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Exploring Ethnomatematics on the Fish Breeding Activities in Tambak Bulak, Sidoarjo

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Abstrak

Etnomatematika adalah ide matematika yang tumbuh dalam suatu budaya. Etnomatematika menjadi sebuah gagasan penting untuk mengetahui peran matematika dalam kehidupan sehari-hari. Melalui etnomatematika, pembelajaran matematika dapat diajarkan dalam situasi yang dekat dengan siswa. Sehingga, siswa akan lebih mudah dan termotivasi dalam memahami konsep matematika di sekolah. Oleh sebab itu, penelitian ini dilakukan untuk mengidentifikasi bentuk etnomatematika yang ada pada aktivitas pembudidayaan ikan di Tambak Bulak Sidoarjo yang berfokus pada enam aktivitas fundamental dalam suatu budaya. Penelitian ini merupakan penelitian kualitatif dengan pendekatan etnografi. Data yang diperoleh berasal dari observasi partisipan dan wawancara yang dilakukan dengan pembudidaya ikan dari masyarakat Tambak Bulak Sidoarjo dengan instrumen pengumpulan data yaitu lembar observasi, lembar pedoman wawancara, dan lembar catatan penelitian. Selanjutnya, data akan dianalisis menggunakan teknik analisis data kualitatif. Hasil penelitian menunjukkan bahwa, terdapat bentuk etnomatematika pada aktivitas pembudidayaan ikan di Tambak Bulak Sidoarjo yang berkaitan dengan konsep bilangan, sistem koordinat kartesius, panjang, perbandingan senilai, perbandingan berbalik nilai, bangun datar yaitu persegipanjang, trapesium, lingkaran, belahketupat, segitiga, dan segilima, serta konsep logika matematika. Dengan demikian, pada aktivitas pembudidayaan ikan dapat digunakan guru sebagai jembatan untuk mengajarkan konsep matematika di sekolah dengan harapan siswa dapat lebih mudah memahami konsep matematika.

Kata kunci: *etnomatematika, budidaya ikan, Tambak Bulak Sidoarjo.*

Abstract

Ethnomathematics is a mathematical idea that grows in a culture. Ethnomathematics is an important idea to know the role of mathematics in everyday life. Through ethnomathematics, learning mathematics can be taught in close situations with students. Thus, students will be easier and interested in understanding mathematical concepts at school. Therefore, this study was conducted to identify the ethnomathematical form that exist in fish breeding activities in Tambak Bulak Sidoarjo which focuses on six fundamental activities in a culture. This research is a qualitative research with an ethnographic approach. Data obtained from participant observation and interviews with fish breeders from the Tambak Bulak Sidoarjo community with data collection instruments are observation sheets, interview guidelines, and research note sheets. Furthermore, the data will be analyzed using qualitative data analysis techniques. The results showed that, there were ethnomathematical form in fish breeders activities in Tambak Bulak Sidoarjo related to the concept of numbers, cartesian coordinate system, length, direct proportion, inverse proportion, plane figures namely rectangles, trapezoids, circles, rhombuses, triangles, and pentagons, also the math logic concepts. Thus, fish breeders activities can be used as a bridge to teach mathematical concepts in schools with the hope that students can more easily understand the mathematical concepts.

Keyword: ethnomathematics, fish breeding, Tambak Bulak Sidoarjo.

INTRODUCTION

Mathematics is still regarded as a tough, unpleasant subject and a learning scourge today (Kurniawan, 2017). Mathematics education is thought to be dry, academic, less contextual, and less diversified, and it is inflexible, formal, with just numbers having discussed in official educational institutions (Masamah, 2018). According to Wildaniati and Afriana (2019), the concepts studied in mathematics

are abstract. As a result, mathematical things are difficult to view and comprehend with the five senses, thus a bridge or intermediary is needed to study them. Ethnomathematics can be seen as a bridge between mathematics and culture (Kou and Deda, 2020). Mathematics and culture cannot be separated because mathematics is one of the sciences that originates from culture (Abdullah, 2016). Furthermore, ethnomathematics is the study of several approaches to assisting in the solution of mathematical issues depending on each other's viewpoints (Budiarto, Artiono, & Setianingsih, 2019). Ethnomathematics is the study of mathematical ideas from a traditional society's perspective (Ascher, 1991).

According to Dominikus (2019), learning mathematics will be more exciting as a result of ethnomathematics, as well as an endeavor to preserve a culture that may assist the Indonesian nation's progress. Various mathematical principles can be found in culture, so it can be used as a concrete learning resource to teach more contextual mathematics to students through their surroundings (Hardiarti, 2017). Thus, ethnomathematics can be used as a bridge to teach abstract mathematical concepts in the classroom. Ethnomathematics can provide a better and more fun mathematics learning environment for students by influencing their mathematical ability through their cultural context (Fajriyah, 2018). Traditional games, artifacts, and behaviors (activities) that express culture are all examples of ethnomathematical objects, according to Hardiarti (2017). Indonesia has a variety of cultures in each region with their own characteristics (Renavitasari, Irawati, & Prasetyo, 2016). One area that is rich in culture is East Java. East Java is divided into 29 regencies and 9 cities, one of which is Sidoarjo Regency. Sidoarjo Regency has a variety of existing potentials such as trade, industry, tourism, and small to medium enterprises, especially fish ponds with the largest commodities, namely milkfish and shrimp (Aji, 2018). One of the areas that still has potential for pond yields is Tambak Bulak Hamlet, Tambak Rejo Village, Waru District, Sidoarjo Regency. Some people in Tambak Bulak, Sidoarjo work as fish cultivators using freshwater ponds. The types of fish that are widely cultivated are milkfish and vaname shrimp.

According to Budiarto and Setianingsih (2019), in the ancestral heritage there are various cultural products that show the existence of mathematical concepts. Mathematical concepts that are contained in various forms of cultural results are referred to as ethnomathematical form in a culture (Abi, 2016). According to Nyoman (2010), the term "form" refers to a real-life situation. While ethnomathematics is a mathematical idea that is contained in a culture. Thus, the form of ethnomathematics can be interpreted as a real-life situation of mathematical ideas contained in a culture. Zaenuri, Teguh, and Nurkaromah (2017) state that in daily activities there are cultural elements related to designing and counting. Thus, community fish breeding activities in Tambak Bulak Sidoarjo also contain cultural elements, so it can be seen indirectly that fish breeding activities also contain mathematical concepts. In fish breeding activities at Tambak Bulak Sidoarjo, it consists of the fish hatchery process, the fish maintenance process, and the fish harvesting process. At Tambak Bulak Sidoarjo, there are several forms that demonstrate mathematical concepts in fish breeding activities, such as rhombus-shaped fishing gear, the use of local units in calculating the number of fish, and calculations in the process of selling fish. With the emergence of several mathematical concepts in fish breeding activities in Tambak Bulak Sidoarjo, researchers are interested in learning more about the ethnomathematical form of fish breeding activities in the area.

Mathematical concepts that grow in activities related to waters and fisheries are present. This is supported by the study from Malalina et al (2020) about the ethnomathematical forms in fish catching activities in the Musi River, which found ethnomathematical forms in determining location, measurement, and designing using concepts such as Cartesian coordinates, sets, social arithmetic, velocity, and geometry. Research on ethnomathematical exploration in the fisheries sector was also carried out by Muzdalipah and Yulianto (2018) who explored ethnomathematics in the technique of calculating gourami fry using the Sundanese style with research results showing the existence of mathematical concepts related to the distributive properties of multiplication, the concept of identity and inverse. Other relevant research was conducted by Ubayanti, Lumbantobing, & Manurung (2016) regarding the ethnomathematical exploration of fishing gear called *sero* in the culture of the Kokas people of Fakfak, West Papua which obtained research results that there are mathematical ideas that arise in the process of making measurements and determining the exact location related to the concepts of numbers and geometry. The difference between this research and previous research is the culture and the focus of the research conducted. This research will conduct an ethnomathematical exploration of fish breeding activities at Tambak Bulak, Sidoarjo and focus on ethnomathematical forms in fish breeding activities in Tambak Bulak, Sidoarjo based on the six fundamental activities proposed by Bishop (1997) namely counting, determining location, measuring, designing, playing, and explaining.

Bishop (1997) also suggests that counting activity related to determining how to calculate and performing numerical calculations with mathematical topics that can

be derived are numbers, calculation methods, number systems, number patterns, and statistics. The activity of determining location is an activity related to finding a path in the spatial world by directing oneself and other objects which are geographical aspects of mathematics with mathematical concepts that appear in the activity of determining the location, namely dimensions and Cartesian coordinates. Meanwhile, measuring activity is an activity in determining an amount that can be assessed which includes measurement techniques and all units involved, in measuring mathematical concepts that can be derived are order, size, unit, measurement system, and quantity. Designing activity is an activity in making an object shape, both from the differences in the forms that are built, the nature, to the way these forms are related to the decline in mathematical topics in this activity, namely shape, regularity, harmony, similarity, construction drawings, and geometric properties. Playing activity are activities related to a person's behavior in carrying out a pleasant behavior by involving certain skills from strategic thinking, guessing, and planning, in playing activities there are mathematical ideas that can be derived, namely procedures, rules, plans, and one's strategies in perform a certain action. Explaining activity is an activity related to a person's activity in trying to explain both to himself and to others about the reasons for something happening in their own way, in their own way. Activities to explain mathematical topics derived are the rules of logic and equations.

According to internet searches, there has been no research on the exploration of ethnomathematical forms in the activities of fish breeders in Tambak Bulak, Sidoarjo. Furthermore, fish breeding activities have previously been viewed solely from an economic standpoint, rather than from the cultural perspective associated with mathematics. Thus, the research question in this study was to identify the ethnomathematical form of fish breeding activities in Tambak Bulak, Sidoarjo. The goal of this study was to describe the role of ethnomathematics in the activities of fish breeders in Tambak Bulak, Sidoarjo.

METHOD

In this study, the type of research used is qualitative research with an ethnographic approach. Qualitative research is used for researchers who want to carry out activities in the field intensively, take field notes and conduct reflective analysis of the findings of documents in the area, which is used in writing detailed research reports (Budiarto, Setianingsih, and Artiono, 2020). In connection with that in this study, the researchers wanted to describe fish breeding activities in Tambak Bulak Sidoarjo by conducting field observations, field recordings, and analyzing documents found in the field. Ethnography in this study was used to observe fish breeding activities in Tambak Bulak, Sidoarjo through interviews, observations, and field notes. This research was conducted in Tambak Bulak Hamlet, Tambak Rejo Village, Waru District, Sidoarjo Regency.

The research subjects or informants selected in this study were a fish breeder from the Tambak Bulak community who had been in the field of fish breeding for more than ten years and a native who was 62 years old. The selection of informants was carried out using reasonable informant selection requirements in ethnographic research, according to Spradley (1997), namely through enculturation, direct involvement, foreign cultural views, sufficient time, and non-analytical. The data collection technique used is the data collection technique in the ethnographic research design. According to Fraenkel, Wallen & Hyun (2011), the method of collecting data in ethnographic research consists of participant observation and interviews. Observations and interviews conducted were open observations and interviews. Open observation is an observation made with a request for approval and permission on the subject to be observed (Resmini & Taufikurahman, 2020). Meanwhile, open interviews are interviews conducted with subjects who have realized the intent and purpose of the interview process (Tentama, 2013).

In this study, the interview process will be carried out as much as the researcher needs to obtain the required information. This is because to get data results that are by needs. It can be known after the process of analyzing data from interviews. After the interviews were conducted, the results of the interviews were then collected for later analysis. If there is a lack of information in the process of analyzing the data, then another interview will be conducted with the research subject. However, if the information obtained is by the needs, then research activities can be continued in the data analysis process, which is then carried out in writing research reports. If there is a lack of information in the preparation of the research report, a step back can be taken by conducting another interview and continuing with the data analysis process. This flow can be carried out continuously until the appropriate research report results are obtained. In this study, the researcher is the main instrument of research or referred to as a human instrument, with the supporting instruments to collect data such as observation sheets, interview guidelines, and fieldnote sheets which have been validated. The aim of the research validation instrument was to determine the feasibility of the research instrument to be used (Laili, 2014).

The research procedure that will be used in this study is the ethnographic procedure proposed by Creswell (2012) which is described as follows.

1. Identify goals and designs related to the research problem being carried out.
   In this study, problems were identified regarding fish breeding activities at Tambak Bulak, Sidoarjo and the stages of fish breeding.
2. Discuss consent and consideration of access to research sites.
   In this study, informants were taken intentionally through determining the research location first.
3. Using appropriate data collection methods.
   Data collection methods used were interviews and participant observation with supporting instruments used in data collection in the form of interview guidelines, observation sheets, and research note sheets.
4. Use design to analyze and interpret data.
   The data obtained will be analyzed using qualitative data analysis techniques according to Miles, Huberman, and Saldana (2014) to be developed as a whole based on the research theme.
5. Write a research report based on the design used.
   The research results will be reported as an objective study.

The data analysis technique used in this study is a qualitative data analysis technique, according to Miles, Huberman, and Saldana (2014), which consists of three stages, namely data condensation, data presentation, and drawing conclusions. Data condensation is used in the process of selecting data obtained in the field by playing interview recordings, writing summaries of the results of interviews and observations, and making transcripts of interview results by providing a code for each researcher's question and subject's answers. Code "Pi" is used to indicate the principle of the researcher's query, with "i" being the number of questions given and code "S" to show the answer from the subject.

In this study, the data is presented in the form of a narration accompanied by pictures derived from interviews and observations, which are then analyzed based on 6 (six) fundamental activities in a culture in order to avoid there is a misunderstanding of meaning by the reader, the playing activity in the fundamental activity is adapted into doing something activity according to the research topic.

Conclusions are drawn from the beginning of data collection to the end of the research process by determining the meaning of the data that has been obtained, followed by determining the relationships, differences, and similarities to draw conclusions as answers to the research objectives.

RESULTS AND DISCUSSIONS

Tambak is a term widely used by Javanese people, especially the people of East Java, which means "artificial pond." *Tambak* is an artificial pond used as a means of aquaculture. Some people in Tambak Bulak, Sidoarjo, livelihood as fish cultivators. It is supported by the natural conditions in the area, namely the availability of an adequate site of pond land.

Fish breeding activities have become a local culture that has been passed down from generation to generation. Some cultivated fish are shrimp, milkfish, catfish, tilapia, and others. Without realizing it, in this breeding activity, several mathematical concepts emerged fish breeders used in Tambak Bulak, Sidoarjo. In addition, fish breeding activities at Tambak Bulak, Sidoarjo are a local cultural concept that has been passed down from generation to generation and is still practiced today.

The existence of mathematical concepts in the local culture of fish breeding in Tambak Bulak Sidoarjo shows an ethnomathematical concept in this activity. There is an ethnomathematical form in fish breeding activities at Tambak Bulak Sidoarjo, such as measurements, calculations, and the tools used. The following is a description of the ethnomathematical form of fish breeding activities in Tambak Bulak Sidoarjo, based on the results of interviews and observations that have been made based on 6 (six) fundamental activities in a culture related to mathematics according to Bishop (1997).

1. Ethnomathematics Form in Counting

Bishop (1997) states that counting activities are activities related to determining how to calculate and perform numerical calculations with mathematical topics that can be derived, namely numbers, calculation methods, number systems, number patterns, and statistics. In line with this statement, counting activities appear in fish breeding activities at Tambak Bulak Sidoarjo during the fish hatchery process. The fish hatchery process, the number of fish using the unit calculation method *rean.* In units *rean, the* value of one *rean* is equal to 5000 fish. *Rean* is used to facilitate fish breeders in calculating the number of fish to be cultivated due to the relatively small size of fish seeds. In a study conducted by Muzdalipah and Yulianto (2018) regarding the exploration of ethnomathematics on technique seed calculation of carp, the results showed that the method of calculation of the unit *rean* to count the number of fish seed is not used by the Sundanese people, but in the calculation of fish seed, Sundanese people use the unit *siuk* namely the unit used to calculate fish fry carried out in a zinc plate container.

Counting activities also appear in the fish harvesting process. In the fish harvesting process, the

amount of fish obtained will be sold to buyers at a price determined based on the number of fish per kilogram. The calculation method used by the people of Tambak Bulak to state the number of fish per kilogram is known as a *cek*. For example, if there are ten fish in one kilogram of fish, it can be stated that the calculation shows "*cek 10.*" The aim of the calculation method *cek* is to make it easier to classify the size of each harvested fish so that the appropriate price can be determined. The term *cek* to express the number of fish per kilogram has not been found in other areas. This can be seen from the results of Manfa'atin's (2013) research which shows that the amount of fish harvested per kilogram in Karanganyar Village, Sidoarjo is called *isi*. Thus, it can be seen that there is an ethnomathematical form in calculating fish breeding activities at Tambak Bulak, Sidoarjo, namely calculating the number of fish seeds and calculating the number of fish harvested in each kilogram related to the concept of numbers and calculation methods.

2. Ethnomathematical Form in Determining Location

The activity of determining the location is an activity related to finding a path in the spatial world by directing oneself or other objects, which are geographical aspects of mathematics with mathematical concepts that appear in the activity of determining the location, namely the dimensions and Cartesian coordinates (Bishop, 1997). The activity of determining the location appears in fish breeding activities in Tambak Bulak during the process of finding the location of fish ponds before fish breeding activities are carried out. In contrast to the results of research conducted by Malalina et al. (2020), which explored the ethnomathematical form of fishing activities in the Musi River, the activity of determining the location carried out was searching for fishing locations. Before the cultivation activity is carried out, the fish breeders determine the pond's location by searching for locations at certain points adjacent to the river. Searching for the location of fish ponds at certain points adjacent to the river can be seen in Figure 1.

Figure 1. *Determining the Location of Fish*

In the process of finding the location of fish ponds, fish breeders in Tambak Bulak Sidoarjo look for fish ponds adjacent to the river to facilitate the process of filling and draining water at the time of harvesting fish. With the pond's location close to the river, breeders can fill or discharge pond water into the river. Several fish pond locations that can be selected close to the river resemble the (x,y) coordinates in the Cartesian coordinate system, as shown in Figure 2.

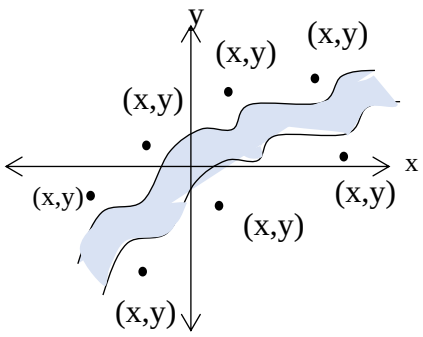


Figure 2. *Location Determination and Concept Sketch of the Coordinate System*

After finding the location of the fish pond to be used, fish breeding activities can be carried out. After the fish pond location selected and used for the fish breeding activities studied in this study is in Tambak Bulak Hamlet, Waru District, Sidoarjo, with the fish pond location point, which can be seen in Figure 3.

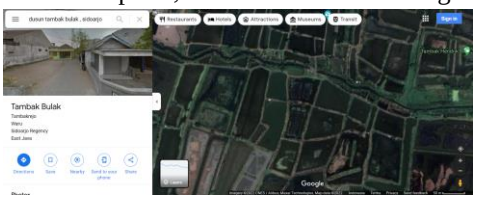


Figure 3. *Fish Pond Location on Google Maps*

From the previous illustration and explanation, it can be seen that there is an ethnomathematical form in the activities of fish breeding in Tambak Bulak, Sidoarjo, in determining the location of fish ponds before fish breeding activities are carried out related to the Cartesian coordinate system in mathematical concepts.

3. Ethnomathematics Form in Measuring

In fish breeding activity in Tambak Bulak, Sidoarjo was performed to measure activity at the time of measurement of the length, width, and height of the fish pond made to the fish breeding process. This statement is in accordance with the meaning of measuring activity proposed by Bishop (1997), namely the activity of determining an amount that can be assessed which includes the measurement technique and all units involved, in the activity of measuring mathematical concepts that can be derived, are the order, size, unit, measurement system, and quantity. In making fish ponds, there is a measurement technique used by the people of Tambak Bulak, Sidoarjo, namely using the local unit *depa* to determine the length, width, and height of each fish pond to be made. According to Miradayanti (2019), *depa* is a measurement vocabulary in units of length using both hands outstretched to measure the size of an object.

In fish breeding activities in Bulak Tambak, Sidoarjo, *depa* units are used because it is easier and more practical to determine the size of the fish pond to be made. The measurement process is carried out by extending both hands every *depa* of the length, width, and height of the excavated pond that has been made. Cultivators measure the pond's length, width, and height continuously until the desired size is obtained. The process of measuring the pond using *depa* can be seen in Figure 4.

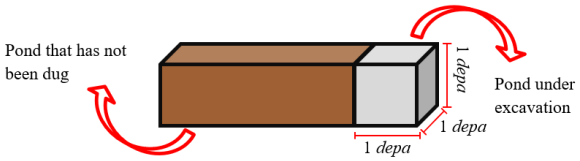


Figure 4. *The Process of Measuring the Pond Made using Depa*

After making the pond is complete, the overall length and width of the fish pond can be known. In *depa* unit, the size of the fish pond used by fish breeders in Tambak Bulak, Sidoarjo. The process of measuring the overall pond size in *depa is* done by stretching a rope along the width and length of the fish pond, then measured using the span of both hands to determine the length and width of the fish pond in *depa*. After measuring the pond in *depa* unit, the results of measuring the length and width of each fish pond are shown in Figure 5.

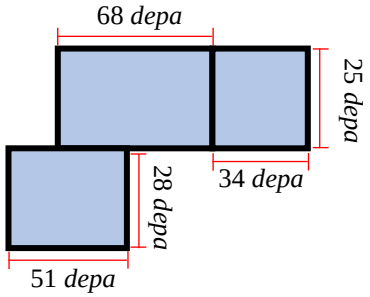


Figure 5. *Fish Pond Shape and Size Sketch in Depa*

In fish breeding activities at Tambak Bulak, Sidoarjo, three fish ponds are used that are located side by side, as illustrated in Figure 5. After measuring the fish pond using a meter measuring tool, it is found that the results of measuring the length and width of the fish pond are the details shown in Figure 6.

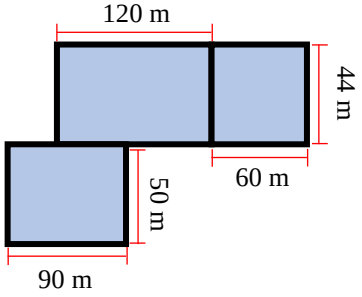


Figure 6. *Sketch of Size in Meters*

Based on Figure 5 and Figure 6, we can see that the length and width of one *depa* in a pool measuring 34 *depa* × 25 *depa* or the equivalent of 60 m × 44 m are 1.76 m and 1.76 m. On the other hand, for a pond with a size of 68 *depa* × 25 *depa* or the equivalent of 120 m × 44 m, the length and width of one *depa* are equivalent to 1.76 m and a width of 1.76 m. Meanwhile, the pool with size 51 *depa*× 28 *depa* or equal to 90 m × 50 m shows that for one length and width in *depa* equivalent to 1.76 m and a width of 1.78 m. Based on the measurement results, it can be seen that the length of one *depa* is equal to 1.8 m.

The use of *depa* to determine the length and width can result in measurement inaccuracies. Fish pond size results will also change if different people measure the pond. This thing is because everyone has a different arm span. Thus, to get a more accurate measurement, it can be calculated using standard units such as "meters." This is supported by Sopamena, Kaliky, and Assegaf (2018), which stated that one *depa is* equal to 1.6 meters. Meanwhile, Franjaya, Zamdial, and Muqsit (2018) state that one *depa equals* 1.5 meters.

The fish harvesting process also includes measuring activities, namely when measuring the size of fish that have been harvested to determine the selling price of fish. In fish breeding activities at Tambak Bulak, Sidoarjo, fish size is determined using a calculation method *cek*. Determination of fish size using *cek* calculation method is done by weighing one kilogram of fish to calculate the number of fish in one kilogram. Then the size of the fish can be classified into three categories, namely large, medium, and small. Classification of fish sizes using the calculation method *cek* has not been carried out in other areas. This can be seen in the research conducted by Yanti and Lubis (2018) regarding the ethnomathematical identification contained in the Bengkulu people's proverb "fish sejerek, bere secupak" which obtained the result that fish size was not classified using *cek* calculation method, but the fish size was determined by using *jerek* (a bunch of fish) and is sold to the buyer at a price determined by each *jerek*.

In measuring fish, the larger the *cek* obtained, the smaller the size of the fish, and the smaller the size of the fish, the lower the price of fish per kilogram. Sappaile (2019) states that a direct proportion is a comparison with a property; if one quantity increases, the other quantity will also increase, while a reversed proportion is a comparison with a property; if one quantity increases, then the other quantity will decrease. From this description, it can be seen that there is a concept of reverse proportion in determining fish size using a check system and the concept of a

direct proportion in determining fish prices. So, it can be seen that in fish breeding activities at Tambak Bulak, Sidoarjo, there is an ethnomathematical form in measuring, namely in the process of measuring fish ponds and the size of fish harvests related to the concept of length, the concept of reverse proportion and the concept of direct proportion in mathematics.

4. Ethnomathematical Form in Designing

In fish breeding activities at Tambak Bulak, designing activities are carried out when making fish breeding tools independently. Fish breeding tools are used in the form of fishing gear called nets. The net is made traditionally by assembling slapped threads into a single object using a bamboo needle called a *coban*. The assembled nets are then shaped according to the needs of fish breeding. The activities carried out by fish breeders in the process of making nets are designing activities in culture. This is in accordance with Bishop's (1997) statement that the designing activity is an activity in making an object form, from the differences in the form that built, the nature, to the way these forms are related to the decline in mathematical topics in this activity, namely form, order, harmony, similarities, construction drawings, and geometric properties.

Making fishing nets is used to assist farmers in catching fish. The fishing nets used by the people of Tambak Bulak are often called *caruk* and *krakat*. *Caruk* used consisted of small *caruk* and big *caruk*. In designing activities, there is an ethnomathematical form that grows, namely in the form of fish breeding tools that are designed related to the concept of plane figures. According to Untu (2019), a plane figure is a flat area bounded by straight or curved lines. The description of the ethnomathematical forms that grow in several forms of fish breeding tools designed is given below.

4.1 Coban

Figure 7. *Coban*

Coban is a needle used to assemble nets for fish breeding activities at Tambak Bulak, Sidoarjo. *Coban* can be made of bamboo and plastic materials, but the people of Tambak Bulak often use *coban* made of bamboo material. This tool is also often known as the *juri* by some people around Tambak Bulak. *Coban* can be obtained by buying it in traditional markets or fish breeding equipment stores. However, some people in Tambak Bulak still make it themselves, one of which is the informant of this research. *Coban* as a needle for assembling nets is used in Tambak Bulak, Sidoarjo but widely in various parts of Indonesia. In a study conducted by Bidayani (2007), *coban* was used by the community in Bacang Village, Palangkaraya, as a substitute for needles to assemble fishing nets. The same thing is also found in the people of Lombok, who also use *coban* as a needle to assemble fishing nets (Langkosono, 2008).

Coban is made by flattening bamboo with a thickness of approximately 0.5 cm and then formed into two parts consisting of the head and body. In the form of a *coban*, there is a hole between the head and body that serves as the entrance to the slap thread. The head of the *coban* is made tapered to insert the thread into the net assembly, while the body is made to protrude forward as far as 4 cm on different parts of the head of the *coban* to accommodate the slapped thread. In the design of the *coban*, it was found that there was a plane figures concept in the form of a trapezoid and a rectangle, as shown in Figure 8.

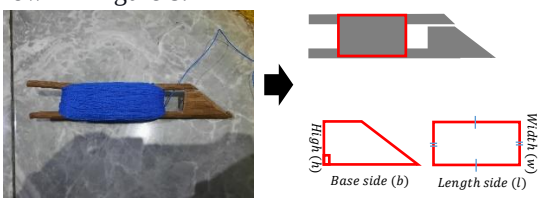


Figure 8. *Coban and Plane Figures Sketch*

4.2 Caruk

Figure 9*. Caruk*

Caruk is one of the fishing gear used in the fish breeding process by the community in Tambak Bulak, Sidoarjo. *Caruk* serves as a tool to take fish seeds in sterile ponds into a container to be released in breeding ponds. In addition, *caruk is* also used to collect crops from fish ponds to be collected and sold to buyers. *Caruk* is made of slapped thread which is assembled using a *coban*. The assembly process *caruk* can be illustrated in Figure 10.

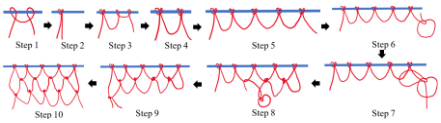
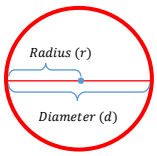
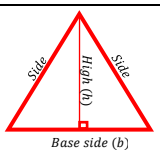
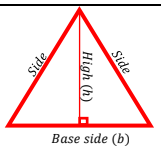
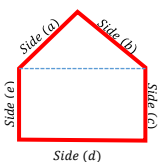
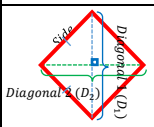
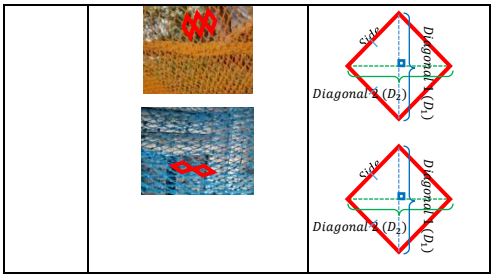


Figure 10. *Assembling Stages Caruk*

Assembly process *caruk* begins with setting up a rope stretched lengthwise as the base node. After that, the assembly process is continued by making the anchor knot *(cow hitch)* on the rope stretched previously. Furthermore, making the mesh is carried out using the flag knot *(English knot)*. Using flag knots to create mesh also carried out by the people of Tanjung Jabung Barat Regency, Jambi, as contained in the research results of Nelwida et al. (2019) regarding the construction of nets in the Village of Fishermen's Village, Tanjung Jabung Barat Regency, Jambi. After making the number of meshes and length of the *caruk* the desired, the making of the *caruk is* continued by tying the base of the rope and connecting the meshes on the right and left to form a circle. Next, the slapping thread at the top is connected to wood or iron for fish to enter and handle *caruk*. In the *caruk* design, there are plane figures, namely circles, rhombuses, pentagons, and triangles, and it can be seen in Table 1.

Table 1. *Small Caruk, Big Caruk, and Plane Figures Sketch*

No.	Ethnomathematics	Mathematical Concepts
1.		
2.		
3.		
4.		
5.		



4.3 Krakat

Figure 11. *Krakat*

Krakat is one of the fishing gear which is also used in the process of fish breeding by the community of Pond Bulak, Sidoarjo. *Krakat* is made from a long net, which is weighted at the bottom. The ballast serves as a barrier to the net so that it does not float to the surface of the water. The ballast used by the people of Tambak Bulak, Sidoarjo, is made of artificial cement. *Krakat* is usually used to lead fish under the pond, which will then be collected using a *caruk*. In fishing activities in the Musi River, long nets are known as drift nets, are also used with shapes that are similar to *krakat*. The similarity lies in the shape of the mesh and the weight at the bottom of the net. However, the *krakat* does not use a buoy at the top of the net as is used in drift nets by fishermen in the Musi River.

Making *krakat is* done by combining a long net with a length and width of 15 m and 1 m into one part using basting embroidery. After that, the manufacturing process is continued by tying the pendulum at the bottom of the net using artificial cement that has been made previously. Next, the process of making the *krakat* ends by tying the rope at the top corner on the right and left of the net, which functions as a handle for the net. The stages of making *krakat* can be seen in the illustration in Figure 12.

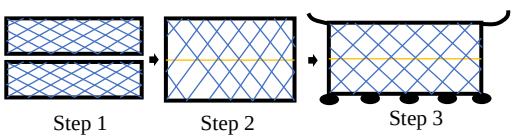


Figure 11. *Stages of Making Krakat*

In the research on fishing activities in the Musi River conducted by Malalina et al. (2020), a

geometric concept appears in the shape of the drift net used. The same thing is also found in the design *krakat* used by the people of Tambak Bulak, Sidoarjo, which is related to the concept of plane figures, namely rectangles and rhombuses, as shown in Figure 13.

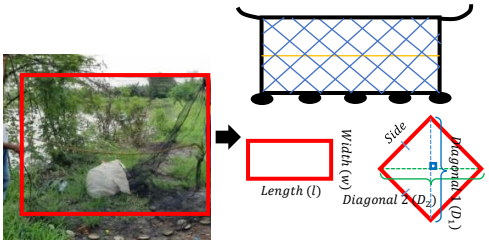


Figure 13. *Krakat* and Plane Figures Sketch

From the process of designing breeding tools, it can be seen that in fish breeding activities at Tambak Bulak, Sidoarjo, there are ethnomathematical forms in designing activities related to the concept of plane figures, namely rectangles, trapezoids, circles, rhombuses, triangles, and pentagons.

5. Ethnomathematical Form in Doing Something

The activity doing something is an activity related to a person's behavior doing pleasant behavior by involving specific skills from strategic thinking, guessing, and planning. In the activity of doing something, there are mathematical ideas that can derive, namely procedures, rules, plans, and strategies of a person in carrying out a particular action (Bishop, 1997). In fish breeding activities at Tambak Bulak, Sidoarjo, the activity of doing something was found during the implementation of fish breeding activities which resulted in strategic thinking and previous planning.

In the implementation of fish breeding activities at Tambak Bulak, Sidoarjo, there are three fish culture procedures carried out, namely the hatchery stage, the maintenance stage, and the harvest stage. These three procedures are mandatory for fish breeding, especially for freshwater fish breeding. This is supported by the training of freshwater fish cultivation by Gani & Fadlih (2021), which was delivered in a seminar on community service results with the result that there are three freshwater fish breeding procedures included in the external targets of the training, namely the process of hatchery breeding, maintenance, and harvesting. The implementation time of the three stages of cultivation depends on the type of fish being cultivated. The regular time required for vanamey shrimp and milkfish is about 3-4 months. Three procedures for fish breeding at Tambak Bulak, Sidoarjo can be described as follows.

1. Fish Hatchery Stage

   The fish hatchery stage begins with the preparation of a sterile pond that has been cleaned of fish ponds from pests and wild plants that grow. After cleaning, the pond is left for approximately 1-2 days and continued with the stocking of fish seeds. After the fish seeds have begun adjusting to their new conditions, the fish seeds can be transferred to the breeding pond for the maintenance phase.

2. Fish Maintenance Stage

   At the maintenance stage, periodic checking of the condition of the fish pond is carried out starting from the volume of water, the availability of moss and algae as natural food, feeding fish, and fish health as seen from the movement of fish. After the treatment process is complete, fish can be harvested at the age of 3-4 months under normal conditions. However, if there are indications of disease in fish, the fish will be harvested before the estimated time.

3. Fish Harvesting Stage

   At this stage of harvesting, fish can be done in two ways, namely by draining water or without draining water. Draining of water is carried out if the condition of the river water volume is small. The pond water is then discharged into the river using a diesel engine carried out for 1-2 days. Furthermore, the fish will gather under the pond and then be collected using a *caruk*. Meanwhile, if the volume of river water increases, fish harvesting is carried out without draining pond water. Fish are collected using a *krakat* that is stretched from one side of the pond to the front of the pond, which is then collected using *caruk*. The harvested fish are then sold to fish collectors or consumers directly after the harvesting process is carried out.

With the existing implementation procedures in fish breeding activities at Tambak Bulak, Sidoarjo shows an ethnomathematical form in the activity of doing something related to the implementation procedure of fish breeding, which is a derivation of mathematical ideas.

6. Ethnomathematical Form in Explaining

In fish breeding activities at Tambak Bulak, Sidoarjo, explaining activities are found in delivering information about the reasons for losses in fish breeding. This is in line with the opinion expressed by Bishop (1997) regarding explaining activities, namely activities related to a person's behavior in trying to explain both to himself and to others about the reasons

for something happening in their way, in the activity of explaining mathematical topics derived are rules. Logic and equations. Losses in fish breeding activities at Tambak Bulak, Sidoarjo were caused by a decrease in the quality of the pond water used. The decline in water quality is thought to be caused by industrial waste generated by production activities in factories around the breeding location. The same thing also happened in another Sidoarjo area close to the fish pond used by the people of Tambak Bulak, Sidoarjo. This is evident from the research conducted by Widiyanti (2017) regarding the analysis of pond water quality in Karanganyar Village, Sidoarjo with research results showing that there has been a decline in pond water quality as seen from the detergent content in water that exceeds the threshold and causes disruption to the around fishing industry.

The disadvantages of fish breeding also depend on the care of the fish carried out. The better the fish care, the lower the possibility of losses experienced. Fish care that is carried out must be adjusted to the type of fish being cultivated. In fish breeding at Tambak Bulak, Sidoarjo, the types of fish still being cultivated are vanamey shrimp and milkfish. The selection of fish species is adjusted to the water conditions, which tend to be more suitable for the two types of fish.

The activity of explaining was also found in the process of delivering information regarding the reasons for the decrease in the number of fish breeders in Tambak Bulak, Sidoarjo. Fish breeding in Tambak Bulak, Sidoarjo is a culture that must be preserved. However, this has become difficult to do because the younger generation's interest in continuing this cultural heritage has begun to decline. The decline in interest in the younger generation is caused by the development of increasingly modern times in various fields, thus making the younger generation more interested in pursuing a profession in another field. This is the reason for the decreasing number of fish farmers in Tambak Bulak, Sidoarjo. From the description of the information regarding the reasons for the decrease in the number of fish cultivators in Tambak Bulak, Sidoarjo, it can be seen a statement that if the interest of younger generation decreased in interest in fish breeding activities, the number of fish breeders in Tambak Bulak, Sidoarjo will decrease. Through this statement, it can be described in two statements as follows.

p = The interest of younger generation in fish breeding activities decreased.

q = The number of fish breeders has decreased.

Through these two statements, an implication can be determined if p then q or p→q, namely if the interest of the younger generation in fish breeding activities decreases, the number of fish breeders decreases. So, it can be seen that in fish breeding activities at Tambak Bulak, Sidoarjo, there is an ethnomathematical form in explaining activities, namely in the process of delivering information about the reasons for the loss and decreasing number of fish breeders related to the concept of mathematical logic.

CLOSING

Conclusion

Based on the results and discussion of ethnomathematical exploration in fish breeding activities at Tambak Bulak, Sidoarjo was obtained through interviews and observations. It can be concluded that there is an ethnomathematical form in fish breeding activities at Tambak Bulak, Sidoarjo. This ethnomathematical form appears in counting, determining location, measuring, designing, doing something, and explaining. In counting activities, there is an ethnomathematical form in calculating fish seeds and the number of fish harvested per kilogram related to the concept of numbers. In determining the location, there is an ethnomathematical form in the process of searching for fish ponds before fish breeding activities are carried out, which is related to the Cartesian coordinate system. There is also an ethnomathematical form in measuring activities, namely in the process of measuring ponds to be made and measuring fish to be sold, which is related to the concept of length, the concept of reverse proportion, and direct proportion. In designing activities, there is an ethnomathematical form in the process of making breeding tools such as *coban*, *caruk*, and *krakat* related to the concept of plane figures, namely rectangles, trapezoids, circles, rhombuses, triangles, and pentagons. In the activity of doing something, there is an ethnomathematical form in implementing fish breeding activities which includes breeding procedures that decrease in mathematical ideas. There is also an ethnomathematical form in explaining activities, namely in delivering information about the reasons for the decreasing number of fish breeders in Tambak Bulak, Sidoarjo, related to mathematical logic.

Suggestion

This research gives suggestions to other prospective researchers who wish to research the same topic, namely that future researchers can explore fish breeding activities in different places and indicators. The researcher's advice to fish breeders is that fish breeding activities should be carried out; (1) division of pond size into several sections to facilitate monitoring of fish conditions; (2) pay more attention to the size and number of fish seeds to be cultivated to obtain maximum results. Meanwhile, the researcher's suggestion for teachers is that teachers should be able to use the results of ethnomathematical exploration

in fish breeding activities in Tambak Bulak, Sidoarjo, as cultural-based contextual mathematics learning resource for learning mathematics in schools.

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