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KETUPAT EID TRADITION OF THE NORTH COAST OF JAVA AS AN ALTERNATIVE MATHEMATICS LEARNING MEDIA

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ABSTRACT

Learning mathematics requires real situations that students often face. Tradition as local wisdom from the surrounding community can be used for learning mathematics so that students can reach the context of abstract mathematics. In this article, the researcher explains how teachers can take advantage of local culture and traditions in the form of *Ketupat* Eid on the north coast of Java to be used in learning mathematics. This research was conducted on the northern coast of Java, where every seventh day after Eid Mubarak, the area performs the *Ketupat* Eid tradition. Researchers tried to connect some foods that only exist in the *Ketupat* Eid tradition in the form of *Ketupat* and *Lepet* with mathematics in school. The results showed that diamonds could be used for rhombuses, prisms, and beams, and Lepet can be used as a tube context in geometry learning.

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1. INTRODUCTION

Mathematics learning that is currently developing still tends to be less flexible, less applicable, very theoretical, and less contextual. Mathematics learning in secondary schools is less varied, thus affecting students' interest in further learning mathematics. Teaching mathematics in schools is too formal, so the mathematics that children find in everyday life is very different from what they find in school. In other words, most of the teachers in learning mathematics have provided abstract mathematical concepts, without relating them to the context of the surrounding environment, so that students consider mathematics to be the most difficult subject for them.

The effect of learning mathematics in Indonesia which tends to be less flexible, less applicable, very theoretical and less contextual can be seen from the ability of students in mathematics to have a tendency to be below the international average score of 500. The results of a survey conducted by Trends in International Mathematics and Science Study in 2015 obtained a score of 397 (Mullis et al., 2015), as well as the results of the Program for International Student Assessment (PISA) which measures reading, math, and science literacy skills, in 2015 the average score was successively The participants were 397, 386, and 403 which were still below the international average score of 500 (OECD, 2016; Wijaya, 2016). These results are in line with the results of previous studies which showed that students' ability to solve mathematical problems was very weak.

Mathematics is recognized as developing along with the development of human civilization, while human civilization always produces culture. This means that mathematics is indirectly very closely related to the culture of an area. In other words, mathematics is closely related to every aspect of social life (D'Ambrosio, 2001; Irfan et al., 2019; Rosa & Orey, 2016; Rosa & Shirley, 2016). This is what causes the development of the mathematical context in each region to be different. For example, the context of the day in the Javanese calendar uses modulo 5, while the context of the day in the Christian calendar which is used internationally uses modulo 7. Even in several regions in Indonesia, architecture. Various studies that study ethnomathematics, including researching the architecture of mosques in several areas have been identified for learning mathematics (Hardiarti, 2017; Lusiana et al., 2019; Putra et al., 2020), regional musical instruments for learning mathematics (Andarini et al., 2019; Marina & Izzati, 2019), batik for mathematics learning (Fatkhurohman et al., 2021; Sudirman et al., 2018; Wahyudi et al., 2021), including traditional regional cultures such as in Mandailing Natal and Sleman areas can be used for learning (Dewita et al., 2019; Irfan et al., 2019).

Integrating local culture or traditions or traditions in the environment around students with the context of mathematics is often called ethnomathematics (D'Ambrosio, 2001; Rosa & Shirley, 2016). Ethnomathematics is the way various cultural groups carry out mathematics in their activities. Ethnomathematics is perceived as a lens for viewing and understanding mathematics as a cultural product (Rosa & Orey, 2013, 2016), so that ethnomathematics can be used as a culture-based approach in learning school mathematics so that mathematics can be understood well by students. The process of integrating the surrounding environment such as tradition or culture in learning mathematics is in line with the paradigm of meaningful learning for students (Reiser & Gagné, 1982; Widodo et al., 2018). But the implementation in the field, mathematics learning in schools has not fully used the local cultural context (Aini et al., 2019; Ayuningtyas & Setiana, 2019; Sudirman et al., 2018), Mathematics learning in schools is still focused on abstract mathematical material and cannot be observed directly by students.

Each region has a tradition that is a distinctive feature to distinguish culture from other regions. As in the northern coast of Java, one of the Eid Mubarak traditions that are still being preserved is the *Bodo Kupat* (Ketupat Eid) tradition. In this tradition, two types of food that must be present to commemorate this are *ketupat* and *lepet*. Apart from the vegetable menu, such as *rendang* and *opor* as a complement to the Eid Mubarak tradition, they are also made as a companion to eating *ketupat*. There has not been much research on the Ketupat Eid tradition as an alternative medium for learning mathematics. Most researchers reveal the Ketupat Eid tradition from the aspect of character education values such as the adhesive rope of friendship between humans or for Muslims it is often called *hablum minannas* (Arif & Lasantu, 2019), cultural acculturation such as the formation of a Javanese Muslim family mindset to carry out the Ketupat Eid tradition (including the

tradition of eating *ketupat*) in various areas occupied by Javanese Muslim families (Misbah, 2019).

For this reason, this study seeks to identify typical foods in the Ketupat Eid tradition that can be used as an alternative medium for learning mathematics. Learning media involves the use of activities that require mental processes in learning. So that mental activity in learning mathematics can be generated by using systematic manipulation of instructional events. In this connection, the learning media used are *ketupat* and *lepet* which exist in the Ketupat Eid tradition on the north coast of Java. It is hoped that by using the Ketupat Eid tradition, mathematics learning becomes more meaningful because abstract mathematics content can be brought into real mathematics learning.

2. METHOD

2.1. Research Design

This is qualitative and descriptive research with an ethnographic approach (Creswell, 2012). Descriptive data is collected in the form of words and pictures (Fraenkel et al., 2012; Mohajan, 2018). Meanwhile, the ethnographic method is used to describe, explain and analyze the cultural elements of a society or ethnic group using a more contemporary language (Bass & Milosevic, 2018; Dobbert, 1982). Ethnography means writing about a cultural group (Bass & Milosevic, 2018; Dobbert, 1982; Naidoo, 2012).

2.2. Data Collection

Authors are irreplaceable when used as a human instrument (Brisola & Cury, 2016; Wa-Mbaleka, 2020). Therefore, the data collection techniques in this research were obtained through documentation and in-depth literature research. Literature searches are carried out in the form of primary and secondary reference sources such as journals, research reports, thesis, dissertations, proceedings papers, books, and internet sources.

2.3. Analyzing of Data

The data analysis technique used includes four main processes, namely: (1) Data collection through literature and documentation, (2) data reduction, (3) data presentation in the form of narrative text, and (4) conclusion (Creswell & Creswell, 2017; Fraenkel et al., 2012). The data collected were validated using a triangulation technique (Carter et al., 2014; Renz et al., 2018). This technique checks data through several relevant sources (informants). Data verification is a step used to confirm the conclusions from the collected data (Carter et al., 2014; Creswell & Creswell, 2017). Verification is carried out by reviewing literature researches, interviews results, documentation, and placing a copy of the determined data using the validity technique (Fraenkel et al., 2012).

3. RESULT AND DISCUSSION

3.1. Result

This study focuses on the food served in the ketupat Lebaran tradition. This tradition in the Islamic calendar occurs on the 7th of Shawwal. different from the Eid tradition in general which occurs on the 1st of Shawwal, the level of crowds in the ketupat Eid tradition is higher than the Eid tradition. This is because on the 3th to 6th of Shawwal, Muslims still carry out the fasting worship of Shawwal.

In general, there are two foods that must be present in the ketupat Lebaran tradition. the two foods are *ketupat* and *lepet* (see Figure 1). Although some Muslim families provide opor menus as a complement to ketupat, not all Muslim families provide opor menus.

Figure 1. On the figure left is a ketupat food, while the right is a lepet food

3.2. Discussion

There are two discussions that will be written in this article. The *first* discusses the philosophical foundations of the ketupat Eid tradition, along with the ketupat food and lepet foods. The second is talking about mathematics learning media using ketupat and lepet food.

3.2.1. Historical of Ketupat Eid

Eid Mubarak is a Muslim holiday that occurs after the fasting worship of Ramadan. In some areas in Java Island, such as the northern coastal region, two-holiday momentums occur in the month of Shawwal, namely Eid Mubarok and Ketupat Eid.

Ketupat Eid, also known as R*iyoyo Ketupat* or *Bakda Kupat* in Javanese tradition, occurs on the 8th of Shawwal after the one-week *sunnah* fasting. Muslims carry out the *sunnah* of Shawwal fasting because the reward erases one's sins for a year. However, Sunan Kalijaga or *Raden Mas Said* introduced the *bakda ketupat* on the 8th of Shawwal, in acculturating the Javanese language *bakda* (after) becoming *Bodo*, to obtain *bodo kupat*.

In this regard, Ketupat Eid, which occurs on the 8th of Shawwal, is calculated based on the intuition that the 1st of Shawwal is the feast of Eid Mubarak carried out in one week (7 days). However, Muslims are not allowed to fast on the 1st of Shawwal because it is a day of *tasrik*. In some areas on the Java Island, such as regencies of Jepara, Pati, Rembang, Kudus, Blora, and Grobogan, *Bodo Kupat* was carried out on the 7th of Shawwal. The difference in the *Bodo Kupat* is due to variation in time calculation between the Javanese and general calendar. The calculation of time on the Javanese calendar starts after *Asar* (3 pm), leading to a *Bodo Kupat* celebrated on the 7th of Shawwal.

The Javanese northern coastal Java community usually prepares special foods to celebrate the *Bodo Kupat* tradition. The typical food is *ketupat* and *lepet,* in addition to making *opor* or *gulai* as a companion to enjoy *kupat*. *Ketupat* is a food made with the basic ingredients of rice wrapped in woven yellow young coconut leaves, as shown in Figure 2.

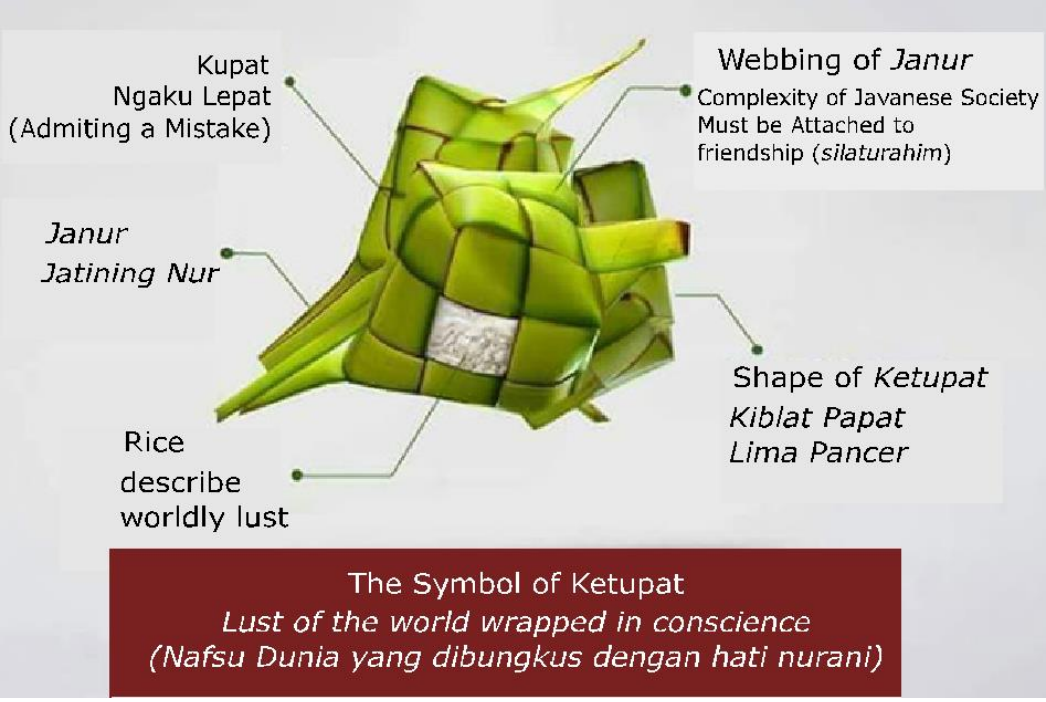

Figure 2. The Philosophy of *Ketupat*

Ketupat, in Javanese, also known as *kupat* is an acronym for *ngaku lepat* and *laku papat*, which means admitting a mistake and four-step, respectively. *Ngaku lepat* in Javanese tradition, specifically in the *syawalan* and *sungkeman*, is used by children to admit for mistakes. In this tradition, children are taught to respect their elders by apologizing and asking for guidance and blessing. The symbol of *sungkeman* tradition is the process of using *ketupat* as a treat to ask for forgiveness. The door is automatically opened and all mistakes that occurred between the two will be erased once the guest eats *ketupat*. Therefore, the use of this symbol to acknowledge mistakes by humans (*hablu minnanas*) and ask for forgiveness are in accordance with Allah SWT.

The words *laku papat* philosophically come from 4 terms, namely *Lebaran* (Eid), *Luberan* (overflow), *Leburan* (melted), and *Laburan*. *Lebaran* (Eid) means the end of the fasting month of Ramadan and preparing to welcome the day of the victory of Eid Mubarak (return to holy). *Luberan* (overflow) means to melt and overflow due to significant volume. It is morally associated with the culture of sharing with the poor by paying zakat to achieve sacredness. *Leburan* means exhausted or united, with the Eid moment used to eradicate sins against one another by apologizing and forgiving. *Laburan* comes from the word *labur* or lime, which means using a white dye to purify liquids. This means that humans need to maintain their inner and outer purity.

Each element in *ketupat* has a philosophical meaning. For instance, *kupat* means purity of heart after apologizing for mistakes made to others. *Janur* is a young and yellow coconut leaf which means *jatining nur* or conscience. According to some preliminary researches, the leaves used as wrappers are taken from the Arabic *Java Nur*, which means the light has come. Rice as the main ingredient for making *ketupat* symbolizes human lust. Therefore, the *kupat* made from rice wrapped in coconut leaves represents lust limited by conscience. This means that humans need to be able to restrain the lust of the world with their conscience. The *ketupat* weaving has intricate details, meaning that human life is also full of twists and turns and is expected to strengthen each other physically and spiritually.

The rectangular shape of the *ketupat* also symbolizes the four lusts of the world, namely, anger, hunger, the desire to have something beautiful, and the desire to force oneself. Those who eat *ketupat* are likened to be able to control these four passions during fasting. In addition, the rectangular shape of the diamond depicts *kiblat papat lima pancer*, which means four cardinal directions and one center, namely the direction of human life where the center is Allah SWT.

Lepet is a snack made with sticky rice and grated coconut wrapped in corn husks, coconut, or banana leaves, as shown in Figure 3. *Lepet* lexically comes from the word *silep kang rapet* (close tight), which means closing the past mistakes committed by our brothers and sisters and forgiving them. Mistakes are forgiven when admitted upon (*lepat*), with the promise for not repeating it, thereby making brotherhood closer to such sticky rice in a *lepet*.

Figure 3. *Lepet*

The existence of *ketupat* and *lepet* food during the celebration of Ketupat Eid in the Javanese Islamic tradition is a form of reaffirmation. Furthermore, apologizing and forgiving after fasting is manifested by real actions, not just lip-smacking and saying sorry during holidays with words such as *minal* aidzin *wal faidzin*. The word sorry needs to be born from the inner heart and students do not need to fight each other again.

3.2.2. Media of Learning

Learning media is a tool used to convey messages for students to ensure that they obtain its objectives (Trisniawati et al., 2019; Widodo et al., 2019). In this regard, the use of media in learning needs to consider the objectives adjusted to the level of student development and teachers ability in accordance with the characteristics of the material and support facilities (Balaji & Chakrabarti, 2010; Kerres & Witt, 2003; Scardamalia & Bereiter, 1991).

The use of appropriate learning media generates new desires and interests, motivates, and stimulates learning activities to improve their understanding, facilitate data interpretation, and condense information (Malaini et al., 2021; Sedkaoui & Khelfaoui, 2019; Yusandra, 2021). Hence, learning media is a very important factor used by the teacher (Yusandra, 2021). This is because it is closely related to the learning experience and the meaningfulness of student outcomes (Utami, 2019; Widodo, 2018).

The characteristics of abstract mathematics make students unable to understand mathematical concepts (Scandura & Wells, 1967; Swanson & Williams, 2014). Therefore, media is needed to provide the right concepts concretized to understand mathematical material. Previous researches stated that the use of media in learning improves students' cognitive abilities (Irfan et al., 2019; Widodo et al., 2018; Widodo et al., 2021), activities (Jonassen et al., 1994), and creativities in solving problems. However, this research indicates that the media used in learning promotes students ability to understand the material presented by the teacher during learning.

Several researches have been carried out to examine the use of media for learning, emphasizing technology-based learning media, specifically computer-based. Although the curriculum in Indonesia has emphasized the introduction of computer and information technology since the elementary school level, the limited facilities do not support the widespread application of computer game-based learning. Therefore, this led to the use of learning media in the surrounding environment as an alternative solution. One aspect that exists in the environment and can be used as a learning medium is culture or tradition. Mathematics is born from the activities of the cultural environment (Bishop, 2013; Dominikus et al., 2020; Gerdes, 2013). Ethnomathematics is the cultural anthropology of mathematics, which uses broad mathematical concepts (D'Ambrosio, 1985, 1989, 2001; D'Ambrosio, 2006; Rosa & Shirley, 2016). Therefore, culture in learning Mathematics is possible, specifically in Indonesia, where each region maintains heritage and respects ancestors. One of the traditions or cultures still maintained is *Bodo Kupat* and *lepet*. Therefore, using these 2 foods as learning media help students understand abstract mathematical concepts.

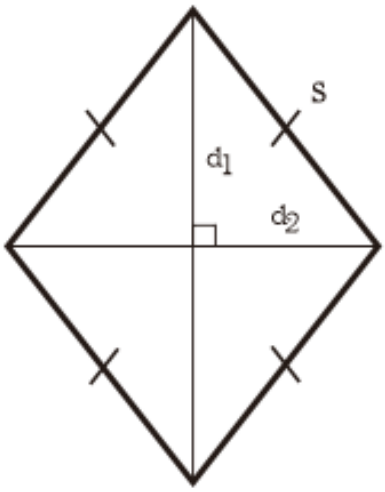

Figure 4. Rhombus

A rhombus is a parallelogram with 4 equal right-angled triangles, as shown in Figure 4. A rhombus has the properties that all four sides are the same length, with the two diagonals

perpendicular to each other, while the opposite angles are equal with 2 axes of symmetry. Its area and circumference are determined using $L = \frac{d_1 \, x \, d_2}{2}$ and $k = 4 \, x \, s$, respectively.

The shape of the diamond, when viewed in two dimensions, is similar to a rhombus, as shown in Figure 5. The diamond found in *Bodo Kupat* tradition is used as a medium for learning rhombus.

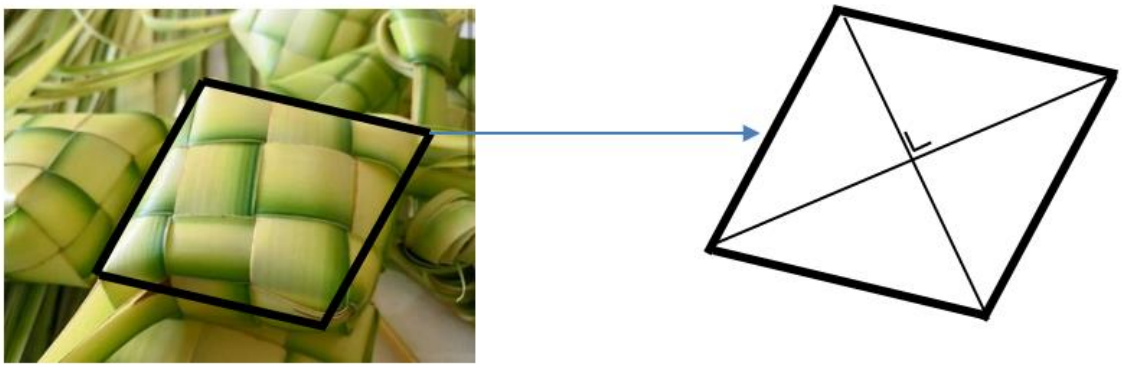

Figure 5. *Ketupat* that resembles a rhombus

Ketupat is used as a learning medium for rhombuses and prisms, a three-dimensional shape bounded by an identical base and covered in an n-sided and the upright sides in the form of a square or rectangle. In other words, a prism is a shape with a cross-section of equal size. Figure 6 shows that the shape of *ketupat* resembles a rectangular prism.

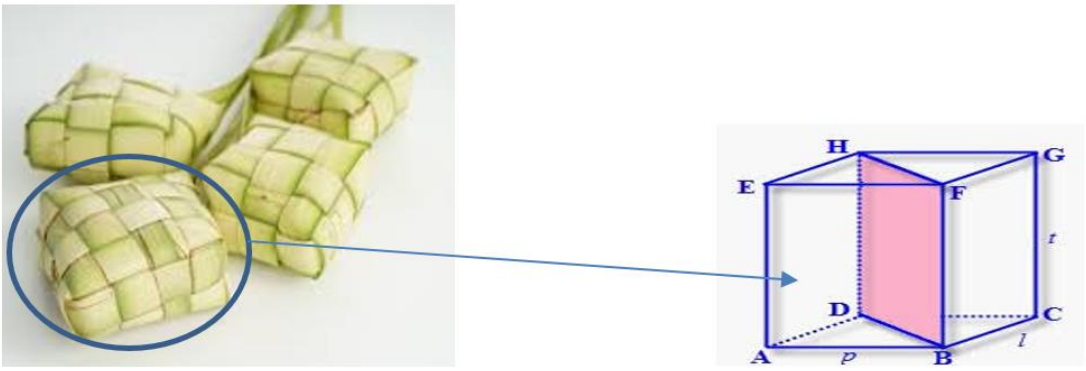

Figure 6. *Ketupat* resembles a rectangular prism

Rectangular prisms are often referred to as beams due to their similar characteristics. These include: (1) having a rectangular base and roof that are congruent, (2) 6 side planes, (3) 4 vertical side planes, (4) 12 ribs, and (5) 8 corner points. A rectangular prism is called a cube when its base and roof are congruent with the 4 vertical sides. The volume of a rectangular prism or block is determined as $V = p \, x \, l \, x \, t$, where $p \, x \, l$ denotes formula from wide, therefore, $v = base \; area \; x \; t$.

In addition to *ketupat*, the *lepet* in Ketupat Eid tradition are used as a medium for tube learning. A *lepet* is made such as rice cake resembles a tube, as shown in Figure 7. The characteristics of the tube are found in the *lepet* shape. It includes: (1) the circular base and bag area and (2) a rectangular blanket area. The concept of volume used to determine the volume of the tube is $V = base \; area \; x \; tall$. Since the base of the cylinder is a circle, the area of the base is $\pi \, x \, r^2$, therefore, the volume of the cylinder is $V = \pi \, x \, r^2 x \, t$.

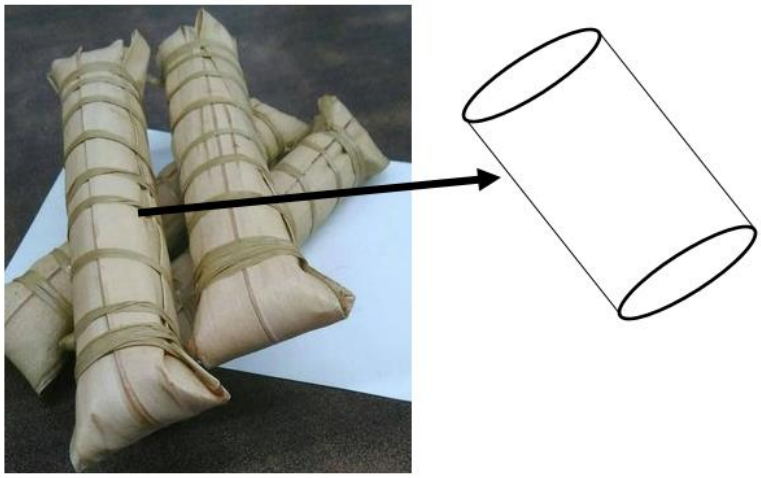

Figure 7. The picture of a slime that resembles a tube

From the previous explanation, *ketupat* and *lepet* foods that exist in Ketupat Eid tradition can be used as a medium for learning geometry, such as rhombuses, rectangular prisms, rhombus prisms, and blocks. *Lepet* can be used as a learning medium for tubes in connection with the formation of rhombus and other mathematical shapes.

In addition, *ketupat* and *lepet* food when viewed from the manufacturing process can be used to formulate mathematical problems with diamond context such as the following.

If 10 ketupat is used to commemorate Eid Mubarak with an average thickness and side of 4 cm and 10.5 cm. Determine the average area of the leaf used to wrap ketupat and its volume!

From this problem, it is known that the average thickness and side of the diamond are 4 cm and 10.5 cm. Terms of the area of the leaves needed to wrap *ketupat* can be interpreted by the surface area. Therefore, $L_{ketupat} = 10.5\big(10.5 + 2(4)\big) = 10.5(18.5) = 194.25\ cm^2$. The volume of *ketupat* is obtained from $V_{ketupat} = (10.5)(10.5)(4) = 63\ cm^2$.

In addition to use *ketupat* context, the process of making diamonds can also be used to arrange questions. Suppose every 500 grams of rice produces 12 diamonds, therefore, each *ketupat* is only filled by 2/3 of the volume which is not too thick *pera* (harsh) and mushy. Unlike ketupat, *lepet* is made using a mixture of sticky rice and grated young coconut. It takes 1 kg of sticky rice mixed with 2.5 young coconuts grated to 400gr to make 40 *lepets* at a boiling time of 4 to 5 hours.

From the process of making *ketupat* and *lepet*, a teacher can use the context of *ketupat* and *lepet* to make math problems such as the following:

Mrs. Retno is a seller of lepet and ketupat. During Eid Mubarak she had 100 leaves with 1 leaf used to make ketupat, while half is used to produce lepet. In addition, to make 12 ketupat it takes 500 grams of rice, therefore, the capital needed to make 12 ketupat is Rp. 6,000.00. To make 40 lepet 1 kg of sticky rice and 2.5 coconuts are needed. The price of 1 kg of sticky rice is IDR 25,000.00, while 1 coconut is IDR 5,000.00. Hence, the capital needed to make 40 lepet is IDR 37,500 at a total of IDR 100,000.00 with a selling price of Rp. 3,000.00 and Rp. 2,000 for ketupat and lepet, respectively.

Suppose x = number of *ketupat* production, and y = number of sticky productions, then to determine the number of *ketupat* and *lepet* made from 100 leaves using $x + \frac{1}{2}y = 200$. Conversely, 500 grams of rice is used to make to make 12 *ketupat*. Therefore, the

capital is Rp. 6,000.00. To make 40 *lepet* requires 1 kg of sticky rice and 2.5 coconuts. The price of 1 kg of sticky rice is IDR 25,000.00, while 1 coconut is IDR 5,000.00. Therefore, the capital needed to make 40 *lepet* is IDR 37,500 with a total of IDR 100,000.00 $\frac{6000}{12}x + \frac{37,500}{40}y = 100000$. Due to the number of available leaves and limited capital, the appropriate sign of inequality is "≤" from Table 1.

Table 1. Estimation of *ketupat* and *lepet* modeling

Variable	Sum of Ketupat (x)	Sum of lepet (y)	Symbol	Stock
Sum of janur	1	½	≤	100
Startup capital	$\frac{6,000}{12} = 500$	$\frac{37,500}{40} = 937.5$	≤	100,000

The following constraint functions were obtained from Table 1:

a. $x + \frac{1}{2}y = 100$ or $2x + y = 200$.

b. $\frac{6,000}{12}x + \frac{37,500}{40}y = 100,000$ or $500x + 937.5y = 100,000$.

c. x and y are positive integers therefore $x \geq 0$ and $y \geq 0$.

The objective function is obtained from the statement "If the selling price of *ketupat* is Rp. 3,000.00 and *lepet* is Rp. 2,000.00" then the objective function is $Z = 3000x + 2000y$.

Furthermore, use inequalities to determine the area of the set of solutions. For instance, $2x + y = 200$ is used to determine the point of intersection of the coordinates $(0,200)$ and $(100,0)$. Meanwhile, for inequality $500x + 937,5y = 100000$ the point of intersection for the coordinate are $(0,106.67)$ and $(200,0)$. Therefore, a solution set for inequalities is formulated from these points, as shown in Figure 8.

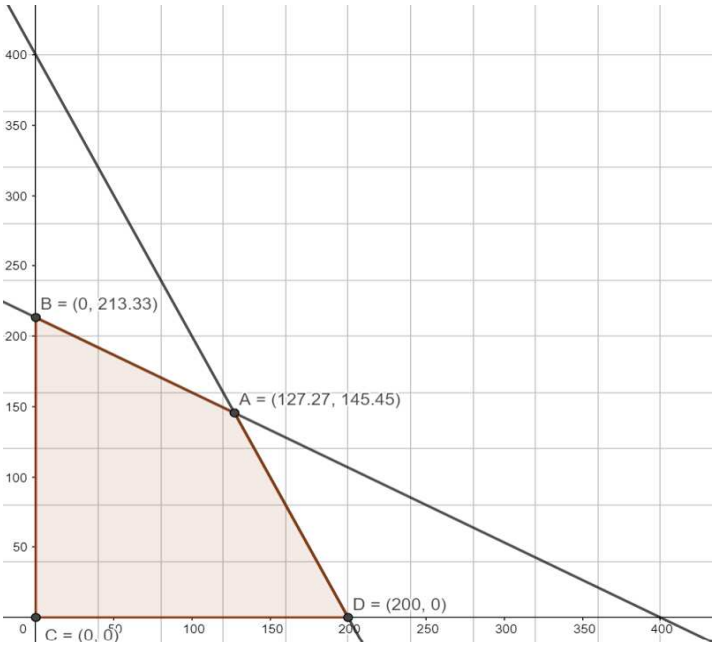

Figure 8. Ketupat and lepet problem modeling

Figure 8 shows that the solution set is limited by points $(0,0)$, $(100,0)$, $(106.67,0)$ and $(63.64, 72.73)$. Point $(63.64, 72.73)$ is used to obtain the intersection of lines $2x + y = 200$ and $500x + 937.5y = 100000$ by eliminating or substituting the two equations. Then, compare the value of the objective function at each corner point and substitute it into the objective function (see Table 2). It is found that the number of *ketupat* and *lepet* required to obtain the highest sales result of Rp. 479,000.00 are 63 *ketupat* and 72 *lepet*.

Table 2. Value of the objective function for each boundary points

Point	$Z = 3000x + 2000y$
$(0,0)$	$Z = 3000(0) + 2000(0) = 0$
$(100,0)$	$Z = 3000(100) + 2000(0) = 300.000$
$(0,106)$	$Z = 3000(0) + 2000(106) = 212.000$
$(63,72)$	$Z = 3000(127) + 200(145) = 479.000$

Based on the two examples of cases of using *ketupat* and *lepet* for learning mathematics that have been previously described, namely the area and perimeter of several geometric shapes, and linear programming problems. Does not rule out the possibility that the context of *ketupat* and *lepet* can be used for mathematics learning media on other materials.

4. Conclusion

Learning mathematics requires the integration of real objects that are close to students and school life. Therefore, the use of *ketupat* and *lepet* in *Kupat Eid* tradition is often practiced by Muslims in some areas on the north coast of Java as learning media to build rhombuses, rectangular prisms, rhombus prisms, and blocks help in making this process easier for students. Similarly, for linear programming material, *ketupat* and *lepet* contexts are used to formulate mathematical problems.

The research results that have been obtained, it is very possible to learn mathematics using the context of *ketupat* and *lepet*. Both of these foods are very exposed to residents on the north coast of Java, so that teachers in these areas can use the context of *ketupat* and *lepet* in learning mathematics.

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