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# Study of Javanese Cultural Weton Significance Through Falak Science: An Ethnomathematical Analysis

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**ABSTRAK**

Ilmu Falak memiliki peran penting dalam berbagai kegiatan keagamaan. Selain itu, ilmu ini juga berkaitan erat dengan beberapa materi matematika, salah satunya dalam proses perhitungan weton budaya Jawa. Bidang ilmu matematika yang mempelajari matematika dengan pendekatan budaya adalah etnomatematika. Tujuan dari penelitian ini adalah untuk mendeskripsikan bentuk etnomatematika dalam penentuan weton budaya Jawa dengan menggunakan ilmu falak. Penelitian dilakukan di Desa Bantur, Kecamatan Bantur, Kabupaten Malang. Penelitian ini menggunakan metode kualitatif dengan teknik dokumentasi dan wawancara. Proses dokumentasi didasarkan pada artikel ilmiah dan buku-buku, sedangkan wawancara dilakukan dengan narasumber tertentu untuk memperkuat hasil yang diperoleh dari dokumentasi. Teknik keabsahan data yang digunakan adalah triangulasi sumber. Hasil penelitian menunjukkan bahwa masyarakat Desa Bantur menggunakan ilmu falak dalam menentukan weton seseorang dengan menerapkan konsep operasi bilangan.

**Kata Kunci**: Etnomatematika; Falak; Weton

**ABSTRACT**

Falak has an important role in various religious activities. In addition, science is closely related to several mathematical materials, one of which is calculating Javanese cultural weton. The field of mathematics that studies mathematics with an artistic approach is ethnomathematics. The purpose of this study is to describe the ethnomathematical form used to determine Javanese cultural weton using Falak. The research was conducted in Bantur Village, Bantur District, Malang Regency. This research uses qualitative methods with documentation and interviews. The documentation process is based on scientific articles and books, while interviews are conducted with certain sources to strengthen the results obtained from the documentation. The data validity technique used is source triangulation. The results showed that the people of Bantur Village used falak science to determine a person's weton by applying the concept of number operations.

**Keywords**: Ethnomathematics; Falak; Weton

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## 1. INTRODUCTION

In Islamic teachings, Falak science is important in various religious activities (Izzuddin, Budiwati, & Zubaidah, 2021). This is because the entry of falak in Indonesia almost coincided with the entry of Islam (Muslim et al., 2023). Some activities related to science are determining prayer times, Qibla direction, calendar, eclipse, the beginning of the month of Komariyah, takwim, and several other natural events (Muslim et al., 2023; Qulub & Munif, 2023). As Pasaribu (2020) Also said, in Islam, the science of Falak plays an important role in determining the time of worship, such as determining the direction of Qibla. Falak science is also a form of progress in Islamic civilization (Muslim et al., 2023). However, in its implementation, many people have yet to practice it because science-related knowledge still needs to be improved (Alamsyah et al., 2022; Astria & Kusno, 2023).

The dating system in Indonesia can also be studied using Falak (Ramdhani, 2020). Two dating systems are used in Indonesia: the Gregorian calendar and the Hijri calendar (Yusran et al., 2023). Falak science began by adopting the Hijri dating system to the Javanese calendar (Muslim et al., 2023). As Listyana and Hartono (2015), also Mahmudah and Izzuddin (2023) said, the Javanese Islamic calendar combines the Javanese or Saka calendar used by ancient Javanese people with the Hijri calendar. These two calendars are combined because they are used to homogenize important activities by Javanese and Islamic traditions (Mahmudah & Izzuddin, 2023). One of the activities that has become a tradition in Indonesia is related to the traditional calendar of Javanese culture (Listyana & Hartono, 2015; Iskandar & Iskandar, 2022).

Javanese culture has its own culture in determining good days to perform various rituals considered sacred events such as weddings, house moves, and birthday celebrations, namely weton or neptu (Ridwan & Basith, 2021). Javanese still believe in customs and traditions related to good and bad days in an activity (Aditya, 2018; Budhi, Subiyantoro, & Wahida, 2022). To find out good, bad, and other days is not done by fortune-telling but by using Javanese calendar calculations (Amalia & Mariana, 2023). The calculations carried out by the Javanese use the customary dating system or Javanese dating from the inheritance of the ancestors.

## 2. METHOD

This research is descriptive qualitative research. The data collection was from books and scientific articles related to mathematics, science, and Javanese culture (Prahmana & D' Ambrosio, 2020). The documentation process is based on scientific articles and books, while interviews are conducted with certain sources to strengthen the results obtained from the documentation. The weton calculation method obtained from several sources proves that mathematics can be applied to several sciences, including Falak, in determining Javanese cultural weton—furthermore, a case study analysis of problem-solving determined weton using the concept of number operations in science. The data validity technique used is source triangulation.

## 3. RESULT AND DISCUSSION

In Javanese culture, weton is considered sacred by Javanese people, so people carry out activities or hold certain events based on accurate calculations. Weton's science of calculation is a way of calculating good days. Weton has a very strong influence on the daily lives of Javanese people (Khoirurrozi, 2023; Setiadi &; Imswatama, 2017). The count on Weton is referred to as Neptu. As Abdullah et al. (2019) stated, each day's name has a neptu value denoted by a number. Using neptu, the Javanese calendar is obtained as follows in Table 1.

Table 1. Javanese Calendar

| Day | Neptu | Market | Neptu |
|---|---|---|---|
| Sunday | 5 | Legi | 5 |
| Monday | 4 | Pahing | 9 |
| Tuesday | 3 | Pound | 7 |
| Wednesday | 7 | Wage | 4 |
| Thursday | 8 | Kliwon | 8 |
| Friday | 6 | | |
| Saturday | 9 | | |

Source: (Setiadi &; Imswatama, 2017)

1. Determining Uss (code) Using Falak Science

According to science, every month has a USS (code), so each month must have a different USS. Moreover, each month has a different benchmark value. To find the benchmark number for each month has the following formula:

Benchmark number = eight − month age

Information: Eght = 35-da

Age of the month = 31, 30, and 29.28

So, it is obtained as in Table 2.

Table 2. Benchmark Number

| No | Moon | Eight | Age of the Moon | Result |
|---|---|---|---|---|
| 1 | January | 35 Days | 31 days | 4 |
| 2 | February | 35 Days | 29/28 days | 7 / 6 |
| 3 | March | 35 Days | 31 days | 4 |
| 4 | April | 35 Days | 30 days | 5 |
| 5 | May | 35 Days | 31 days | 4 |
| 6 | June | 35 Days | 30 days | 5 |
| 7 | July | 35 Days | 31 days | 4 |
| 8 | August | 35 Days | 31 days | 4 |
| 9 | September | 35 Days | 30 days | 5 |
| 10 | October | 35 Days | 31 days | 4 |
| 11 | November | 35 Days | 30 days | 5 |

| No | Moon | Eight | Age of the Moon | Result |
|---|---|---|---|---|
| 12 | December | 35 Days | 31 day | 4 |

2. Determining Uss (code) Early in the Coming Year

**Uss beginning of the coming year = uss current year + 16 (leap) /15 (bashitah)**

If the sum is more than 35, then subtract 35, and the rest will become USS early next year.

3. Determining the Uss (code) of the Beginning of the Coming Month

**Uss beginning of the next month = uss of the current month − benchmark number**

Information:

If it cannot be reduced, then add 35. So, it becomes uss next month. There are several conditions for knowing the leap year or bashitoh year.

For leap years:

a. Years can be divided by 400 or 4
b. Years are not divisible by 100

For the bashitoh year:

a. Years are not divisible by 400 and 4
b. Years can be divided by other than 400 and 4

Information:

If it cannot be reduced, then add 35. So it becomes uss next month. There are several conditions for knowing the leap year or bashitoh year.

For leap years:

c. Years can be divided by 400 or 4
d. Years are not divisible by 100

For the bashitoh year:

c. Years are not divisible by 400 and 4
d. Years can be divided by other than 400 and 4

Example:

S: It is known that the USS in January 2019 is 30, so what is the USS month in 2020? Show in Table 3

A: uss January 2020

= USS Current Year + 16 (leap) /15 (Bashitah)

= 30 + 15

= 45 − 35 (eight)

= 10

Information:

2019 is the year of bashitoh, so it is at +15.

Because the sum result is more than 35, it is subtracted by 35 (eight)

February USS

= Current Month USS − Benchmark Number

= 10 − 4

= 6

Uss March = 6 − 6

= 0 + 35 (eight)

= 35

(If the result of subtraction is 0 then immediately add 35 from eight)

Uss in April = 35 − 4

= 31

Uss in May = 31 − 5

= 26

Uss June = 26 − 4

= 22

Uss in July = 22 − 5

= 17

August USS = 17 − 4

= 13

Uss bulan September = 13 − 4

= 9

Uss October = 9 − 5

= 4

Uss in November = 4 − 4

= 0 + 35 (eight)

= 35

Uss December = 35 − 5

= 30

So, it can be written in Table 3 as follows:

Table 3. Uss Code Every Month

| U.B. | Moon | Benchmark | 2020 | K | 2021 | B | 2022 | B | 2023 | B | 2024 | K | 2025 | B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31 | January | 4 | 10 | | 26 | | 6 | | 21 | | 1 | | 17 | |
| 28/29 | February | 6(K) / 7(B) | 6 | | 22 | | 2 | | 17 | | 32 | | 13 | |

| U.B. | Moon | Benchmark | 2020 K | 2021 B | 2022 B | 2023 B | 2024 K | 2025 B |
|---|---|---|---|---|---|---|---|---|
| 31 | March | 4 | 35 | 15 | 30 | 10 | 26 | 6 |
| 30 | April | 5 | 31 | 11 | 26 | 6 | 22 | 2 |
| 31 | May | 4 | 26 | 6 | 21 | 1 | 15 | 32 |
| 30 | June | 5 | 22 | 1 | 17 | 32 | 11 | 28 |
| 31 | July | 4 | 17 | 32 | 12 | 27 | 6 | 23 |
| 31 | August | 4 | 13 | 28 | 8 | 23 | 2 | 19 |
| 30 | September | 5 | 9 | 23 | 4 | 19 | 33 | 15 |
| 31 | October | 4 | 4 | 19 | 34 | 14 | 28 | 10 |
| 30 | November | 5 | 35 | 15 | 30 | 10 | 24 | 6 |
| 31 | December | 4 | 31 | 10 | 25 | 5 | 19 | 1 |

4. Determining Javanese Weton

In the process of determining Javanese cultural weapons by applying science, the first day is Sunday or Sunday and has a benchmark number to help determine weton as Table 4 below:

Table 4. Weton Java

| Day | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|---|
| Legi | 35 | 15 | 30 | 10 | 25 | 5 | 20 |
| Pahing | 21 | 1 | 16 | 31 | 11 | 26 | 6 |
| Pound | 7 | 22 | 2 | 17 | 32 | 12 | 27 |
| Wage | 28 | 8 | 23 | 3 | 18 | 33 | 13 |
| Kliwon | 14 | 29 | 9 | 24 | 4 | 19 | 34 |

To determine the weton, several steps must be taken, including the following:

a. Specify the month and year of birth.
b. How many uss in that month and year.
c. Find the number of uss that have been searched into the benchmark to determine weton
d. When you meet weton using a benchmark, then it is used as the 1st (the date of starting to look for weton)

Example:

S: Abdad was born on October 09, 2020. So, when is Abdad's weton?

J: Abdad was born in October 2020

Known:

October 2020 Uss = 4

The number 4 is located on Thursday kliwon

Then the beginning of the calculation / 1st starts from Thursday Kliwon.

The results are as in Table 5 below:

Table 5. Results of Java Weton Determination

| | | | | |
|---|---|---|---|---|
| Sunday | 4 (pounds) | 11 (Kliwon) | 18 (Pahing) | 25 (Wage) |
| Monday | 5 (Wage) | 12 (Legi) | 19 (pounds) | 26 (Kliwon) |

| | | | | | |
|---|---|---|---|---|---|
| Tuesday | | 6 (Kliwon) | 13 (Pahing) | 20 (Wage) | 27 (Legi) |
| Wednesday | | 7 (Legi) | 14 (pounds) | 21 (Kliwon) | 28 (Pahing) |
| Thursday | 1 (Kliwon) | 8 (Pahing) | 15 (Wage) | 22 (Legi) | 29 (pounds) |
| Friday | 2 (Legi) | 9 (pounds) | 16 (Kliwon) | 23 (Pahing) | 30 (Wage) |
| Saturday | 3 (Pahing) | 10 (Wage) | 17 (Legi) | 24 (pounds) | 31 (Kliwon) |

So, for weton abdad is on the 9th pound.

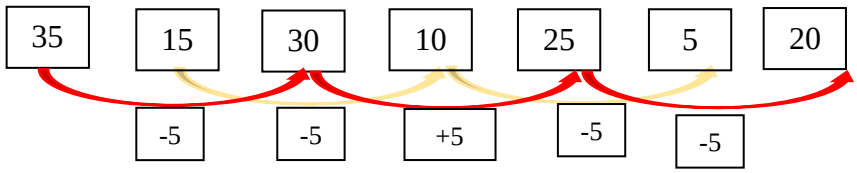
The relationship between science and finding Javanese culture weton with the concept of number operations in mathematics learning in schools can be described as follows.

1. Concept of Number Operations

Several kinds of numbers are found in benchmark numbers, uss (code), and neptu including natural numbers, odd numbers, even numbers, and prime numbers. In the process of determining the benchmark number using the concept of subtraction operations. In deciding the uss (code) at the beginning of the year, the idea of number addition operations was found, and commutative properties can be used to determine the uss (code) at the start of the month using the concept of subtraction operations. Furthermore, in the determination of Javanese weton, multiples of 7 were found in the Sunday column, starting from 35, 21, 7, 28, and 14. In the process of determining Javanese weton using science, several steps involve the concept of number operations, including assessing the number of uss (code) in months and years using the concept of addition and subtraction operations. Then, determine what weton date one lies on and continue until the date is sought.

2. Number Patterns

There is a pattern of regular numbers at the age of the month, namely 31, 30, 29, and 28. In addition, the results of the benchmark number and the age of the month also found a regular number pattern starting from March to December, namely 4, 5, 4, 5, ... and 31, 30, 31, 30, .... Furthermore, in the Javanese weton table found a pattern of numbers in the column "Legi", namely:




3. Division Concept

The concept of division operations with predetermined numbers is found in the calculation process to find out leap years or bashitoh. To determine leap years, you can use the concept of divisible numbers 400 or 4, and the idea of division of the rest when divided by 100. To determine the year bashitoh can use the concept of divisible by numbers other than 400 and 4, and use the idea of division of the rest when divided by the numbers 400 and 4. Some

calculations made to determine Javanese cultural weton using science prove that the ancestors have long used mathematics. As it was delivered by Sulaiman (2021) someone will ask for help from a considered expert to determine the time that matches neptu and weton using a uniquely patterned calculation. Using ethnomathematics makes mathematics learning more meaningful because it can integrate with culture and preserve it (Zahira et al., 2022).

## 4. CONCLUSION

Based on the explanation above, this study concludes that science can be used to determine weton for each person by exploring the concept of number operations in mathematics into weton calculations with neptu that ancestors have determined. The logical relationship of traditional weton calculations with the basis of science contains patterns and concepts of mathematical calculation operations. Thus, it can be seen logically that Islamic science can be integrated into existing cultures in Indonesia, especially Javanese culture.

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