pmod{5}=-1 \pmod{5}$	<i>Pasaran</i> -1
The 100 th day of the death	$99=5 \times 19+4 \pmod{5}=4 \pmod{5}=-1 \pmod{5}$	<i>Pasaran</i> -1
<i>Mendhak pisan</i>	$353=5 \times 70+3 \pmod{5}=3 \pmod{5}$ or $354=4 \times 71+4 \pmod{5}=4 \pmod{5}$	<i>Pasaran</i> +3 or <i>Pasaran</i> +4

<i>Mendhak pindho</i>	$707=5 \times 141 + 2 \pmod{5} = 2 \pmod{5}$ or $708=5 \times 141 + 3 \pmod{5} = 3 \pmod{5} = -2 \pmod{5}$	<i>Pasaran</i> +2 or <i>Pasaran</i> +3
<i>Nyewu</i>	$999=5 \times 199 + 4 \pmod{5} = 4 \pmod{5} = -1 \pmod{5}$	<i>Pasaran</i> -1

CONCLUSION

The tradition of death commemoration in Java consists of (1) *geblag* or commemoration after burial, (2) *nelung dina* or commemoration of three days of death, (3) *mitung dina* or commemoration of seven days of death, (4) *matangpuluh dina* or commemoration of 40 days of death, (5) *nyatus dina* or commemoration for 100 days of death, (6) *mendak pisan* or commemoration for one year of death, (7) *mendhak pindho* or commemoration for two years of death, and (8) *nyewu* or salvation for 1000 days of death. The Javanese calendar uses the day and also *pasaran*. *Pasaran* is a Javanese day which consists of only 5 days, namely *kliwon*, *legi*, *pahing*, *pon*, and *wage*. The order of the day and *pasaran* is always the same and it rotates according to the order. So, to determine the day and *pasaran* for death salvation, modulo 7 and modulo 5 are used, respectively. Modulo 7 is used to determine the day of death. Meanwhile, modulo 5 is used to determine the death *pasaran*.

The 7th day of death (*mitung dina*) falls on 1 day before the day of death and 1 *pasaran* after the *pasaran* of the death. The 40th days of death falls on 4 days after the day of death and 1 *pasaran* before the *pasaran* of death. The 100th day of the death falls on 1 day after the day of death and 1 *pasaran* before the death *pasaran*. *Mendak pisan* (one year death commemoration) falls on three days after the death day and three *pasaran* after the death *pasaran* or on four days after the death day and one *pasaran* before the death *pasaran*. *Mendhak pindho* (two years death commemoration) falls on the same day as the death day and two *pasarans* after the death *pasaran* or on one day after the death day and three *pasaran* after the death *pasaran*. While *nyewu* falls on 2 days before the death day and 1 *pasaran* before the death *pasaran*.

Suggestion

The existence of Javanese culture in the form of a death salvation tradition which is a form of ethnomathematics can be used by teachers in schools as an example of the application of mathematics in life and used to organize fun mathematics learning.

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