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Preface

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Preface

It is a very great privilege for Faculty of Mathematics and Natural Science (FMIPA) Universitas Negeri Semarang to host the 5th International Conference on Mathematics, Science, and Education (ICMSE 2018) in Kuta, Bali, Indonesia on 8-9 October 2018. We are honored to have the opportunity to work with Indonesian Chemical Society, Indonesian Physical Society, Indonesian Biology Society, Association of Computer Science Higher Education, Indonesian Mathematical Society, and Association of Indonesian Science Educator in this forum. In 2018, our theme of "Collaborative Research on Science, Mathematics, and Education: Its Application As The Development of Sustainable Resources" celebrates the annual conference to provide a platform to the researchers, experts and practitioners from academia, governments, NGOs, research institutes, and industries to meet and share cutting-edge progress in the field of mathematics, natural science, and science education. Also, this event provides an opportunity to enhance understanding of relationships between knowledge and research in the scope of Mathematics, Biology, Chemistry, Physics, and Science Education.

The committee of ICMSE 2018 would like to express the sincere gratitude to the keynote speakers and all authors of the contributed papers in the conference proceedings. Moreover, would like to thank the expert reviewers for reviewing the manuscripts. We also highly appreciate the assistance offered by many volunteers in the preparation of the conference and the proceedings, and of course, to the sponsors assisting in funding this conference.

The committee selected papers and report findings presented in this forum to be published in **Journal of Physics: Conference Series (Institute of Physics Publisher)** indexed in some databases, including the Conference citation index, Scopus, Inspec, Chemical Abstracts Service, and Astrophysics Data System. We hope that this program will expand the mutual understanding and respect in stimulating research in Mathematics, Science, and Education; share research interest and information, and create a form of collaboration and build a trust relationship. We are delighted to be able to show the world what recent developments in the field of Mathematics, Natural Science, and Science Education through this fruitful program.

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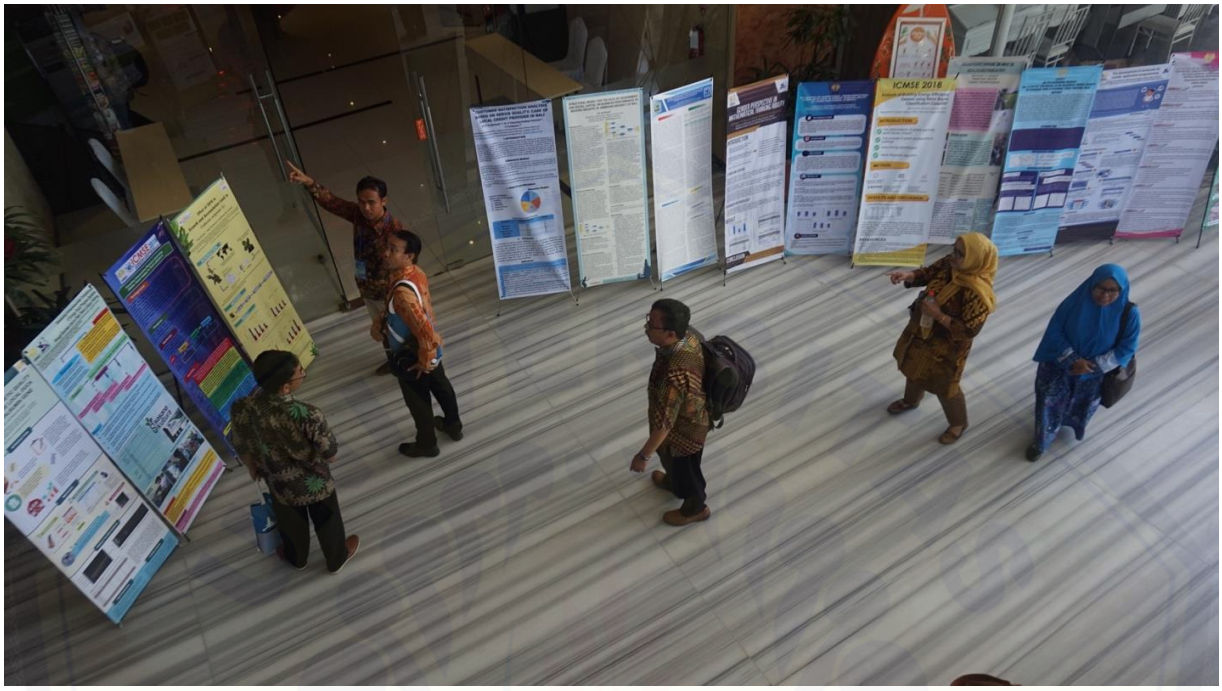

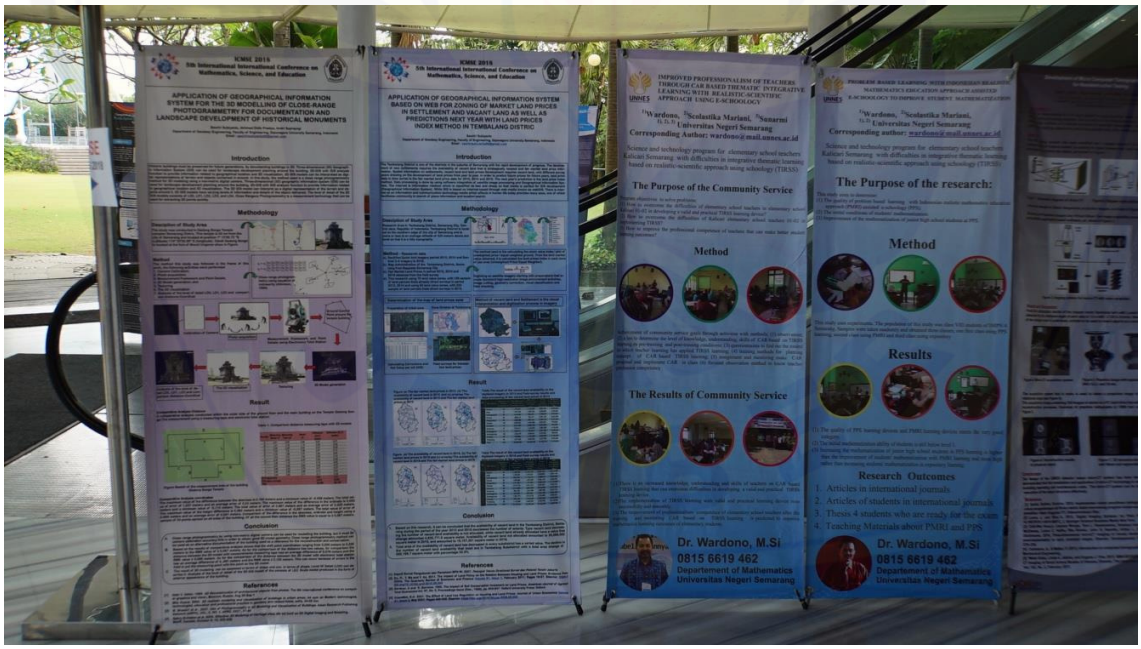

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Ethnomathematics activities of coffee farmers in Sidomulyo jember area as project student sheet

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Abstract. Ethnomathematics is a study of mathematics ideas form society. This research is undertaken in Sidomulyo Jember. This research goal is describe ethnomathematics model on ethnomahematics activities of coffe farmers. This research is qualitative type research with an ethnographic approach. The method of collecting data used are observation and interview. Research subject are four farmers in Sidomulyo Jember. The result of data collection were analyzed descriptively. As the result of this research visible farmer's activity such as design activity, measure activity, and calculate activity. The activity starts from the beginning of planting to the harvest.

1. Introduction

Indonesia is a country with myriads of cultures. Indonesia also has diverse natural resources, one of which is coffee [1]. Basic concepts such as counting, measuring, and designing activities are some of the activities carried out by coffee farmers. Activities in the field of mathematics are commonly known as etnomatematics. Ethnomatematics applies concepts that are widely used, such as avoiding, measuring, measuring, or determining locations [2,3].

Ethnomatematics research which discusses the concept of geometry, considered more complicated by society on woven motifs [4–7]. Another study entitled "Mathematical Approach in Solving Hausa Puzzles in Northern Nigeria" also accounts for how to overcome natural and community problems in Nigeria [8,9]. Students said geometry is considered difficult and when solving problems, students desperately need anticipation, including in understanding farmers' ethnomatics activities [6,10–13]. This is where the researchers are interested in delving more into the activities in the Jember Sidomulyo region, which is one of the best and well known coffee producers in Jember area, through a study entitled "Ethnomatics Activities of Coffee Farmers in Sidomulyo Jember as Teaching Material for Project Sheets Students ". The results of the study serve the basis for developing printed instructional materials for students' project.

2. Methods

The present study was qualitative in nature with ethnographic approach. Qualitative research is research aiming to understand the phenomenon of what is experienced by research subjects [14]. Qualitative research is often called a kind of naturalistic research because this research is carried out within natural setting; also called ethnography method [15]. Ethnography is a systematic depiction and analysis of a cultural group, community, or ethnic group collected from research site *in situ* [8,16–18]. Data were collected by observation and interview. The research site was Sidomulyo Village coffee plantation of Jember regency. The subjects of this study were 4 coffee farmers. To achieve the objectives of this study, the following steps were carried out: (a) Introduction: the initial process was

to determine the research site and subject of the study. The research subjects were coffee farmers in Sidomulyo Jember. The data under investigation were coffee gardening activities, determined due to the aim of getting the focus of research through interview and observation, (b) research instruments: the qualitative instrument operative in the study was "human instrument". The instrument was developed from the results of relevant literature studies and through proper preparation using fine and correct techniques. The instruments at work were observation guidelines and interview guidelines, (c) instrument validation: to develop good research instrument, it was deemed necessary to conduct instrument validation. The instrument validation was done by involving Mathematics lecturer to validate it. Once the results of validation were accurate and satisfactory, then the researchers proceeded to the next stage. However, in case unsatisfactory validity was evident, revision on the instrument was called forth, followed by another validation, (d) data collection: data collection was done by observation and interview. This method was done by directly observing the ethnomatematics activities carried out by coffee farmers in their garden at Sidomulyo area, Jember Regency. Interview was conducted to 4 coffee farmers in Sidomulyo Jember area, (e) data analysis: the process of data processing was done by collecting and organizing data into certain patterns. Data analysis was carried out to get answers regarding predetermined topics related to the coffee farmers 'ethnomatics activities and formulate ways to apply them to school mathematics, (f) conclusion: conclusions were drawn by summarizing the results of the analysis and discussion of data obtained on coffee farmers' ethnomatics activities in Sidomulyo area of Jember Regency, and (g) developing student project sheets: after drawing conclusions, the students' project sheets were then made in the form of worksheets by referring to the results of exploration of the farmers' ethnomatics activities in Sidomulyo, Jember Regency.

3. Results and Discussion

Coffee farmers' Ethnomatics activity in Sidomulyo Village, Jember Regency, ranged from the planting to harvesting. These mathematical activities included counting, measuring, and designing. Counting mathematical activities appeared in farmers' various activities in Sidomulyo Village. The first activity was when the farmer counted how many trees would be planted on the land. Farmers were able to estimate how many trees they need to plant by measuring the spacing between trees. To estimate the number of trees that would be planted, the farmers relied on their parents' experience, learning outcomes from the coffee research center in Jember Regency, and their habits. These three activities were collaborated. Plant spacing between coffee trees varied, ranging from 2.5 m, 3 m, to 4 m. This demonstrated that all four subjects were familiar with the unit of length in their activities, one of which was to estimate the number of trees to be planted.

In addition, farmers also pondered land area to determine the number of trees to be planted. For example, a coffee tree with a spacing of 2.5 mx 2.5 m requires about 1,500 trees planted on an area of 1 hectare. the planting distance is 3 m × 3 m, then the number of trees required is roughly 900 trees. Coffee trees with a spacing of 4 m × 4 m calls forth approximately 500 trees. Estimates of the number of trees could also be used as a reference to determine the number of coffee trees at different sizes. If there are 900 trees in one hectare of coffee trees, then for half a hectare land it takes nearly 450 trees with the same spacing. In this calculation, the concept of a comparative comparison is operative, that is the more comprehensive plantation land is, the more trees can be planted.

The next counting activity was performed when the farmers calculated the area of their land. In order to calculate the area of land owned by the farmers, they applied the mathematical concept to find the area by multiplying the length and width. The next counting activity appeared when the farmers had to determine the amount of fertilizer needed for the land. For example, in one area of 800 coffee trees, each tree requires 2.5 ounces of fertilizer. The total fertilizer needed is 800 × 2.5 = 1,000 ounces or 100 kg. In this activity, a mathematical concept is at play, namely multiplication. Farmers use the multiplication concept to determine the amount of fertilizer needed by multiplying the number of trees and the amount of fertilizer needed for each tree. In addition, the activity operative when applying fertilizer is calculating the ratio of fertilizer. Sidomulyo coffee farmers usually provided chemical

fertilizers mixed in different compositions. S1's fertilizer has a composition of 2:1:1 consisting of urea, ponska, and zwavelzure ammoniac (ZA). To determine the right composition, S1 would buy two sacks of urea fertilizer, 1 sack ponska, and 1 sack ZA at the same weight. S1 used the measurement of one sack as the composition of the ratio involving many fertilizers needed. This calculation also employed the concept of equal comparison, indicating that the more urea fertilizer is, the more ZA and ponska fertilizers are needed.

The farmers also determined the planting time and harvest time by involving counting activity. The time period of one year is needed to make a hole to plant it. For example, farmers made planting holes in the 3rd month or March, so they would plant coffee trees in the 3rd month of the following year. This activity involved the concept of addition. Calculation was also at work in harvesting coffee. Coffee harvesting comprised of two stages, namely picking fertilizer and harvesting. Picking fertilizer was the activity of picking coffee trees that seemed to have a defect, commonly indicated by reddish marks. Picking coffee was usually done in June. Around 15-30 days after picking up the fertilizer, harvesting was carried out. Harvesting was done when the coffee beans were red. The counting activity performed at this juncture was when the farmers determined how many days were needed for the harvest after picking up fertilizer. For example, when they needed 25 days, usually they remembered or marked the date for picking coffee, then counted 25 days forwards from that date and put another mark in the calendar. At this point, the farmers would know on what day and date the harvest had to be carried out.

When determined the amount of capital, the farmers also performed counting activity. For example the area of one hectare of land can encompass 800 trees. Seed costs Rp1,000 per tree. If there are 800 trees to plan, that will mean 800 × Rp1000 = Rp.800,000. Fertilizer is given twice a year, and an once of fertilizer costs around Rp. 500,000. One-year fertilization incurs Rp. 1,000,000, and if it reaches 3 years of harvest, then the calculation is 3 × Rp1,000,000 = Rp. 3,000,000. To pay the cost of labor for one-month treatment at particular time of the year, the farmers need to spend 35,000. One-year treatment will require 12 × Rp 35,000 = Rp.420,000, and 3-year treatment requires 3 × Rp 420,000 = Rp1,260,000. In this activity, farmers applied the concept of multiplication and addition to determined the capital needed. The farmers also applied different multiplication. When the multiplication was quite comprehensive, then the farmers would calculate number in tens first, whereas if the multiplication is only in unit form, then the farmer will use the addition concept.

Multiplication in Tens
Rp35.000 × 12
Step I: Rp35.000 × 10 = Rp350.000 (multiplying the value in tens)
Step II: Rp35.000 × 2 = Rp70.000 (multiplying the value in units)
Step III: Rp350.000 + Rp70.000 = Rp420.000 (summing the results from step I and step II)

Figure 1. The method in two-digit calculation

In addition to calculating activity capital, another calculation they performed was when calculating the profits obtained. To calculate profits, the farmers add up all the costs needed. The result is multiplied by the price per kilogram. For example, the price is Rp 20,000/kg, which means 500 kg × IDR 20,000 = IDR 10,000,000. After that, the result is reduced by capital, Rp 10,000,000 - Rp 5,000,000, so the profit is Rp 5,000,000.

Based on the research results, mathematical activities were operative when farmers measured the size of the land area and when farmers planted coffee. Measuring activities are also useful when determining the area of land the farmers would cultivate, done by stating the area in the form of units of hectares, such as one hectare, half hectare and the other.

In measuring the length and width of the land, the farmers had two methods. First, using an ordinary meter and the second was by following the details in land certificate. Farmers had two types of land, namely private land and government-owned land. For private land, farmers obtained it by

purchasing it, where the size was adjusted based on the land certificate when the deal was made. To measure length and width, the farmers usually used a measuring tape. However, if the land was owned by the government, meaning that the land was located in the forest and thus the farmers only had the right to use it, then they measured the length and width without the measuring tape. The farmers referred to the number of trees planted in one row and one column. Initially, the farmers would open the land in the forest, then they made the planting hole with the desired distance. For example, each tree is planted with a distance of 3 m apart. In one row there are 20 trees planted. This helps the farmers to determine the length of the land by multiplying the number of trees with spacing between trees. Therefore, they determined the length of land based on 3 m × 20 = 60 m.

In measuring the spacing between trees, each farmer had a different tool. Some used the size of an adult's hand, while some used bamboo cut in 3 meters long or used any desired spacing. Another farmer used plastic rope, which was marked every 3 meters. In addition, if the land was skewed then the measurement of the tree was also different, depending on the slope and direction of the sun.

Other measuring activities were performed when measuring the holes for planting coffee tree. The size of the planting hole for robusta type was usually 40 cm × 40 cm × 40 cm. To measure the hole, the farmers used hoe size. When the hoe had a size of 20 cm, the hole would dig in size of 2 hoes. Two hoes weremultiplied by 20 cm to 40 cm. Moreover, the process of cutting the coffee tree also applied calculation. The downside was that the cutting angle was not determined. Farmers only estimated the size of the angle by cutting the part that would be stretched with the size of the angle, which was a sharp angle.

Fertilizing also involved measuring activity. Each tree was given about 2.5 ounces fertilizer, but they only estimated 2.5 ounces by using their hand grip. There were also farmers who used small milk cans. A small milk can was considered equal to 2.5 ounces. The farmers learnt it from their parents' experiences and habits.

Figure 2. The extension of coffee tree

Figure 3. The hole for fertilizer

In addition, measuring activity was also at work when farmers made holes around the coffee tree to sow fertilizer. The area around the coffee tree would form a circle of different sizes. The size of the circle would follow the outer distance of the coffee tree with the coffee tree as the center of the circle. This size was used for flat land. When the land was tilted, the farmers only made a hole in which they the coffee tree would be planted. As such, the bigger the coffee tree was, the bigger the circle was formed around the coffee tree as the area to sow fertilizer.

Based on the results of the research that has been done, the activity of designing mathematics appears when farmers do the process of planting coffee. When making planting holes the farmer will first measure the distance between holes and design to be straight and parallel to each other by using stretched raffia. For land that is in the forest, farmers directly make planting holes, but if the land is privately owned, farmers must consider the distance first so that they can be planted optimally. In addition, if the land is tilted in the mountainside area, then planting coffee trees follows the mountain belt with the same spacing. The next design activity arises when farmers make tools to measure plant spacing. Farmers make tools from ropes or slaps that are fixed eyes with a distance corresponding to the desired spacing, 2.5 m, 3 m, or 4 m. In addition, farmers also carry out activities when designing

fertilizer. The area to be fertilized for flat land is circular, this shape follows the shape of a coffee tree. The shape of the circle is also easier to form. However, if the soil is tilted then the hole for sowing fertilizer is shaped like the letter U.

Based on the research results, the material or subject matter which will serve as the focus of student project sheet are indicators which can be observed well and applicable in calculations and clear mathematical concept. In this project sheet, the material is related to the system of linear equations and set completion. The questions and explanations are concerned with the applications of ethnomatics in coffee farming in Sidomulyo Jember. Activities serving as the focus of student project sheets are those involved in determining the spacing, amount of required fertilizer, and yields obtained by coffee farmers. The resultant student project sheet will illustrate some of the farmers' activities which integrate mathematical concepts in farming. The first activity is fertilization. The questions related to this activity will be related to the calculation of fertilizer application on coffee plants. The provision of different fertilizers requires different capital. Therefore, this required capital will produce call forth calculations that can be applied as practice on the student project sheet.

In addition, the activities performed in determining the planting distance are also involved in producing the sheet. Determining the planting distance will affect the number of coffee trees planted, so the results obtained by each farmer will differ from one another. The student sheet will focus on the issues of how farmers can grow coffee trees optimally with different spacing and generate maximum benefits. The next ethnomatics activities are harvesting coffee and calculating the profits. Calculating profits can be done in advance. This calculation will be applied in the student project sheet by considering the cost of fertilizer and other capital as well as the coffee harvest potentially obtained. Furthermore, questions will be made regarding the calculation of profits that can be maximally obtained.

4. Conclusion

Based on the analysis and discussion, it can be concluded that there are several ethnomatics activities in coffee farming activities carried out by Sidomulyo community in Jember regency. The mathematical activities operative in the coffee farming activities included measuring activities, calculating activities, and designing activities. Counting activities are performed in several farmer activities. Sidomulyo coffee farmers calculate the number of coffee trees to be planted in one area with a certain spacing. When fertilizing, the farmers also calculate the amount of fertilizer needed and the composition of different fertilizers. Furthermore, counting activities also take place when farmers calculate the capital and profits gained from farming process. Planting and harvesting coffee also require counting to determine the planting time and harvesting time. Measuring activity is performed when farmers measure the length and width of the land using the calculation of spacing between trees and the number of trees planted. Also, measuring activities also occur when farmers make planting holes and set coffee trees. The designing activity is done when farmers plant coffee trees with the same distance in shapes involving straight lines on flat land. The farmers design the planting patter based on mountain belt when the land is tilted. These ethnomatics activities serve as the basis for creating student project sheets with the topic of ethnomatics activities of Sidomulyo village coffee farmers. The material applied to make student project sheets is linear equations.

References

[1] Kurniawan B P Y 2016 *Int. J. Appl. Bus. Econ. Res.* **14** 965
[2] Wahyuni I 2015 Eksplorasi etnomatematika masyarakat sidoarjo *Fenomena (Jurnal Penelitian Islam Indonesia)* **15** 225
[3] Orey C 2011 *Ethnomathematics Cult. Asp. Math. Etnomatemática os Asp. Cult. da matemática*
[4] Hartoyo A 2012 *Jurnal Penelitian Pendidikan* **13** 14
[5] Garii B and Silverman F 2009 *Rev Latinoam Investig en Mat Educ* **12** 333
[6] Rosa M and Orey D C 2011 *Rev Latinoam Etnomatemática*

[7] Pressley A 2010 *Elementary differential geometry*. 2nd ed. *Springer*
[8] Waziri M Y, Saidu I and Musa H 2010 *Procedia - Soc Behav Sci* **8** 694
[9] Gerdes P 1994 *Hist Math* **21**(3) 345
[10] Yudianto E, Sunardi, Sugiarti T, Susanto, Suharto and Trapsilasiwi D 2018 *J Phys Conf Ser* **983** 1
[11] Yudianto E, Suwarsono S and Juniati D 2017 *J Phys Conf Ser* **824**
[12] Cimen O A 2014 *Procedia - Soc Behav Sci* **152** 523
[13] Stathopoulou C, Kotarinou P, y Appelbaum P 2015 *Rev Latinoam Etnomatemática* **8**(2) 105
[14] Miles M, Huberman M and Saldana J 2014 *Qualitative data analysis* vol 1 (SAGE Publications, Inc)
[15] Reeves S, Kuper A and Hodges B D 2013 *Br Med J* **337** 512
[16] Miles M B and Huberman A M 2009 *Qualitative data analysis* (USA: Sage Publication)
[17] Tobergte D R and Curtis S 2013 *Introduction to Qualitative Research Methods* vol 53
[18] Sugiyono 2013 *Metode penelitian pendidikan: Pendekatan kuantitatif, kualitatif, dan R & D* (Bandung: Alfabeta)