

## An Ethnomathematics Study on the Javanese Astrology

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### Abstract

Ethnomathematics in astrology is an intellectual property inherited by human ancestors today, but in school how mathematics was discovered and created in the process humans understand life and the universe is often not mentioned, but rather in schools given mathematical products completed in the form of formulas, theorems and structures abstrak. This often makes it difficult for students to understand mathematics and consider mathematics to be far from the reality of their lives. This study aims to explore ethnomathematics in Javanese astrology in the form of predictions of fate that are currently still used and trusted by the Javanese people to predict their fate in the future. The study used ethnography to explore ethnomathematics in Javanese astrology. The data on the study was collected with literature, photo and video documentation, interviews and field records. The data is then analyzed with descriptive analysis and presented in the form of narrative reports. In this study found ethnomathematics in predictions of fate in the Javanese Book which contains the mathematical values of modulo 7, modulo 8, modulo 9, and arithmetic of number operations. The results of this study are expected to contribute science in the field of mathematics and mathematics education and can be a reference for teachers and researchers to develop learning that uses the context of Javanese astrology that is close and familiar with the daily life of students, especially students in Java.

**Keywords:** Fate Prediction, Javanese Astrology, Ethnomathematics, Modulo, Arithmetics

### Abstrak

Ethnomathematics dalam astrologi adalah kekayaan intelektual yang diwarisi oleh nenek moyang manusia saat ini, tetapi di sekolah bagaimana matematika ditemukan dan diciptakan dalam proses manusia memahami kehidupan dan alam semesta sering tidak disebutkan, melainkan di sekolah-sekolah yang diberikan produk matematika yang diselesaikan dalam bentuk rumus, teorema dan struktur abstrak. Hal ini sering membuat sulit bagi siswa untuk memahami matematika dan menganggap matematika jauh dari realitas kehidupan mereka. Penelitian ini bertujuan untuk mengeksplorasi ethnomathematics dalam astrologi Jawa dalam bentuk prediksi nasib yang saat ini masih digunakan dan dipercaya oleh masyarakat Jawa untuk memprediksi nasib mereka di masa depan. Studi ini menggunakan etnografi untuk mengeksplorasi ethnomathematics dalam astrologi Jawa. Data tentang penelitian ini dikumpulkan dengan literatur, dokumentasi foto dan video, wawancara dan catatan lapangan. Data kemudian dianalisis dengan analisis deskriptif dan disajikan dalam bentuk laporan naratif. Pada penelitian ini ditemukan ethnomathematics dalam prediksi nasib yang berisi nilai matematika modulo 7, modulo 8, modulo 9, dan aritmatika operasi bilangan. Hasil penelitian ini diharapkan dapat memberikan kontribusi ilmu pengetahuan di bidang pendidikan matematika dan matematika serta dapat menjadi referensi bagi guru dan peneliti untuk mengembangkan pembelajaran yang menggunakan konteks astrologi Jawa yang dekat dan akrab dengan kehidupan sehari-hari siswa, khususnya siswa daerah Jawa.

**Kata Kunci:** Prediksi Nasib, Astrologi Jawa, Ethnomathematics, Modulo, Aritmetika

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## Introduction

Humans living in this world cannot be separated from the universe, living humans are fused with the earth, sun, planets, stars and others that exist in the universe (Chopra & Kafatos, 2017). Since 25,000 years ago when humans were still living in caves, humans have been trying to understand about themselves and the universe or so-called astrology (Boland, 2016). This is seen from the reliefs on the caves and bones that show the calculation of the lunar cycle, earth cycle, seasons and others. Then in the 30th century BC many human civilizations such as Mesopotamian civilization, Greek civilization,

Egyptian civilization, Maya civilization, Javanese civilization and others developed a fairly complex understanding of astrology that then builds beliefs, myths and predictions in their culture (Boland, 2016).

Human civilizations in understanding astrology have used and developed their own mathematical ideas, ways and techniques such as in calculating lunar cycles, calculating earth cycles, making predictions of seasons, making predictions of fate and others (Monteferrante, 2011). According to D'Ambrosio (1985), mathematical ideas, ways and techniques that have been used and developed by a particular civilization or culture are called ethnomathematics. This means that every human civilization used their ethnomathematics in establishing astrology. Including the Javanese civilization in building their own Javanese astrology ethnomathematics even long before formal mathematics entered the mareka civilization (Prahmana, Yuniarto, Rosa and Orey, 2021). Until now javanese astrology is still preserved and used by javanese people such as pranatamangsa or prediction of the seasons to determine agricultural activities, day calculations and birth markets to determine the day either for, weton calculation or birthday to determine a good direction day to build a house and others (Prahmana, Yuniarto, Rosa and Orey, 2021; Umbara, Wahyudin & Prabawanto, 2021; Budrisari, 2014).

Ethnomathematics in astrology is an intellectual property inherited by ancestors to humans in the present day, but in school how mathematics is found and created in the process of humans understanding life and the universe is often not mentioned, instead in school given the finished mathematical products in the form of formulas, theorems and abstract structures (Risdiyanti & Prahmana, 2020). This often makes it difficult for students to understand mathematics and consider mathematics far from the reality of their lives (Muhtadi, Sukirwan, Warsito & Prahmana, 2017; Rosa & Orey, 2016; Risdiyanti, Prahmana & Shahrill, 2019). Therefore, this study aims to explore ethnomathematics in Javanese astrology in the form of predictions of fate that are currently still used and trusted by the javanese people to predict their fate in the future. This research takes a role in completing research on ethnomathematics in Javanese astrology that has been studied by Prahmana, Yuniarto, Rosa & Orey (2021) on ethnomathematics in Javanese astrology in the form of pranatamangsa and predictions of the anniversary of birth and death, Utami, Sayuti & Jailani (2019) about ethnomathematics in Javanese astrology in the form of Javanese primbon, Syahrin (2015) on ethnomathematics in Javanese astrology in the form of aboge calendar of West Java, And others. The results of this study are expected to contribute science in the field of mathematics and mathematics education and can be a refeensi for teachers and researchers to develop learning that uses the context of Javanese astrology that is close and familiar with the daily life of students, especially students in java.

## **Methods**

The ethnomathematics study uses an ethnographic method referring to Geertz. Understanding

culture relies on positive logic and involves interpreting the various components that contribute to cultural meaning. Therefore, the meaning of culture is interpretive; culture is seen as a text that needs to be interpreted rather than as a concrete pattern of behavior (Fenn & Geertz, 1974). This method was chosen because it is precise and effective for exploring ethnomathematics on prediction of fate in Javanese astrology. The data on the study was collected with literature, photo and video documentation, interviews and field records. The data is then analyzed with descriptive analysis and presented in the form of narrative reports.

To insights culture into the ethnomathematics perspective, we must enter into mathematics as an entirely social world rather than a world of forms, signs, symbols, imagination, intuition, and reason (Restivo, 1994). So that, we do an exploration of cultural values by referring to the framework of Alangui's ethnomathematics study, which is carried out through 4 questions, namely where to start looking, how to look, how to recognize that you found something significant, and how to understand what it is (Alangui, 2010). In the "where to start looking" stage, we conducted interviews with people who had this knowledge, namely Mbah Kalam, one of the traditional elders in Java, and conduct document studies, namely Javanese books. We do the "how to look" stage by determining the ideas of quantitative, relational and spatial aspects that are embedded in these cultural practices. The stage of "how to recognize that you found something significant" we do by identifying whether the cultural practice is a concept or practice as mathematics. The stage of "how to understand what it is" is carried out by describing two forms of cultural and mathematical knowledge from that culture, and if possible new mathematics can be described.

## Results and Discussion

### *Fate Prediction in Javanese Elder*

Interviews conducted with Mbah Kalam, an elder in Java, obtained information that prediction of fate is the basis of a relationship with life's destiny. Determine the future of humans can be done based on the number of birth *neptu* a person, a person's name, and others. Based on the results of interviews with traditional elders about the prediction of fate:

Sri, lungguh, gedong, loro, pati. The first is *Sri*, which means many friends. It can for the marriage match. *Lungguh* is power. It can for position, matchmaking also includes life. *Gedong* is lux house. *Loro* is sick, but it does not have to be physically sick, concerned, patient. *Pati* is ide. It can be difficult to have offspring, no child, difficult to find fortune, divorce, sticks. (interview, Friday, March 15, 2019, 10:36:57 AM).

The results of the interview show that Javanese people still use prediction to see the fate of humans. Furthermore, variations in the predictions of the Javanese people are more fully contained in the Javanese book.

### Fate Prediction in Javanese Book

Predictions of human fate are also found in Javanese books. In this Javanese book, there are various types of forecasts about the future. The variation in this type of prediction is due to the fact that the Javanese book is a collection of prophetic notes, which are compiled into one book. The recorded forecast is recorded based on several sources, which are compiled into one. The notes were originally recorded in palm leaf sheets, which were recorded based on habits or previous occurrences, so there were various variations. Between one prophecy and another prophecy have their respective followers. However, today this prediction is rarely used by modern Javanese. In this fate prediction, the prediction of human fate is described based on the *neptu* of the day and *pasaran* at birth.

### Fate Prediction I

In fate prediction I, we reveal the fate prediction based on the Javanese book on note number 104. Forecasting the fate of this *primbon* number is done by adding up the *neptu* days and markets at birth, then dividing it 7. The remainder of the division is used as a tool for forecasting. The remainder of the division and its meanings are presented in Table 1.

Table 1. Fate Prediction I

Remainder	Fate
1	<i>Segarawasesa</i> (whatever he/she does, it good and have much luck)
2	<i>Tunggaksemi</i> (much luck)
3	<i>Satriyawibawa</i> (always get coziness)
4	<i>Sumursinaba</i> (noble)
5	<i>Bumikapetak</i> (suitable to be a farmer)
6	<i>Satriyawirang</i> (problematic)
7	<i>Lebukatiyupangin</i> (destitute)

The *Petung* in Javanese book no 104 uses *neptu* day as follows: Friday = 1; Saturday = 2; Sunday = 3; Monday = 4; Tuesday = 5; Wednesday = 6; Thursday = 7. *Pasaran* neptu used: *Kliwon* = 1; *Legi* = 2; *Pahing* = 3; *Pon* = 4; *Wage* = 5. Examples of combat performed, for example born on Sunday *Wage*, Sunday = 3, and *Wage* = 5, then  $\frac{3+5}{7} = 1$  remainder 1. The remaining 1 means *sagarawasesa* which means whatever he / she does, it good and have much luck.

### Fate Prediction II

In fate prediction II, we reveal fate prediction based on the Javanese book on note number 106.

Forecasting the fate of this *primbon* number is done by adding up the *neptu* days and markets at birth, then dividing 9. The remainder of the division is used as a tool for forecasting. The remainder of the division and its meanings are presented in Table 2.

**Table 2.** Fate Prediction II

Remainder	Fate
1	<i>Dangu watu</i> (always happy, never hardships)
2	<i>Jagur macan</i> (bad luck and lots of enemies)
3	<i>Gigis bumi</i> (feared because of his arrogance)
4	<i>Keterangan srengenge</i> (unlucky, and despite have power but impoverished)
5	<i>Nohan rembulan</i> (lots of luck)
6	<i>Wogan ulet</i> (poor)
7	<i>Tulus banyu</i> (well, whatever's done)
8	<i>Wurung geni</i> (wretched)
9	<i>Dadi kayu</i> (loved by power person, always lucky)

### Fate Prediction III

In this fate prediction III, we reveal the fate prediction based on the Javanese book on note number 107. Forecasting the fate of this *primbon* number is done by adding the *neptu* days and *pasaran* at birth, then dividing by 8. The remaining division is used as a tool for forecasting. The remainder of the division and its meanings are presented in Table 3.

**Table 3.** Fate Prediction III

Remainder	Fate
1	<i>Giruron keringan</i> (respected)
2	<i>Dur raben apesan</i> (cheat, polygamy and often get unfortunate)
3	<i>Nglampra mblaur</i> (often move, where he lives is uncertain)
4	<i>Brama panan</i> (greedy)
5	<i>Kuat menangan</i> (strong, often win in many ways)
6	<i>Cantula</i> (bad character)
7	<i>Punjul</i> (always overreacting)
8	<i>Ilmu, lantipan</i> (smart, good at everything)

An example of the calculation for people born Thursday *Pahing*. Thursday's *neptu* is 8, and *Pahing*'s *neptu* is 9, so the calculation  $\frac{(8 + 9)}{8} = \frac{17}{8} = 2$  leaves 1, meaning dry *Ginuron*. As another example,

people are born on Tuesday *Wage*, so the *neptu* of Tuesday is 3, and the *neptu* of *wage* is 4. The calculation is  $\frac{(3 + 4)}{8} = \frac{7}{8}$ . The remainder of the calculation is 7, which means the *punjul*.

#### Fate Prediction IV

In fate prediction IV, we reveal the fate prediction based on the Javanese book on note number 117. Forecasting the fate of this *primbon* number is done by adding up the *neptu* day and market at birth, which means it is presented in Table 4.

**Table 4.** Fate Prediction IV

Sum	Astrology
7	<i>Mijan Star</i> The lucky day is on Saturday in the month of <i>Besar</i> . The unlucky day is on Friday in the month of <i>Rejeb</i> .
8	<i>Arab Star</i> The lucky day is on Wednesday in the month of <i>Ruwah</i> . The unlucky day is on Tuesday in the month of <i>Mulud</i> .
9	<i>Kukus Star</i> The lucky day is on Thursday in the month of <i>Pasa</i> . The unlucky day is on Wednesday in the month of <i>Sawal</i> .
10	<i>Jadi Star</i> The lucky day is on Wednesday in the month of <i>Mulud</i> . The unlucky day is on Saturday in the month of <i>Sawal</i> .
11	<i>Dalu Star</i> The lucky day is on Friday in the month of <i>Dulkaidah</i> . The unlucky day is on Tuesday in the month of <i>Jumadilakir</i> .
12	<i>Kuda Star</i> The lucky day is on Thursday in the month of <i>Besar</i> . The unlucky day is on Tuesday in the month of <i>Rejeb</i> .
13	<i>Asma Star</i> The lucky day is on Sunday in the month of <i>Sawal</i> . The unlucky day is on Saturday in the month of <i>Ruwah</i> .
14	<i>Sur Star</i> The lucky day is on Wednesday in the month of <i>Sapar</i> . The unlucky day is on Saturday in the month of <i>Ruwah</i> .

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15	<i>Jun Star</i> The lucky day is on Sunday in the month of <i>Rabingulawal</i> . The unlucky day is on Wednesday in the month of <i>Pasa</i> .
16	<i>Surtan Star</i> The lucky day is on Wednesday in the month of <i>Sawal</i> . The unlucky day is on Sunday in the month of <i>Jumadilawal</i> .
17	<i>Sada Star</i> The lucky day is on Sunday in the month of <i>Jumadilawal</i> . The unlucky day is on Saturday in the month of <i>Besar</i> .
18	<i>Sumbul Star</i> The lucky day is on Wednesday in the month of <i>Jumadilakir</i> . The unlucky day is on Saturday in the month of <i>Dulkaidah</i> .

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For example, children born on Wednesday *Kliwon*, Wednesday *Kliwon*, and  $Kliwon = 8$ , then the number of *Neptu* is  $7 + 8 = 15$ . The count value of 15 means Latitude Jun, Kukul latitude, Sada latitude. He is gentle in speaking, agile, hitting, lots of children, diligent at work, his heart is not calm, likes to do good, does not like having fun, is not suitable for buying and selling, because money becomes damaged, lack sustenance, will get help on the next day. Will come, moderate in shape, forbidden to do bad deeds, if it is violated it will be damned, shy, and because of fire, it will become disabled.

### ***Ethnomathematics in Fate Prediction***

The concept of calculating human character and fate in predicting human destiny is described as follows.

#### 1. Modulo 7

The division by number 7 is in the Javanese Book, *petung* at number 104. *Petung* in the Javanese book number 104 is done by adding up the *neptu* days and the market at birth. The sum is divided by 7, and the remainder of the division is used as basic in knowing his character and fortune. The concept of counting by dividing by the number 7 and using the remainder of the division as a decision-making process shows that this *petung* contains modulo 7.

#### 2. Modulo 8

The division by number 8 is in the Javanese Book, *petung* at number 107. *Petung* in the Javanese Book number 107 is done by adding up the *neptu* days and *pasaran* at birth. The result is divided by 8, and the remainder of the division is used to predict one's character. The concept of counting by dividing by the number 8 and the use of the remainder of the division as a prediction of a person's

character shows that this context contains modulo 8.

### 3. Modulo 9

The division by number 9 is in the Javanese Book, *petung* at number 106. *Petung* in the Javanese Book number 106 is done by adding up the *neptu* days and *pasaran* at birth, then the result is divided by 9, and the remainder of the division is used as the basis in predicting one's character. The concept of counting by dividing by the number 9 and using the remainder of the division as a prediction of a person's character shows that it contains modulo 9.

### 4. Addition of Numbers

The sum of the numbers is in the Javanese Book, *petung* at number 117. *Petung* in the Javanese book number 117 is done by adding up the *neptu* days and *pasaran* at birth. The summation results are used as a consideration to determine the character and fate of a person.

According to the findings, ethnomathematics in Javanese Astrology contains modulo 7, modulo 8, modulo 9, and add numbers. It is similar to the conclusions of the ethnomathematics of matchmaking in the Javanese society, which contains modulo (Utami, Sayuti, & Jailani, 2019). As in matchmaking in Javanese culture, this finding can also be extended to number bases, remainder theorems, modulo, and modulus of congruences. The results of this study have added references and knowledge about ethnomathematics owned by javanese people in building Javanese astrology in the form of predictions of fate. In Mesopotamia and Babylonia there is also astrology in the form of predictions of fate determined based on calculations of the celestial sphere (Gerber, Hunger & Pingree, 2001), Chinese civilization determines fate predictions based on the calculation of birth dates (Homola, 2021), virtual civilization determines fate predictions based on the movement of the sun, moon, planets and stars (Lara-Alecio & Morales-Aldana (2020), and others. In some countries ethnomathematics used in astrology some civilizations have been mentioned in mathematics education such as in Colombia and Africa (Catepillan, 2016; Jama, 1999).

Furthermore, several other researchers in Indonesia have also captured the results of ethnomathematics exploration in astrology used in various cultures in Indonesia, including Suarjana & Suharta (2014) exploring ethnomathematics in Bali astrology in the form of the Bali calendar; Fajrin (2016) duplicates ethnomathematics in sunda astrology in the form of sunda caka calendar; Syahrin (2015) explores ethnomathematics in astrology in Cirebon kasepuhan calendar in the form of aboge calendar; Arisetyawan & Supriyadi (2020) explores ethnomathematics in Bedouin astrology in the form of dating systems; Prahmana, Yunianto, Rosa & Orey (2021) explore ethnomathematics in Javanese astrology in the form of pranatamangsa and predictions of the celebration of birth and death; And others.

The integration of ethnomathematics close to the realities of student life can help make mathematics



relevant and meaningful to students (Risdiyanti, Prahmana & Shahrill, 2019). In addition, it can also encourage the interest and excitement of students in learning mathematics in school. This is in line with D'Ambrosio (1985) and Freudenthal (2006) that by using the real context around students, it can make students become more able to take meaning and can increase students' understanding and creativity in learning and using mathematics to deal with phenomena and problems encountered in the reality of student life. In Indonesia this is in line with the goal of education which is to make students understand mathematical concepts and their relationship to real life by making generalizations of matematika, proofs, ideas, explaining ideas matematika and solving real-life problems mathematically. In essence, mathematics exists in this world because of the human need to deal with phenomena and problems in real life, so that in school learning mathematics should be taught mathematics from real life so that students can understand how to use mathematics to deal with problems in real life (D'Ambrosio, 2016; Freudenthal, 2006). Not only is it enough to understand how mathematics is used in solving problems in the real world, math users should also be able to use mathematics wisely in order to bring benefits instead of damage, therefore it is important that ethnomathematics are taught in schools because they contain values that can form good ethics in students so that they can use mathematics wisely (D'Ambrosio, 2016; Risdiyanti & Prahmana, 2020).

## Conclusion

In Javanese astrology developed by Javanese civilization in the past turned out to have used ethnomathematics, especially in astrology in the form of predictions of fate. Ethnomathematics are modulo 7, modulo 8 and arithmetic in number operations. This prediction of fate is still used and trusted by the people of Yogyakarta, most commonly in rural areas. This research has shown a rich culture containing Javanese mathematics that has the potential to be used in learning in Java because it is close and familiar in people's lives. The hope is that this research can be expanded into a reference for education in Java to improve students' understanding and relationships regarding mathematics and culture in their lives.

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