



## Ethnomathematics Exploration in Coffee Planting Activities at Durjo Jember Plantation

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**ABSTRACT:** Ethnomathematics refers to the application of mathematics in social and cultural life. This study aims to explore and describe ethnomathematics in coffee planting activities carried out by coffee farmers in Durjo Plantation, Jember which involves mathematical concepts. This type of research is a qualitative research with an ethnographic approach. The data collection method uses observation, documentation, and conducts in-depth interviews with 3 farmers who will be labeled with S1, S2, and S3. The results of data collection were carried out and analyzed descriptively. This research found that in the activities of coffee farmers involving mathematics, there are mathematical elements including the concepts of flat building, building space, revival, congruence, translation, reflection, and rotation.

**KEYWORDS:** Coffee Plantation, Ethnomathematics, Geometry, Mathematics Concepts.

### INTRODUCTION

Science is one of the important capitals for humans to know life, this is no exception in mathematics. The ability to improve students' logical, systematic, critical thinking, and support their future learning success can be achieved by mastering mathematics, so mathematics is needed by everyone in daily activities, especially by students (Maryati & Rully, 2019). The process of applying mathematics can not only be done conventionally, but can be done outside the classroom. It aims to provide encouragement to students by providing a fun, meaningful, and understanding mathematics learning experience in mathematics, besides that this will have implications with students' ability and knowledge to know and connect mathematics with local culture or wisdom around students (Rosa & Clark, 2010). Mathematics and culture are two components that cannot be separated from everyday life. Culture has been integrated into all aspects of people's lives and can be applied in society while on the other hand, mathematics is a tool that humans use in solving and solving problems that occur in everyday life. Therefore, culture and mathematics are like metal currency that go hand in hand and are two important things that cannot be separated and need more attention (Prastika et al, 2021).

One contextual learning resource that can be used is the local culture. Ethnomathematics is a field of study that explains the relationship between mathematics and culture. The term ethnomathematics is defined as the art of understanding, explaining, studying, copying, and managing the natural, social, and political environment through processes such as calculations, measurements, classifications, models, and conclusions generated and developed from certain cultural groups that are clearly and well identified (D'Ambrosio in Pathuddin, et al., 2021). Ethnomathematics is a study that connects mathematical concepts with local culture (Dwidayati & Zaenuri, 2021). Ethnomathematics applies widely used concepts, such as measuring or determining location. The development of connection skills as well as a deep understanding of mathematics is a contribution of a culture of introducing mathematics as part of everyday life. Basic concepts such as calculating, measuring, and designing are some of the activities carried out on coffee planting activities.

Indonesia is a country with a myriad of cultures. Indonesia also has diverse natural resources, one of which is coffee (Sunardi et al, 2019). Coffee cannot be separated from Indonesian culture, currently Indonesia is included in the five (fourth) most coffee-producing countries in the world after Brazil, Colombia, and Vietnam (Musa et al, 2019) with yields reaching 636,000 tons per year. Coffee produced by Indonesia has excellent quality, the types of coffee that are widely produced are Arabica and Robusta which have been exported to several countries such as America, Japan, the Netherlands, Germany, and Italy (Saragih, 2013). Based on this, researchers are interested in further exploring coffee planting activities in Jember Regency, which is famous as one of the best coffee producing regions in Indonesia through a study.

**RESEARCH METHODS**

This research is a qualitative descriptive research with an ethnographic approach. Descriptive qualitative is used to obtain and explain information thoroughly and in depth (Prahmana et al.,2018), besides that qualitative research is also used and used for the assessment of a natural object condition with the main key being the researcher, while the collection, analysis of data that has inductive properties. The more important thing is that the results obtained will focus on meaning rather than generalizations (Sugiyono, 2009). Whereas ethnography is a qualitative approach that describes culture (Spradley,2007). Ethnography provides answers to the question of what is the culture of an individual group (Sulaster et al.,2020).

The purpose of this study is to uncover ethnomathematics in the activities of coffee farmers in Durjo Plantation, Karangpring Village, Jember Regency, East Java, Indonesia. The subjects in this study were coffee farmers who domiciled and carried out coffee cultivation. Data collection is carried out through observation, interviews, and documentation as support in the research. Instruments are developed based on the results of relevant literature studies and through proper preparation so that there is a need for instrument validation to get good research Instrument validation involves Mathematics lecturers to validate it after the results are accurate, it will proceed to the next stage. The data collection method is carried out by observing coffee farmers and interviewing coffee farmers to get the data needed. Interviews were conducted with 3 farmers in the Durjo Plantation area, Jember Regency. Furthermore, at the stage of data analysis, it is grouped based on the results of the research that has been obtained, then the data is compiled according to the focus of the research problem and the purpose of the research, namely to find out the geometric elements contained in the coffee planting process. At the conclusion stage, the researcher draws conclusions from the results of data analysis that refer to the formulation of the problem.

**RESULT AND DISCUSSION**

In this study, ethnomathematics focused on the coffee planting process carried out by farmers in Durjo Plantation, Jember Regency. In this data analysis, the activities of community coffee farmers will be presented in the Durjo Plantation area, Karangpring Village, Jember. These activities are obtained from S1, S2, and S3 who are coffee farmers. The data that has been obtained will later be analyzed and connected with mathematical concepts. Researchers found a mathematical concept contained in the coffee planting process, namely the concept of geometry. Geometry concepts found include building flat and building space, congruence and revival, translation, rotation, and reflection.

**Flat Build Concept**

The flat building concept contained in this study is found in the planting distance between coffee plants determined by farmers, here is the description:

**S1 QUESTIONS AND ANSWERS**

- P1008 : How do you measure the planting distance between coffee plants?
- S1008 : The distance between good plants is 3 x 2, upwards 2 meters to the side 3 meters

**S2 QUESTIONS AND ANSWERS**

- P2008 : How do you measure the planting distance between coffee plants?
- S2008 : The planting distance in my field is 3 x 3, because later if the plants have grown so that they do not overlap between plants, so there are still passages that function when we do maintenance and harvest.



Figure 1. Distance Between Plants S1

Based on interviews in S1, it was found that the result of the distance between plants formed a rectangular flat build with a size of 2 m x 3 m. The existence of this distance aims that if the coffee plant grows large later, there will be lorong used by farmers in subsequent activities such as care and harvesting.

By definition, a rectangle is a shape with 4 sides where the facing sides are the same length and have the same angle forming a right (measuring 90 degrees). The properties of the rectangle include:

- Have 4 sides, 2 pairs of opposite sides aligned
- Has 2-fold symmetry
- Has secondary rotational symmetry
- Has 4 corner points, all of which are the same
- Diagonal rectangles intersect in the center of the rectangle
- The center of the rectangle divides the diagonal into two equal parts
- Has two axes of symmetry, the vertical axis and the horizontal axis

The rectangular formula includes:

Around  $K = 2 \cdot (p + l)$

Broad  $L = p \cdot l$

Diagonal Length  $d = \sqrt{p^2 + l^2}$



Figure 2. Distance Between Plants S2

Based on interviews in S2, it was found that the result of the distance between plants formed a square flat building with a size of 3 m x 3 m. The existence of this distance aims that if the coffee plant grows large later, there will be lorong used by farmers in subsequent activities such as care and harvesting. Square or commonly known as square is a two-dimensional construct formed by four ribs that are the same length and have four angles that are equal in size to all of them right angles. Each build must have properties that are a special distingency of the flat build, including the square. The properties of the square include:

- Has 4 equal sides
- Has 4 right angles
- The opposite sides are aligned
- The two diagoals are equal in length and intersect each other by dividing each other by equal length
- The two diagoals intersect perpendicularly
- Its four corners are divided in half equally large by its diagoal-diagonal
- Has 4 folding symmetries so that the square has 4 axes of symmetry

The square formula includes:

- The square area formula, based on the sense that a square has 4 sides equal in length. The area of a square is the multiplication of two adjacent sides, if the area is symbolized by  $L$  and square sides with  $s$ , then it gets  $L = s \cdot s$
- The formula for the circumference of a square is obtained by looking at its side, if the length side square is  $s$ , then the circumference of a square is four times the panjang of its side  $K = 4 \cdot s$

The next flat build is a circle, the wake is found when the farmers will give fertilizer to the coffee plants. The following is a description of the interview with the source:

**S1 QUESTIONS AND ANSWERS**

- P1018 : How to apply the fertilizer sir?  
S1018 : Make a hole first around the plant, sow the fertilizer and then cover the soil again  
P1019 : How to make the hole, sir?  
S1019 : Around the coffee tree, a circle is formed by hoeing, but not deeply, just to clean the area around the tree.  
P1020 : As for the size of the circle, how is it sir?  
S1020 : It remains only to see the outermost leaves on the main twigs. So the size corresponds to the distance of those outermost leaves, then a circle is formed.

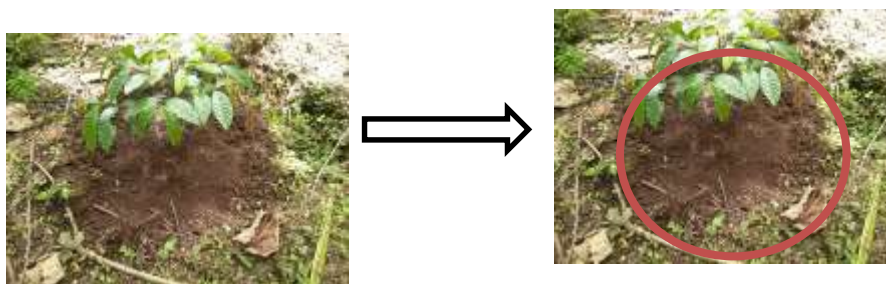
**S2 QUESTIONS AND ANSWERS**

- P2019 : For the application of fertilizer, how is sir?  
S2019 : The method is the same as the others, the fertilizer is sown around the plant.  
P2020 : Is it a regular sow sir?  
S2020 : Excavated to form a circle first, looking at the outermost leaves, and then sown.

**S3 QUESTIONS AND ANSWERS**

- P3014 : How do you calculate and design fertilizer applications?  
S3014 : The fertilizer is later sown, one tree usually uses 2.5 ounces. I only use urea as well as organic fertilizer.  
P3015 : What is the usual sow straight sir?  
S3015 : Yes dug up in a circle around the tree, look at the outermost leaves. If the tree is small, the circle is also small

The fertilization method is done by making holes that are not deep around the coffee plant and are circular by looking at the outermost leaves on the main branch. The tool used is to use a hoe. After the hole is made, it can be sprinkled with fertilizer and then covered again with earth. According to interviews, for plants that are still teenagers, once fertilized as much as 2 ounces, for those who are old, fertilizing more than 2 ounces can be carried out. The following is an illustration of a picture of the fertilization process carried out by coffee farmers.



**Figure 3.** Flat Land Fertilization Pits

It is seen in figure that farmers make a circle around the coffee plant with the coffee plant as the center point. Circles are one of the geometric shapes and flat builds. The shape of the circle includes a curved curve enclosed with regular lines. The circle is quite unique and different from other flat buildings because this flat build only has one curved side that meets each other without having a single corner point. Here are the elements contained in the circle:

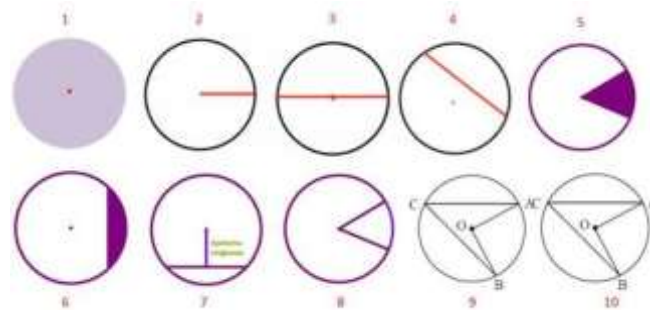


Figure 4. Elements of a Circle

Elements of the circle :

1. Center Point  
This is the point that is in the middle of the circle as its center.
2. Radius of the Circle  
It is a line connecting between the central point and the curved point on the circumference of the circle.
3. Circle Diameter  
A long straight line connecting between two points on the circumference of the circle that passes through the center point of the circle.
4. Circle Chord  
A straight line connecting two points on the circumference of the circle, but not through the center point of the circle. This is in contrast to diameters whose line goes through the central point.
5. Circular Sector  
The area in the circle is bounded by two radius lines and bounded by an arc of circles which is located flanked by the two radii.
6. Circular Segment  
The area that is inside the circle is bounded by a circular arc and a circle chord.
7. Apotema Circle  
The shortest distance between the chord and the center point of the circle. The apotema line is generally perpendicular to the chord.
8. Arc Circle  
A curved line that is part of the circumference of the circle. The chord on the circle is divided into two, namely a large chord and a small chord.
9. Central Angle of the Circle  
An angle formed from the intersection between two radii that are at the center point of the circle.
10. Angle of circumference of the circle  
An angle formed due to the confluence between two chords with one point on the circumference of a circle.

Build flat next which is semicircle. This can be seen when farmers have sloping land to fertilize, the farmer will make a circle setanagh at the top of the coffee plant. Here are the results of the interview:

**S2 QUESTIONS AND ANSWERS**

- P2019 : For fertilizer application on inclined land how sir? Is it the same as flat land?  
 S2019 : The method is the same as the others, the fertilizer is sown around the plant.  
 It's just not a circle, but a semicircle on the top of the coffee plant  
 P2020 : Why a semicircle sir?  
 S2020 : Yes, the land is tilted, so when the fertilizer is sown on the top bangian, it will go down to the bottom of the fertilizer automatically, the land is tilted



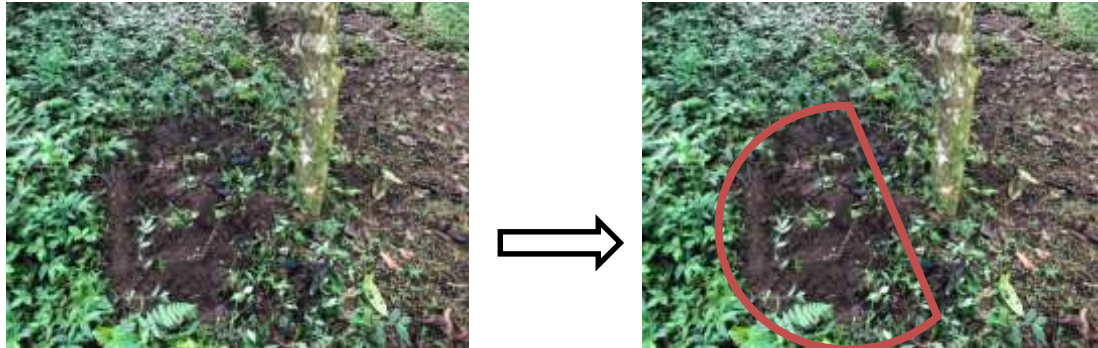


Figure 5. Slicing Land Fertilization Pit

On inclined land, a flat construct is obtained in the form of a semicircle, that is, a semicircle is a full circle divided from the diameter line into two equal parts. The formula for calculating the area of a full circle is  $L = \pi \cdot r^2$ , from the formula then the area of thesemicircle can be determined by  $L = \frac{1}{2} \cdot \pi \cdot r^2$ . As for the formula for the circumference of a full circle, it is  $K = 2 \cdot \pi \cdot r$ , from the formula then to calculate the circumference of a semicircle is  $K = (\pi \cdot r) + d$

**The Concept of Building Space**

This concept is found in planting holes made by farmers and jara between plants that form a flat build and build space.

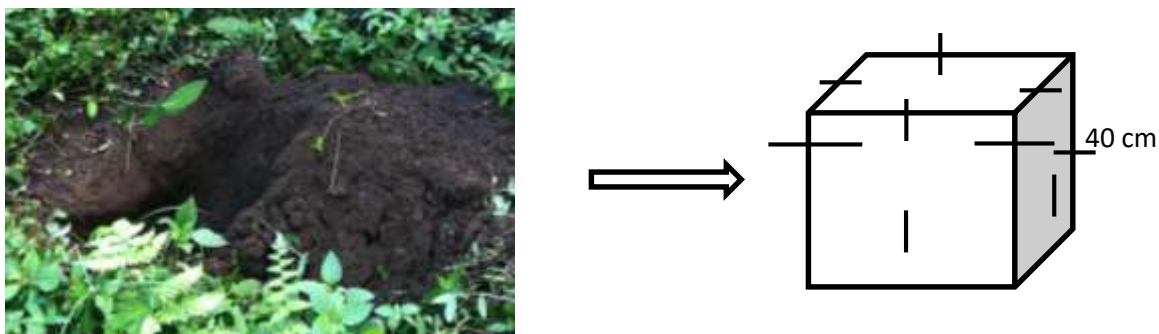


Figure 6. Planting Pits

Build a cube space is a flat side space that all sides are square and all ribs are the same length. The cube has 8 kinds of properties, namely:

1. The cube has six square-shaped sides
2. All sides of the cube build have the same size as well as dimensions
3. All angles of the plane of the cube form a 90-degree plane gais
4. Each side of the cube build line is opposite to the other four sides and is equally large
5. The cube has 12 ribs that are the same length
6. The cube has 12 diagonal sides/diagonal planes
7. The cube has 4 diagonals of space
8. The cube has 6 pieces of rectangular diaggpnal plane

This was also corroborated by interviews with interviewees, where the holes made were 40 cm x 40 cm x 40 cm. Here are the results of the interview:

S1 questions and answers

P1010 : For the beginning of making a planting hole, is there a size, sir?

S1010 : Depending on the coffee to be planted with gold, if arabica is 40 cm x 40 cm



x 40 cm, if the robusta is deeper, it can be 50 cm x 50 cm x 50 cm

S2 questions and answers

P2010 : For the beginning of making a planting hole, is there a size, sir?

S2010 : Yes, there is, for the size itself I am 40 x 40 x 40

S3 questions and answers

P3008 : For the beginning of making a planting hole, is there a size, sir?

S3008 : The size is 40 x 40

Based on this, it was found that the planting holes used formed a cube build without a cover. The formula of the volume of a cube is interpreted as the content or magnitude of a space body. The cube volume formula is a multiplication of the length, width, and height of the cube. The length of the sides and ribs of the cube is the same Here the formula of the volume of the cube is as follows:

$$V = s \times s \times s = s^3$$

In addition, there is also a surface area, surface area is the number of surfaces that have units of distance squared, or simply can be described by the amount of area on the surface of an object. Based on the previously mentioned features, it can be concluded that the cube consists of 6 squares arranged into a space construct. Therefore the surface area of the cube can simply be said to be equal to 6 x the area of the square.

### The Concept of Congruence and Revival

Revival is two flat buildings with the lengths of the corresponding sides having the same ratio and having equally large corresponding angles. Concongruence is two wakes that have the same shape, size, and size of the corresponding angle. The concept of conformity can be found in planting holes made by farmers. The description of the interview results regarding the concept of congruence and revival follows:

S1 questions and answers

P1010 : For the beginning of making a planting hole, is there a size, sir?

S1010 : Depending on the coffee to be planted with gold, if arabica is 40 cm x 40 cm x 40 cm, if the robusta is deeper, it can be 50 cm x 50 cm x 50 cm

P1011 : How to measure it sir?

S1011 : Use *pacul*, *pacul* is 20 cm in size, so the size of the hole is twice the *pacul* or twice half times the *pacul*

S2 questions and answers

P2010 : For the beginning of making a planting hole, is there a size, sir?

S2010 : Yes, there is, for the size itself I am 40 x 40 x 40

P2011 : What tools do you usually use, sir?

S2011 : Wear *pacul*, the size of *the pacul* is usually 20 cm

S3 questions and answers

P3008 : For the beginning of making a planting hole, is there a size, sir?

S3008 : The size is 40 x 40

P3009 : What tools do you usually use, sir?

S3009 : I usually use an inch of mas, one inch of an adult's hand is about 20 cm, meaning it takes 2 inch

P3010 : For its own depth how sir?

S3010 : I estimate just use *pacul*, if it is enough depth, it means that I don't *pacul* the ground anymore

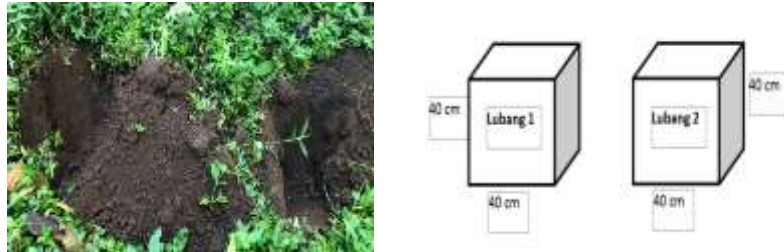


Figure 7. Robusta Coffee Plant Hole (Congruent Concept)

Based on the interviews of the three subjects, it was found that the size of the planting hole was 40 cm which formed a cube without a lid. The wake is said to be constructive and congruent because if it wakes it can be right and close to each other. So that the nature of:

1. The corresponding sides are of the same length
2. Equal value at angles that are positioned together

In other activities, namely determining the distance between plants in coffee, the concept of congruence can also be proven, which is proven and strengthened by interviews as follows:

S2 questions and answers

P2008 : How do you measure the planting distance between coffee plants?

S2008 : The planting distance in my field is 3 x 3, because later if the plants have grown so that they do not overlap between plants, so there are still passages that function when we do maintenance and harvest.



Figure 8. Coffee Planting Pit

The farmer explained in his interview that the size or distance between coffee plants is 3 m x 3 m which can be illustrated in the picture below.

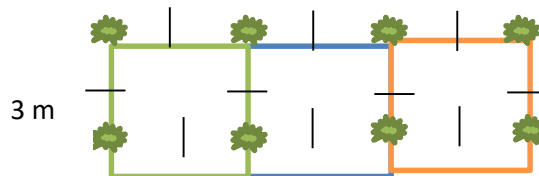


Figure 9. Illustration of Congruence in Coffee Plants

The concept of revival can be seen from the process of making a territory for fertilization with the same shape, namely a circle. The following are the results of interviews with coffee farmers in the Durjo Plantation area.

S1 questions and answers

P1018 : How to apply the fertilizer sir?

S1018 : Make a hole first around the plant, sow the fertilizer and then cover the soil again

P1019 : How to make the hole, sir?

S1019 : Around the coffee tree, a circle is formed by hoeing, but not deeply, just to



clean the area around the tree.

P1020 : As for the size of the circle, how is it sir?

S1020 : It remains only to see the outermost leaves on the main twigs. So the size corresponds to the distance of those outermost leaves, then a circle is formed.

S2 questions and answers

P2019 : For the application of fertilizer, how is sir?

S2019 : The method is the same as the others, the fertilizer is sown around the plant.

P2020 : Is it a regular sow sir?

S2020 : Excavated to form a circle first, looking at the outermost leaves, and then sown.

S3 questions and answers

P3014 : How do you calculate and design fertilizer applications?

S3014 : The fertilizer is later sown, one tree usually uses 2.5 ounces. I only use urea as well as organic fertilizer.

P3015 : What is the usual sow straight sir?

S3015 : Yes dug up in a circle around the tree, look at the outermost leaves. If the tree is small, the circle is also small

Based on the results of the above interview, said that fertilization is carried out once every two years. The fertilization method is done by making holes that are not deep around the coffee plant and are circular by looking at the outermost leaves on the main branch, so that each plant is different in size of the circle. The tool used is to use a hoe.



Figure 10. Fertilizing Hole

Based on the interview above, it is known that in each coffee plant different the size of the circle made by the farmer according to the outermost distance from the twigs of the coffee plant.

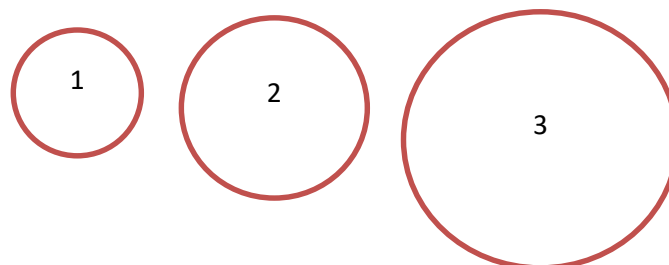


Figure 11. Ilustrtation of The Fertilizing Hole

The wake is said to be a wake because if the wake has the same shape. So that the nature of:

1. The corresponding sides are of the same length
2. Equal value at angles that are positioned together

**Translation**

Translation or shift is a transformation that moves points with a certain distance of direction. Distance and direction are indicated by translational vectors written in the form of a column matrix  $\begin{pmatrix} a \\ b \end{pmatrix}$ .

If the point  $P(x,y)$  is transformed by translation  $T$  by a translational vector  $\begin{pmatrix} a \\ b \end{pmatrix}$ , obtained point shadow  $P'(x', y')$ , written with :

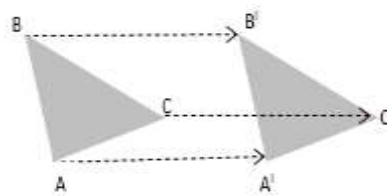
$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix}$$

Information:

$\begin{pmatrix} x' \\ y' \end{pmatrix}$  = shadow points

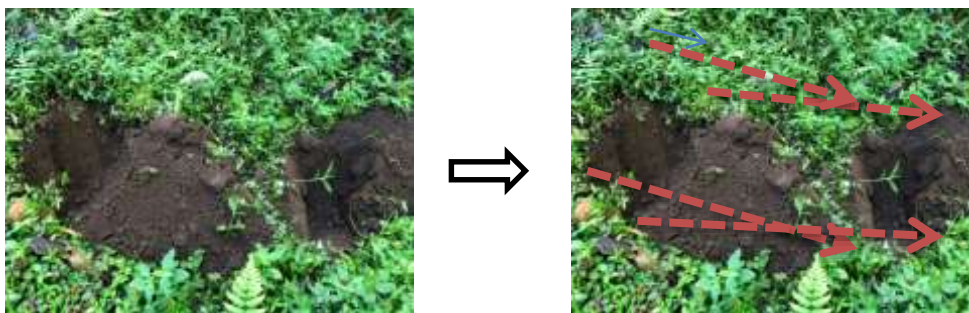
$\begin{pmatrix} x \\ y \end{pmatrix}$  = point of origin

$\begin{pmatrix} a \\ b \end{pmatrix}$  = translational vectors



**Figure 12.** Translation Examples

Translational is an isometric transformation, that is, a transformation that does not change the distance. In coffee plants, translations are found in each coffee plant planting hole, along with pictures and interviews conducted with coffee farmers.



**Figure 13.** Translation in the Coffee Hole

S2 questions and answers

- P2010 : For the beginning of making a planting hole, is there a size, sir?
- S2010 : Yes, there is, for the size itself I am 40 x 40 x 40
- P2008 : How do you measure the planting distance between coffee plants?
- S2008 : The planting distance in my field is 3 x 3, because later if the plants have grown so that they do not overlap between plants, so there are still passages that function when we do maintenance and harvest.

Based on interviews in S2, it is known that the size of each planting hole in coffee planting is 40 x 40 x 40 with a distance between plants of 3 x 3. This proves that in their activities, coffee farmers apply the concept of translation.

**Reflection**

Reflection is a transformation that moves points using the nature of reflection by a mirror. Mirroring is denoted by  $M_a$  where  $a$  is a mirror (axis of symmetry). In mirroring, the distance of the point on the shadow wake to the axis of symmetry is equal to the distance of the point on the rebuild to the axis of symmetry. So, reflection is an isometric transformation.

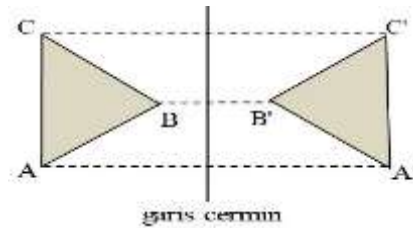


Figure 14. Reflection Examples

In coffee plants, reflections are found in each planting hole of coffee plants, along with pictures along with interviews conducted with coffee farmers.

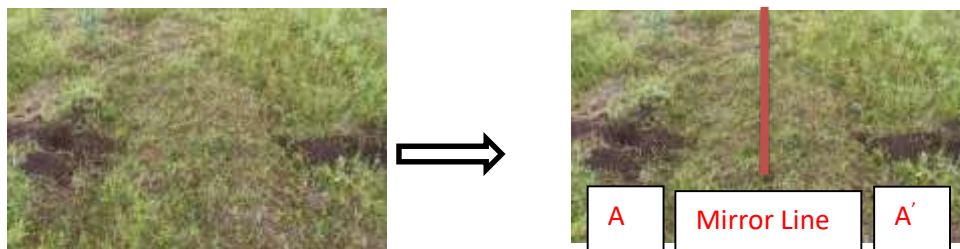


Figure 15. Reflection on the planting pit

From the picture above, the ethomathematics that exists in the coffee planting process related to reflection is in each coffee plant hole made and determined by coffee farmers in Durjo Plantation. Furthermore, to measure the distance between coffee plants, S1 uses a distance of 3 meters x 2 meters of distance between plants, meaning 2 meters forward and 3 meters to the side. The tool used by S1 in measuring the distance between plants is using bamboo which is first cut to a size of 2 meters and 3 meters and then used to determine the distance of coffee plants. For S2, the distance between the coffee plants used is a size of 3 meters x 3 meters, this is intended so that the coffee plants when they have grown do not overlap with other coffee plants, besides that it also provides space for farmers when doing nursery and harvesting. The tool used is a hand range, where one hand span is 1.5 meters, so to measure the distance between coffee plants, S2 requires 2 hand ranges, in determining the distance between coffee plants, S3 uses the same tool as S1, namely by using bamboo. Here's the general formula on reflection:

No	Refleksi	Bayangan	Matriks
1	Againts the X-axis ( $M_x$ )	$(x, -y)$	$\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$
2	Againts the Y-axis ( $M_y$ )	$(-x, y)$	$\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$
3	Againts the line $y=x$ ( $M_{y=x}$ )	$(y, x)$	$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$
4	Againts the line $y=-x$ ( $M_{y=-x}$ )	$(-y, -x)$	$\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$
5	Againts the point of origin O (0,0) ( $M_0$ )	$(-x, -y)$	$\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$

Figure 16. General Formula on Reflection

**Rotation**

The concept of rotation in the coffee planting process is obtained in the line segments obtained when making distances between coffee plants to be planted which aims to provide space or aisles to farmers in carrying out the process of care to harvesting.

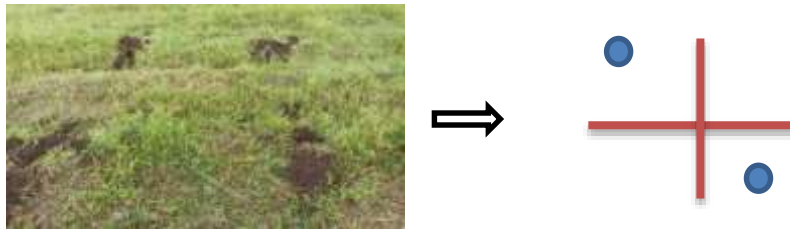


Figure 17. Rotation in the Hole of Coffee Plants

In the picture above is the application of the concept of rotation to coffee plants, where each hole used by coffee farmers will rotate in another hole. Rotation is a transformation that moves points by rotating them as far as  $\theta$  with the center of the point P. If  $\theta$  positive, the direction of rotation is opposite to the direction of rotation of the clockwork. If  $\theta$  negative, the direction of rotation is in the direction of rotation of the clockwork. Rotation is an isometric transformation because it does not change the distance.

A rotation with a center  $O(0,0)$  and an angle of rotation  $\theta$  written with  $R(O, \theta)$  or  $R_\theta$

Rotasi	Bayangan	Matriks
$R_{90^\circ} = R(O, 90^\circ)$	$(-y, x)$	$\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$
$R_{-90^\circ} = R(O, -90^\circ)$	$(y, -x)$	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$
$R_{180^\circ} = R(O, 180^\circ)$	$(-x, -y)$	$\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$
$R_\theta = R(O, \theta)$		$\begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix}$

Figure 18. Rotation

A rotation with a center  $P(a, b)$  and angle of rotation  $\theta$  written with  $R(P, \theta)$ . If the dot  $A(x, y)$  rotated as far as  $\theta$  with a center point in  $P(a, b)$ , the shadow of point A can be determined by the formula

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix} \begin{pmatrix} x - a \\ y - b \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix}$$

Based on the results of interviews with all the research subjects above, it can be seen that the process of growing coffee, caring for coffee trees, to harvesting coffee carried out by the three subjects is almost entirely the same. In general, all three subjects performed the same stages in coffee farming. Starting from the beginning of digging the soil to make planting holes, applying fertilizer to the pit so that the soil becomes fertile, planting seedlings, applying fertilizer to coffee trees, cutting coffee trees to the coffee harvesting process.

The results of the research conducted showed that there were farming activities by Durjo Plantation coffee farmers related to the use of basic mathematical concepts such as calculating, measuring, and designing. This is in accordance with the opinion of experts on ethnomathematics. Barton posits that "Ethnomathematics is a field of study that examines people from different cultures in understanding, articulating and using concepts and practices derived from their culture and that researchers describe as mathematics." (Barton, 1994). Ethnomathematics is also defined as mathematics used by community/cultural groups, such as urban and rural communities, workers/labor groups, professional groups, children of a certain age, indigenous peoples, and many other groups recognized by the common goals/objectives and traditions of the group (D'Ambrosio, 2006).

**CONCLUSION**

This research shows that agricultural activities such as coffee planting are still preserved and maintained by the community in Jember Regency. The farming community in Durjo Plantation has unconsciously practiced mathematics in the coffee growing process. The results of this study show that the coffee planting process contains mathematical concepts and can be used in mathematics learning in schools. The concepts are related to flat constructs and spaces, congruence and similarity, as well as transformations (translation, reflection and rotation). Therefore, coffee planting has the potential to be used as a starting point in making mathematical learning designs. This research is expected to provide motivation and inspiration for mathematics teachers



to apply culture in mathematics learning activities in the classroom. By applying the local culture, students are led to understand mathematical concepts easily because they are presented contextually. Thus, the learning process of students becomes meaningful because their mathematics learning resources come from the local culture and environment. In addition, this research is also expected to be a reference for further research in exploring other ethnomathematics.

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