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Javanese ethnomathematics: Exploration of the *Tedhak Siten* tradition for class learning practices

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Abstract

Tedhak siten is a Javanese traditional ceremony that marks the 8th month of the baby's age, marked by the baby's readiness to set foot on the ground. This tradition has a philosophical meaning with Javanese cultural values related to the concepts of calculating the ceremony time and the geometric shape of the ceremonial equipment used. The purpose of this study was to explore the cultural activities of the Javanese community by outlining the mathematical concepts contained in the implementation of the *tedhak siten* ceremony. This research was a qualitatively descriptive study through an ethnographic approach. Ethnomathematical data were collected from two experts those were the head of a traditional Javanese culture studio and a cultural actor active as a leader of Javanese traditional ceremonies. The ethnomathematics found in the study were counting the date or time for the implementation of the *tedhak siten* tradition and the elaboration of geometric concepts in the form of ceremonial equipment used to perform traditional customary procedures. This research had an impact as a mathematics learning material that originated from the wisdom of the local Javanese community by applying the concepts of time units, least common multiples, modulo 5, modulo 7, circles, triangles, rectangles, cylindrical volumes and spherical volumes.

Keywords: Counting, Ethnomathematics, Geometry, *Tedhak Siten*

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The environment surrounding us is full of values and knowledge from culture, professional activities, and an entire experience contributing to a re-signification of mathematical concepts. Many contents of academic mathematics are present in our daily tasks, such as buying in supermarkets, producing and selling products, working, and cultural activities. By using the ancestral knowledge of community members, in school education, we are valuing culture and contributing to meaningful learning (Ausubel, 2000; Mattos et al., 2020). Knowledge about ethnomathematics is positively perceived by teachers, which can be filled with ethnomathematics studies that ease students to learn and appreciate their local culture (Mania & Alam, 2021).

The challenge ahead in processing knowledge sources for educators is to incorporate ethnomathematics in the learning curriculum by considering collaboration and reflection as a source of knowledge from cultural communities (D'Ambrosio & D'Ambrosio, 2013; Gavarrete, 2015). The generation and dissemination of knowledge of sociocultural groups are the subjects of research by the

Ethnomathematics Program (Mattos et al., 2020). Understanding the role of ethnomathematics will form a constructive, caring, and thinking society that will influence mathematical literacy to support learning (Rizki & Priatna, 2019).

Forming a society that understands ethnomathematics must be explored through a culture that has noble values from teachers managing learning resources for teaching in the classroom (Sudarsana et al., 2020). Cultural wealth has the potential for scientific contributions because of its uniqueness in revealing knowledge about cultural activities in society. Thus, it has an impact on increasing national identity in building civilization, maintaining cultural identity, and the basis of knowledge (Mallqui & Chávez, 2021; Nur et al., 2021; Susilo & Widodo, 2018).

Cultural activities conducted in society do not apply the role of ethnomathematics from a philosophical point of view that has been passed down from generation to generation (Sutarto et al., 2021). It results in students having difficulties understanding mathematics lessons which should be explored through cultural activities in their life experiences (Fendrikfendrik et al., 2020). Regarding mathematics problems, it is necessary to apply effective teaching methods to achieve contextual understanding in students based on learning resources in terms of local culture (Lomibao et al., 2016). Efforts to strengthen mathematical abilities through an approach based on daily cultural activities are the right solution to support the learning process (Choeriyah et al., 2021; Hartinah et al., 2019).

The role of ethnomathematics seeks to understand strategies of a mathematical nature that originate from culture and can be used in school teaching and learning (Mattos et al., 2020). It includes those related to social culture in the form of language or behavioral activity in a particular ethnic group with a good meaning (Pais, 2013; Suciawati et al., 2021). It turns out that culture in the form of artifacts, concrete objects, human intelligence, and noble values can help provide mathematical concepts to the student's environment (Simamora et al., 2018). Facts from cultural values towards mathematics education can be combined with learning methods or learning models.

Several ethnomathematical studies have succeeded in finding mathematical aspects. Research in Columbia discussed ethnomathematical networks with STEAM learning and a global approach obtained from activities in everyday life by the community (Rodríguez-Nieto & Alsina, 2022). In Turkey, ethnomathematical studies in the context of cultural history presented a geometric perspective on carpets, rug motifs, and the play of wits (Kucuk, 2014). In Brazil, the quilombola community showed that ethnomathematics respected the differences and units for the construction of mathematical knowledge associated with the marabaixo tradition (Silva et al., 2022). In South Africa, the Community of Elders was exploring indigenous African games and cultural artifacts that had the potential to link mathematical knowledge in the classroom (Mogege, 2017). In the Philippines, the kabihuf tribe indirectly applied ethnomathematical practices in daily life, which were classified into counting patterns, coding, measuring, classifying, sorting, inferring, and modeling (Rubio, 2016). Existing cultural exploration must be expressed in collaboration with researchers worldwide for research development, especially in ethnomathematics (Zulkardi & Prahmana, 2021). The ethnomathematics studies reviewing the cultural activities of local communities can be explored for the needs of learning materials in the classroom.

There are hidden good intentions, one of which is arranged through a traditional ceremony procession (Cathrin, 2017). The resulting thought from these good intentions can be understood from the basic knowledge received by the surrounding community. Thus, it becomes a characteristic that needs to be explored more deeply. The *tedhak siten* tradition is intended for families with babies to prepare themselves to set foot on the ground and ask the Almighty that the baby will be given safety in living their life (Hafidzi, 2020). The reinforcement that tradition in a cultural community is used as an

ethnomathematical study has been discussed in the ethnomathematical exploration of cultural activities (Aini et al., 2019; Firdaus & Hodiyanto, 2019; Khanafiah, 2020).

The contribution of local wisdom in learning mathematical concepts is applied by teachers by developing ethnomathematics-based lesson plans through material that can be adapted to learning objectives (Utami et al., 2021). The aspect emphasized in the teaching performed by the teachers is introducing local culture in each region, which is rich in noble values in educational institutions (Susiana et al., 2020). Each region has its perspective on interpreting the philosophy of the meaning of cultural activities, such as traditional ceremonies with mathematical concepts, to attract students' attention to participating in mathematics learning in class (Supiyati et al., 2019).

However, the application of mathematical concepts in the *tedhak siten* ceremony has never been reported. Therefore, this study aimed to explore cultural activities in the tradition so that it becomes a guide for the Javanese community, and the learning resources found can be used in classroom learning. The need for mathematics learning resources from community cultural activities is a challenge for mathematics learning in the future. Hence, the author focused on exploring mathematical concepts in the implementation of the *tedhak siten* tradition.

METHODS

This study was qualitative research using an ethnographic method to explain, describe, and analyze cultural elements in a society or ethnic group as defined by Spradley (Spradley, 2007). The ethnographic approach was used to study people's aspects of society, focusing on cultural description and being concerned with meanings and signifiers (Mattos, 2020). Thus, it helped emphasize the Ethnomathematics Program to investigate actions, cultural practices, and the solution of everyday problems by members of a sociocultural group (Mattos et al., 2020). The ethnomathematical research design adopted an ethnographic approach based on four general questions: (1) Where to start the observation (2) How to observe (3) How to find something significant (4) How to understand what is seen (Alangui, 2010).

The subjects of this study were two experts. First, it was Romo Prawoto, the owner of the Makutho Javanese Cultural Arts Studio, Tambak Sari District, Surabaya City, who explained the procedures and meanings of the philosophy of Javanese traditional ceremonies. The second expert was Mrs. Enggar Sosotyaningsih, the executor of the guidelines for Javanese traditional ceremonies, giving strengthened explanations regarding the real conditions of the current *tedhak siten* traditional ceremonies understood by the community. Data collection was obtained from the field study observation by observing the *tedhak siten* traditional ceremony stages. The objects observed were the implementation of traditional activities and the use of traditional equipment that the baby would perform. Researchers observed the implementation of the *tedhak siten* traditional ceremony conducted by families to celebrate the 8-month-old child by writing down what activities were performed, which was then confirmed by the two experts. Data were then analyzed using the triangulation technique to determine the elements of mathematical knowledge in the activities of the *tedhak siten* in Javanese society. The research results were summarized in a schematic diagram of an ethnomathematical model based on local wisdom, which was an integral part of the educational process. The application was related to the exploration of mathematical concepts in the *tedhak siten* traditional ceremony, which was used as teaching material in classroom learning. The development of culturally relevant mathematics lessons using the modified framework is presented in Figure 1.

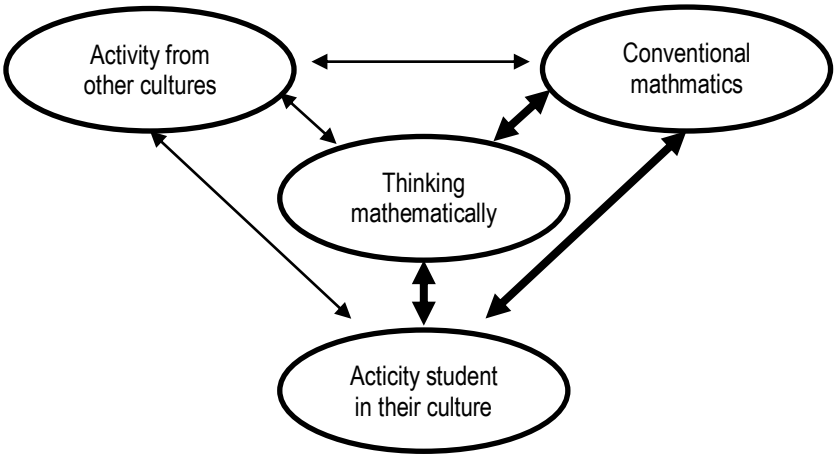

Figure 1. The framework of Ethnomathematics model in classroom learning (Alangui, 2010).

RESULTS AND DISCUSSION

Ethnomathematics in Calculating the Time of the *Tedhak Siten* Ceremony

Information from interviews about calculating the date for executing the *tedhak siten* traditional ceremony for babies aged 8 months is contained in Dialogue 1.

Dialogue 1
Researcher : "What is the background for implementing the *tedhak siten*?"
Informant : "*Tedhak siten* was performed on infants aged seven *lapan* according to Javanese dates as a symbol for the child to start walking."
Researcher :"How much 1 *lapan*?"
Informant :"1 *lapan* or means *Selapan* (Se = one) in the Javanese calendar is the time determined from the meeting of the cycle of 1 week and 1 *pasar*."
Researcher :"How many days in 1 *lapan*?"
Informant :"The sum is 35 days from which 7 days x 5 cycles results."
Researcher :"How many days are there to determine the day for *tedhak siten*?"
Informant :"245 days from date of birth or approximately 8 months"
Researcher :"How if it is not held according to the formulated day?"
Informant :"It makes no difference, the implementation of *tedhak siten* is mutually agreed upon by the father and mother, but it is not too far from the standard of 7 *lapan* since birth."

Dialogue 1 explained that the *tedhak siten* tradition runs as a unique Javanese culture in determining the date of day for an important event in life. The *tedhak siten* tradition is based on the Javanese calendar's traditional calculation. *Tedhak siten* comes from the words tedhak and siti. Tedhak means down, while siti means land (Fitriani et al., 2020; Sholikhin, 2010; Susetya, 2019). This ceremony proposes introducing the baby to the ground as a place to stand for the first time. This tradition is carried out as a form of gratitude to God for the birth of a baby until the age of 7 *lapan* or 8 months (Djaya, 2020; Hafidzi, 2020).

Tedhak siten ceremony begins with finding the date of 7 *lapan*. In the Javanese calendar, 1 lapan is calculated from the first meeting between 7 days a week (Monday, Tuesday, Wednesday, Thursday,

Friday, Saturday, Sunday) and the number of *pasar* (cycle), which is 5 days (*pahing*, *pon*, *wage*, *kliwon*, and *legi*). At that time, the baby will carry out the *tedhak siten* ceremony, which is calculated from the date of birth (Setiyani, 2021; Sosotyaningsih, 2022; Suprawoto, 2022). From the results of multiples of 5 and 7, the least common multiple is 35. Therefore, 1 *lapan* in the Javanese calendar is equal to 35 days. The complete 1 *lapan* is arranged in Table 1.

Table 1. The division of 1 *lapan*

Sunday *Legi*	Monday *Pahing*	Tuesday *Pon*	Wednesday *Wage*	Thursday *Kliwon*
Friday *Legi*	Saturday *Pahing*	Sunday *Pon*	Monday *Wage*	Tuesday *Kliwon*
Wednesday *Legi*	Thursday *Pahing*	Friday *Pon*	Saturday *Wage*	Sunday *Kliwon*
Monday *Legi*	Tuesday *Pahing*	Wednesday *Pon*	Thursday *Wage*	Friday *Kliwon*
Saturday *Legi*	Sunday *Pahing*	Monday *Pon*	Tuesday *Wage*	Wednesday *Kliwon*
Thursday *Legi*	Friday *Pahing*	Saturday *Pon*	Sunday *Wage*	Monday *Kliwon*
Tuesday *Legi*	Wednesday *Pahing*	Thursday *Pon*	Friday *Wage*	Saturday *Kliwon*

The formula for finding the sum of 1 *lapan* is presented by determining the Least Common Multiple (LCM). The smallest multiple of 5 (a day of *pasaran*) and 7 (a day of the week) is presented as follow.

5 : 5, 10, 15, 20, 25, 30, 35, 40, 45, 50.....
7 : 7, 14, 21, 28 ,35, 42, 49....

Babies carry out the *tedhak siten* tradition at the age of 7 *lapan*, or 7 x 35 days of 1 *lapan* = 245 days. To determine the application of the day in a week, the arithmetic system modulo 7 with equations can be used.

HTS =7 *lapan* mod 7
HTS =(7×35) mod 7
HTS =245 mod 7
HTS =0

Note = HTS : *Tedhak Siten* Day

To determine the application of the day *pasaran*, the arithmetic system modulo 5 with equations could be used

PTS =7 *lapan* mod 5
HPTS =(7×35) mod 5
PTS =245 mod 5
PTS =0

Note = PTS : *Tedhak Siten Pasaran*

The division result of modulo 7, or the remainder, is 0 and similar to the division result of modulo 5, or the

residual value is 0. Meanwhile, to determine the date, the following equation is used:

TTS = (L+245)-(B)

Note = TTS : *Tedhak siten* date
L : Date of birth
B : Number of days in each month

Completing the calendar schedule after the calculation through the method described can help understand the number of days each month, presented in Table 2.

Table 2. Number of days each month

Month	Ordinary year/leap	Month	Ordinary year/leap
January	31	July	31
February	28/29	August	31
March	30	September	30
April	30	October	31
May	31	November	30
June	30	December	31

Ethnomathematics in the Stages of the Traditional Ceremony of *Tedhak Siten*

Interviews were conducted to explore the procedures for conducting the *tedhak siten* ceremony, in which each stage has a meaning, as presented in Dialogue 2.

Dialogue 2
Researcher : "What are the stages for *tedhak siten* in the Javanese community?"
Informant : "The implementation of *tedhak siten* remains sustainable to be performed in the modern era like today."
Researcher :"What are the stages that babies go through in the *tedhak siten* tradition ?"
Informant : "The stages that the baby goes through are, treading a seven-colored *jadah*, climbing a wooden stair, stepping on the ground, entering a cage to pick up toys, spreading the *udhik-udhik*, and taking a bath."
Researcher : "What form of equipment is used ?"
Informant : "There's a circle-shaped *jadah* food, a rectangular soil container, a triangular ladder, a tubular cage, a flower bath in the shape of a ball or tube, and a place for *udhik-udhik* as a place for yellow rice."
Researcher : "Do the stages passed have meaning in the Javanese view ?"
Informant : "Yes, all of them possess a good meaning."

In Dialogue 2, as a series of *tedhak siten*, the procession stages that the baby goes through are explained. The stages start from drying the baby's feet to bathing the baby with *setaman* flowers. With the *tedhak*

siten stage using some ceremonial equipment, mathematical concepts would be explored in depth.

Setting Foot on Jadah

Babies walk on *jadah* or food with 7 different colors. *Jadah* is often used in the *tedhak siten* ceremony to mark the first day of a baby's step on the ground (Ardriyati & Wiwaha, 2016). In this procession, the baby is guided by the parents to step on the *jadah* one by one from light to dark color (Setiyani, 2021; Sosotyaningsih, 2022; Suprawoto, 2022). *Jadah*, in the form of a circle, is placed on top of the circle stone mortar, presented in Figure 2. The exploration that can be applied in learning mathematics is to calculate the area of a circle on a specified area. The mathematical equation to calculate the circle area is shown in the equations below.

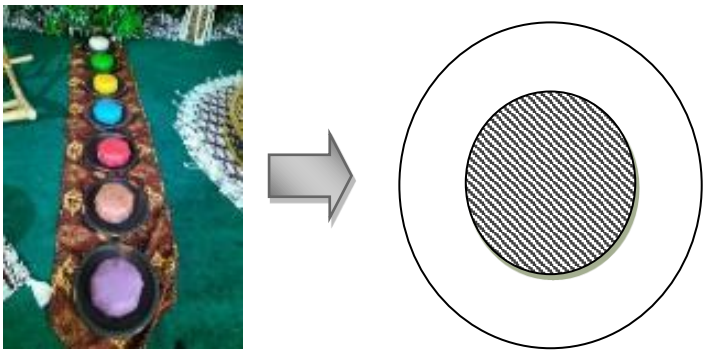

Figure 2. Stage of set foot on *jadah*

$$L = \pi \times r^2 \text{ ..... } (1)$$

Note : $L = \text{area of circle}$

$\pi = 3{,}14 \text{ or } \frac{22}{7}$

$r = \text{circle radius}$

The area searched is denoted by the shaded form, then the equation is

$$L_{\text{shading}} = L_{\text{big circle}} - L_{\text{small circle}} \text{ ..... } (2)$$

Climbing the Stairs

The baby is then brought to the stairs, symbolized as the *tebu wulung*. *Tebu* (bamboo) has an abbreviation meaning called *antebing kalbu* which means full of determination and self-confidence, and wulung means black, denoting that it is ready. Next, the father and mother help their baby climb the stairs. It means that the family supports the baby's hopes, including achieving his goals (Setiyani, 2021; Sosotyaningsih, 2022; Suprawoto, 2022). According to the observation of the equipment of the climbing ceremony, it is found that the stair shape is the isosceles triangle shown in Figure 3. Exploration of the stages of climbing stairs on the sloping side of the triangle applies the Pythagorean theorem concept to a right triangle.

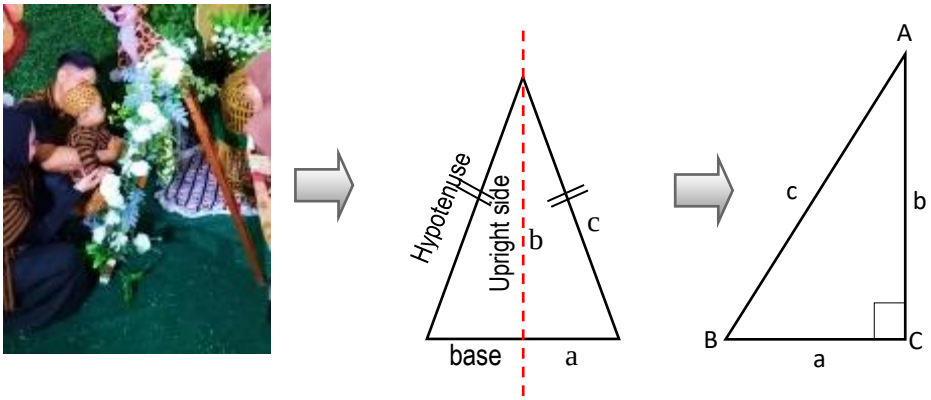

Figure 3. Stage for climbing up the stairs

Square of hypotenuse = Sum of squares of all sides of right angle

$$\text{Hypotenuse}^2 = \text{upright side}^2 + \text{base}^2$$

for ΔABC, if $\angle c$ is a right angle, then it is a right angle. The Pythagorean equation is as follows:

$$C^2 = A^2 + B^2 \rightarrow C = \sqrt{A^2 + B^2}$$

Stepping on the Ground

In this stage, the parents carry their children to prepare to set foot on the ground provided. This stage means that the child is ready to face life with the expectations that both parents and family desire (Setiyani, 2021; Sosotyaningsih, 2022; Suprawoto, 2022). Exploration of ceremonial tools in this stage that can be applied in learning mathematics is a comparison of the area of two flat shapes. The soil placed in a rectangular container is meant to be trampled by babies. The land is arranged in a rectangular shape, and the footprint is also rectangular. Then the equations to calculate the ratio of the areas of the two rectangles are shown in Figure 4.

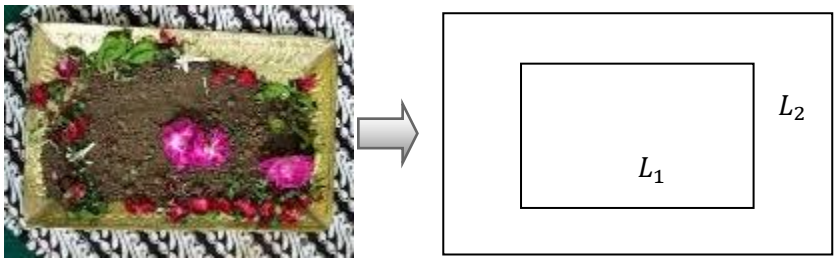

Figure 4. Stage of stepping on the ground

Note : $L = \text{Rectangular area}$

$p = \text{lenght}$

$l = \text{width}$

Comparison of two rectangular shapes uses the equations as follows.

$$L_1 \div L_2 \quad \text{..... (1)}$$

$$\frac{p_1}{l_1} = \frac{p_2}{l_2} \quad \text{..... (2)}$$

Entering the Cage

At this stage, the babies are placed by their father and mother in a cage. Inside the cage, there are some toys that the baby will bring. This stage shows parents' belief that the items chosen by the child reflect their interests when they grow up (Setiyani, 2021; Sosotyaningsih, 2022; Suprawoto, 2022). Exploration of this stage uses the mathematical concept of geometry to build the surface area of a tube without a bottom, as shown in Figure 5.

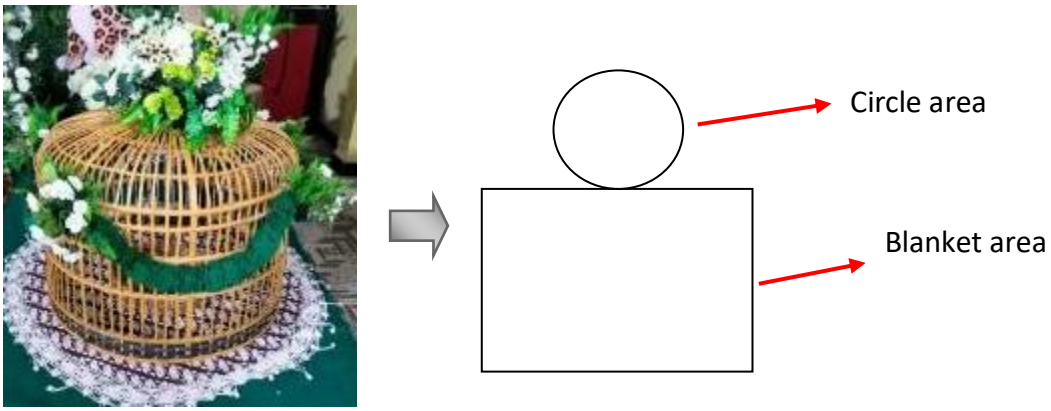

Figure 5. Stage of enter the cage

Circle Area : $La = \pi \times r^2$

Tube Blanket Area : $Ls = 2\pi r \times t$

Surface Area tube without lid : $L_{cirle} = L_a + L_s$

$$L = (\pi \times r^2) + (2 \times \pi \times r \times t)$$

$$L = \pi \times r(r + 2t) \quad \text{.....} \quad (1)$$

Area of cage geometry : $L_{cage} = L_{tube\ blanket} + L_{tube\ cap}$

$$L_{cage} = 2\pi r \times t + \pi \times (r^2 \times t) \quad \text{.....} \quad (2)$$

Note : $L = \text{area}$

$\pi = 3{,}14$ atau $\frac{22}{7}$

r = circle radius

t = height

Taking the Bath

This process is done by fathers and mothers to bathe their children with *setaman* flowers and *gege* water. This process means the parents believe that one day their child will carry the family's good name and can live righteously, and become pious people. The water-filled is only half of the total jug provided, so it does not spill (Sosotyaningsih, 2022; Suprawoto, 2022). At this stage, the mathematical concept of geometry is a jug or vessel filled with water, as presented in Figure 6.

Figure 6. Stage for flower bath

By the formula for the sphere volume

$$V = \frac{4}{3} \times \pi \times r^3$$

Description : V = Volume
$\pi = 3.14$ or $\frac{22}{7}$
r = circle radius

To calculate the volume of water in a jug for a baby bath, we can use this equation,

$$V_{\text{water in jug}} = V_{\text{total ball}} \times \frac{1}{2}$$

Spreading Udhik-Udhik

Udhik-udhik is some yellow rice mixed with coins. This procession is carried out by throwing money to be taken by guests. Throwing the *udhik-udhik* means that children can be generous and like to give alms when they grow up (Setiyani, 2021; Sosotyaningsih, 2022; Suprawoto, 2022). Mathematical concepts applied are geometric shapes of cylinders with volume elements. Exploration of this stage that can be applied in learning mathematics is to calculate the residual volume in the form of a cylinder (tube), as seen in Figure 7.

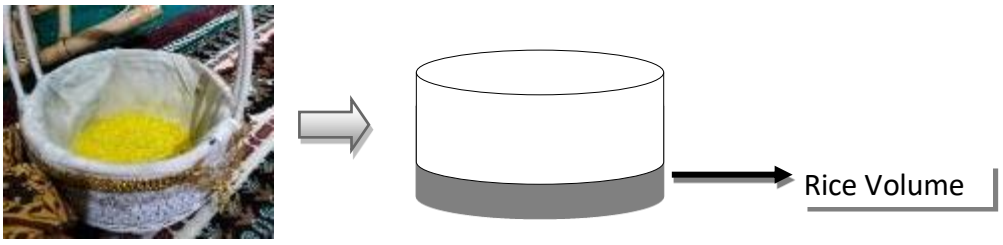

Figure 7. Stage for spreading *udhik-udhik*

The formula used to find a cylinder's volume is as follows.

$V = \pi \times r^2 \times t$ ..... (1)

Note : V = Volume
$\pi = 3{,}14$ or $\frac{22}{7}$
r = circle radius
t = height

If the yellow rice is filled with N of the total tube volume, the volume equation is :

$$V_{\text{yellow rice}} = N \times V_{\text{tube}} \text{ ..... } (2)$$

Reflection is needed on cultural aspects that point to mathematical knowledge, regardless of school knowledge, which can be helpful in the teaching and learning processes in schools. The results of research on the implementation of the *tedhak siten* ceremony show that there are concepts of calculation and geometry that provide experience for the people involved. In addition, the research results also provide mathematics teaching materials that can be used in classroom learning. The *tedhak siten* ceremony contains a moral message that the community can accept through the stages that children go through. Additionally, it is a symbol of parents' expectations for their children (Sosotyaningsih, 2022; Suprawoto, 2022).

The application of the *Tedhak Siten* Tradition as a Contextual Mathematics Learning Resource

Counting Days Tedhak Siten

The celebration of the *tedhak siten* tradition is determined when the baby age reaches 7 *lapan*. 1 *lapan* is obtained by a multiple of one week in one *pasar,* with the mathematical concept of using the Least Common Multiple (LCM); the smallest multiple is 35. Furthermore, to determine the date or day of the *tedhak siten* execution, the concepts of arithmetic modulo 7 and modulo 5 were used. For example, problems in learning mathematics, a Javanese family has been blessed with a baby born on Wednesday *Kliwon*, March 30, 2022; when should the family do the *tedhak siten* tradition?

Answer: 245 is divided by 7, the quotient is 35, and the remainder is 0.

HTS =245 mod 7
HTS =0

With this 0 remaining, Wednesday is only added by 0 days, so the result is still Wednesday. Next, it counts the days at a known *pasaran* in *kliwon*, so the solution is:

PTS =7 *lapan* mod 5
HPTS =(7×35) mod 5
PTS =245 mod 5
PTS =0

With a result of 0, then the *pasaran kliwon* plus the remaining 0 is *kliwon.*
The formula is used to determine the date to perform the *tedhak siten*.

TTS=(L+245)-(B)
= (30+245) - (day of the month)
= 244 - 30 (days in April)
= 214 - 31 (days in May)
= 183 30 (days in June)

= 153 - 31 (days in July)
= 122 - 31 (days in August)
= 91 - 30 (days in September)
= 61 - 31 (days in October)
= November 30, 2022

So the implementation of the *tedhak siten* ceremony for the family is on Wednesday *Kliwon*, November 30, 2022.

Geometric Shapes on Tedhak Siten Ceremonial Equipment

The *tedhak siten* ceremony indirectly uses the concept of geometric mathematics. Its ceremonial equipment has a flat geometric and spatial shape, classified in Table 3.

Table 3. Geometric concepts at the stages of the *tedhak siten* ceremony

Stages of customary ceremonies	Geometry		Exploration of ethnomathematics
	Planes	Solids	
Setting foot on *jadah*	Circle	-	Calculating the area of the circle in the specified area
Climbing the stairs	Triangle	-	Determining the length of the oblique side of the stair object in the shape of the same foot
Setting baby's feet on the ground.	Rectangle	-	Comparison of 2 rectangles
Entering into cage		Tube	Calculating the surface area of the tube without a base
Taking the bath		Sphere	Calculating the volume of contents
Throwing *udhik-udhik*		Tube	calculating the volume of contents

Besides the Javanese, several other tribes in Indonesia also carry out similar traditions to the *tedhak siten* tradition, such as the study on the Inheritance of Sundanese Traditions in the Sundanese Land Tradition (Sari, 2018). A similar tradition passed down from Rajo's descendants in Nagari Koto Rajo, Pasaman Regency, West Sumatra, is still prevalent. This tradition differs in using several things: ground, seven-colored flowers, yellow slings, cloth, and gold (Sarlisa & Nurman, 2021). The Sei Bilah Malay community of Langkat Regency also carries out a similar tradition with different stages. The stages include flour, shaving, bathing children, getting off the ground, taking children for walks, and rocking children (Sihombing, 2021). Various similar traditions vary from region to region, but the meaning is to celebrate births marked by being able to walk around the age of 8 months.

The ethnomathematics research at the *tedhak siten* ceremony found 2 activities that use mathematical concepts, namely counting and geometric activities. Counting activities are completed when determining the date for performing the *tedhak siten* ceremony by applying mathematical concepts,

including the LCM, modulo 7 arithmetic, and modulo 5 arithmetic. The geometric activities were found in equipment during the *tedhak siten* tradition, including studying planes and solids.

Tracing ethnomathematical in traditional *tedhak siten* activities is determined by calculating the execution date. This finding is relevant to previous research on counting activities in the pranatamangsa system in determining the seasonal calendar in Javanese society (Prahmana et al., 2021). Others were the determination of Javanese primbon as the selection of days and dates in conducting events and calculating the death day (Utami et al., 2019); the tradition of calculating the land area of the Sasak tribe in Lombok (Hardiani & Putrawangsa, 2019); and the application of counting materials to the mbojo community for buying and selling activities, measuring traditional houses and traditional fabrics (Sutarto et al., 2021).

The ethnomathematical discovery as a geometric concept in the *tedhak siten* ceremony is found in the ceremonial equipment for performing the ceremony. Prior ethnomathematical research with geometric concepts in cultural activities was found in Yogyakarta batik patterns (Prahmana & D'Ambrosio, 2020) and Yogyakarta palace (Mauluah & Marsigit, 2019). Geometric concepts were also found for food, barongko bugis cakes, and lingga cakes (Muk Minah & Izzati, 2021; Pathuddin et al., 2021).

Teaching Materials Integrate the Ethnomathematics of the Tedhak Siten Tradition into Class Learning Practices

The learning process conducted in a class by studying material that has become a community cultural activity will provide students with an understanding of addressing hereditary cultural heritage. By using the flow and learning objectives, mathematics learning designs can be implemented by delivering culture-based content. This learning design-based ethnomathematics is conditioned by the applicable curriculum according to the needs of students, as presented in Table 4.

Table 4. Ethnomathematics-based learning design

Learning Outcomes
1. Able to generalize understanding regarding the problem of common factors and multiple 2. Able to solve simple equations and inequalities using a variety of shapes with visual representations, symbols, and mathematical statements. 3. Able to solve problems of various shapes (rectangles, polygons, and circles), surface areas, and volumes 4. Able to identify the characteristics of various geometric shapes (sides, edges, and angles) of cylinders and spheres and their combinations of geometric shapes.
Learning Objectives
1.1 Use the Least Common Multiple (LMC) method in completing the addition and subtraction of a number to calculate the age of an 8-month-old baby in the Javanese calendar. 2.1 Understand the concept of Pythagoras in a right triangle to find the unknown side as the baby's path on the traditional ceremonial tool, the stairs. 3.1 Measure the area of the shaded rectangle 3.2 Measure the area of the rectangle and circle as a foothold. 4.1 Measure the surface area of the tube used for the confinement procession. 3.2 Measure the volume of a cylinder and sphere for the siraman procession. 4.1 Measure the volume of a spherical object from the radius or diameter of the *udhik-udhik* and a jug.

Domain
Numbers, Algebra, Measurement, Geometry
Description
Students are shown the procession of the traditional *tedhak siten* ceremony, which is still developing in society. The teachers explain the philosophical meaning of each stage of the ceremony. While observing the traditional ritual procession, the teachers describe the implementation of the *tedhak siten* procession by applying the calculation of the smallest common multiple and then modulo 5 and 7. The teachers also explain the equipment used in the ceremony, and students are given examples of geometric shapes (in this case, circles) to determine their area using mathematical formulas. Students are also explained to understand the comparison of outer and inner quadrilaterals. Students are introduced to the Pythagorean equation used on the sides of triangles. Next, students study the surface area and volume of spheres and cylinders. Then, students are given practice questions to dig deeper into their mathematical knowledge.
Student profile
Thinking critically, students apply understanding in different situations, especially the exploration of the Javanese *tedhak siten* ceremony. Thinking creatively, students gain new knowledge, which is a cultural activity in society to have ideas for preserving other cultures in their area.

Students who think mathematics is not related to everyday life require an ethnomathematical learning approach. Thus, curriculum development and teaching can be used as an alternative to creating more contextual mathematics learning close to the student's culture. Hence, in the end, it can build mathematical thinking skills and literacy and foster an appreciation of the diverse richness of Indonesian culture (Kusuma et al., 2017; Muiz et al., 2022). Proposing a Curriculum Trivium, based on the concept of literacy, materacy, and technocracy, consists of the ability to process written and spoken information, interpret codes and combine instruments to adapt to the situations of everyday life (D'Ambrósio, 2005). Several recommendations from the research on integrating ethnomathematics with learning models can improve mathematical abilities to the maximum (Jatia et al., 2019; Sarwoedi et al., 2018).

Related to the ethnomathematics studied, the aspects needed are: The *tedhak siten* tradition can be analyzed to reveal various mathematical concepts in society, especially in the Javanese tribal community, and helps learn mathematics. The *tedhak siten* tradition has historical, social, and cultural implications that must be preserved as ancestral heritage. Finally, it is necessary to notice learning materials in class through traditions that have good meanings.

CONCLUSION

The *tedhak siten* tradition has a mathematical concept of calculating execution time and geometric shapes in traditional ceremonial equipment. The material used has good potential for ethnomathematics-based learning to support curriculum development. The geometric concept in the *tedhak siten* equipment is critical to embody the meaning of family expectations for the baby. Mathematical exploration on the 7-color *jadah* depicted a shaded circle; the stairs climbed, explained Pythagoras; the earthen container explained a rectangular area ratio; a cylindrical cage surface to determine the surface; a baby tub containing water to calculate the volume; yellow rice in a bowl is to estimate the volume. Exploration of mathematical concepts in the tradition can be implemented with an ethnomathematics-based learning

design adapted to explain learning outcomes, learning objectives, domains, and explanation of the ceremony stages. The ethnomathematics found must be considered so that they can be integrated into classroom learning to strengthen children's mathematical abilities. Hence, it needs the attention of educators in developing, researching, and examining more deeply the potential of learning resources from cultural activities to be taught to students.

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Declarations

Author Contribution : W: Conceptualization, Methodology, Original Draft-Writing, Validation, Review-Writing Analysis, rise funding.
MGP: data curator, write, visualize, review and editing, editing and visualization.
JRLM: Review-Writing Analysis, methodology, Supervision.

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