Ethnomatscience ExplorationThe Tradition of Spreading Apem Ya Qowiyyu Jatinom Klaten

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Abstract. Improving the quality of education is inseparable from the role of the teacher. Especially in providing motivation and the learning process to students. Moreover, in early 2020 the world was shocked by the outbreak of the Covid-19 virus. This has an impact on education in Indonesia, where learning has been carried out for approximately two years online. But currently, learning in Indonesia is in a transition period from online to offline learning. This transition period also has an influence on learning mathematics and science, both teachers and students. Even in teaching until now the teacher still uses simple and unvaried methods, only using conventional methods which make students bored and bored. Based on these conditions, it is necessary to have a learning approach. One of them is a contextual learning approach, so as to be able to create a meaningful atmosphere for learning mathematics and science as in everyday life (Herlina, 2020). Traditional culture is a real form found in everyday life and can be used for contextual learning concepts. The aim of this research is to explore the concept of ethnoscience contained in the Spread Apem Ya Qowiyyu Tradition. This research is a descriptive study with an ethnographic approach, namely describing and analyzing cultural heritage. Based on the results of observations and literature studies, it was obtained several mathematical and scientific concepts contained in parts of the Sebar Apem Ya Qowiyyu Tradition which are displayed in matrix form.

Keywords: Ethnomatscience, ethnomathematics, ethnoscience, The Tradition of Spreading Apem Ya Qowiyyu

1. INTRODUCTION

Improving the quality of education is inseparable from the role of the teacher, where the teacher is the spearhead in an education. Especially in providing motivation and learning processes to students so as to improve the quality of education. However, in reality the learning process in Indonesia is currently still focused on material in books, especially learning mathematics and science. Moreover, at the beginning of 2020 the world was shocked by the outbreak of a disease caused by a virus called corona or known as Covid-19. This has an impact on education in Indonesia, where learning has been carried out for approximately two years online. But currently, learning in Indonesia is in a transition period from online to offline learning.

This transition period also has an influence on learning mathematics and science, both teachers and students. Where the teacher still lacks motivation to learn to students. Even in teaching until now the teacher still uses simple and unvaried methods, only using conventional methods which make students bored and bored. Thus, learning mathematics and science is often perceived by students as learning that is difficult to understand and scary, as well as boring, so that many students do not like these subjects.

Based on these conditions, it is necessary to have a learning approach. One of them is a contextual learning approach, so as to be able to create an atmosphere for learning mathematics and science that is full of meaning as in everyday life[1]. Learning mathematics and science in everyday life that can truly reveal the cultural reality around students is still rare, and the material being taught is not yet tightly integrated with culture. So that it is not in accordance with the expectations of the 2013 curriculum, in realizing contextual learning there needs to be a balance of learning between existing school concepts and traditional culture.

Local culture is a tangible form that can be found in everyday life and can be used for contextual learning. Several studies related to local cultural heritage that have been explored either in the form of historical buildings, arts, and customs but still limited to the context of mathematics[2] or natural sciences[3]. Meanwhile, the 2013 curriculum requires us to learn at school to be more humane, because it is hoped that students will have three abilities at once 2, namely attitudes, skills, and knowledge that will better support the development of each student. Therefore, it is necessary to carry out an innovative learning activity that connects teaching materials in students' daily lives through cultural means, namely learning through ethnomatscience learning.

Ethnomatscience is a way of learning mathematics, physics, chemistry and biology that is linked to culture. Therefore, it can be said that the 2013 curriculum learning process which results in students being able to analyze, observe, and communicate can be realized. With the existence of ethnomatscience, students will tend to be more active because old learning that tends to be formal can be changed by relating it to everyday life. This concept can help students not get bored and not feel lazy with mathematics and science lessons.

The tradition of Spreading Apem Ya Qowiyyu is one of the typical cultures of Central Java, to be precise in Jatinom Village, Jatinom District, Klaten Regency, which always holds traditions in the month of Safar in the Islamic calendar. Until now, the tradition of spreading Apem Ya Qowiyyu is still viewed from a cultural perspective only, in fact, the existence of the Spreading Apem Ya Qowiyyu Tradition can be used for learning in schools judging from its form and constituent materials. This research aims to explore the concept of ethnoscience contained in the Spread Apem Ya Qowiyyu Tradition. The urgency of this research is to explore the concepts of mathematics and science contained in the Sebar Apem Ya Qowiyyu Tradition activities to be used as material for making mathematics and science learning media based on local culture, with the hope that learning mathematics and science will become more meaningful and interesting.

2. METHOD

This research is a descriptive study with an ethnographic approach, namely describing and analyzing cultural heritage including field research. The ethnographic approach is used to describe, explain, and analyze elements of the culture of the community or ethnic group and the type of case studies on the Sebar Apem Ya Qowiyyu Tradition, in order to dig deeper into the mathematical and scientific concepts contained therein. The data collection techniques in this research are observation, interviews, literature study, and documentation. Observations, interviews and documentation were carried out in Jatinom village, Klaten, Central Java, while literature studies were obtained from books, journals and other literary sources related to the Sebar Apem Ya Qowiyyu Tradition. After the data is obtained, data analysis is then carried out[4].

Data analysis in this study includes domain analysis and taxonomic analysis. Domain analysis was carried out by obtaining a general and comprehensive overview of the Apem Ya Qowiyyu Spreading Tradition and continued with determining and grouping according to the category or domain[5]. Furthermore, data related to mathematical concepts are grouped into ethnomathematics and described in the mathematical domain which includes algebra, geometry, calculus and others. Then data related to scientific concepts is grouped into ethnoscience and described in the science domain which includes biology, chemistry and physics.

The implementation of this activity has several stages, namely:

a. The planning stages include: preliminary observation, making proposals, submitting research proposals and making research instruments.
b. The implementation stage includes all activities carried out at the research site, such as data collection, data processing, data analysis and drawing conclusions.
c. The completion stage includes preparing research reports, writing articles and publishing scientific articles

3. RESULT AND DISCUSSION

Traditions or habits are part of culture that have been carried out for a long time and have been part of life for a group of people from generation to generation in a particular area accompanied by the belief system they adhere to. Meanwhile, traditional ceremonies are one of the traditions of traditional communities which are still considered to have values that are still quite relevant to the needs of the supporting communities. One of the traditional community traditions is the Apem Ya Qowiyyu Spreading Ceremony.

The Apem Ya Qowiyyu Spreading Ceremony is a legacy from ancestors held by the community in Jatinom Village, Jatinom District, Klaten Regency, Central Java. Apem Spreading Ceremony Ya Qowiyyu, the ceremony is called Saparan because the ceremony is in the month of Sapar. The ceremony is held once a year to commemorate Ki Ageng Gribig's services in spreading Islam on the island of Java, especially in Jatinom Klaten Village and there are hadrah coastal and banjaran musical arts presented by the Hadrah Mahbaba group as accompaniment to the ceremony[6]. Meanwhile, the word saparan itself comes from the word sapar and the suffix an. The word Sapar is

identical to the Arabic word Syafar which means the second Arabic month. Then the word safar is identical to the word sapar which is the name of the second of the 12 Javanese months. Furthermore, the suffix an here forms the name of the object. So Saparan is a greeting ceremony held in the month of Sapar.

The Apem Ya Qowiyyu Distribution Ceremony is a tradition passed down from generation to generation in Jatinom Village, Klaten, Central Java by using the media in the form of apem cake in its implementation. Apem is a cake made from rice flour. The term apem comes from Arabic, afuan/afuwwun, which means forgiveness. So apem can be interpreted as a means for Muslims to always pray for His forgiveness and always pray to Allah by saying His name, namely, God, the Almighty (Ya Qawiyyu). The Saparan ceremony or distribution of apem in Jatinom is called Ya Qawiyyu or Angkawiyu[7]. The Ya Qowiyyu ceremony is held every month of Sapar between the 12th - 18th of each year, namely on Friday which is considered a holy day for Muslims[8].

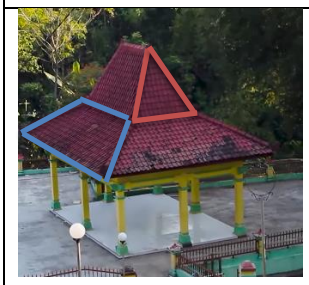
If we pay further attention, the Sebar Apem Ya Qowiyyu Ceremony contains various ethnomatscientic elements including counting, measuring, locating, designing, playing, and explaining. The biological concept is that making apem requires rice flour. The physics concept is found in the art of hadrah and when carrying a mount. And the chemical concept is found in the process of making apem, namely when mixing the ingredients. This proves that the traditional ceremony at the Apem Ya Qowiyyu Spreading Ceremony can be used as a medium for learning mathematics and science as well as learning to appreciate local cultures as a form of nationalism towards the nation. Likewise, looking at pictures of historical objects can add clarity to the history of historical objects. This shows that media use determines students' interest in learning[9].

Based on the results of an analysis of the Sebar Apem Ya Qowiyyu Tradition in Jatinom Village, Klaten, Central Java, there are sections that have both mathematical and scientific aspects that can be related to mathematics and science subject matter. The sections in the Sebar Apem Ya Qowiyyu Tradition are related to the subject matter of Mathematics and Science, namely the concept of flat side shapes including tubes, rectangular prisms and rectangular pyramids in the Sebar Apem tradition, then the concept of dilation lies in the Gunungan Apem, and many others. While the concept of science is the concept of the material used in making apem, then the concept of the content in apem, the concept of weight in the Sebar Apem Ya Qowiyyu Tradition, and there are still many mathematical and scientific concepts that can be used as learning materials for students.

Several concepts of mathematics and science lessons found in the Sebar Apem Ya Qowiyyu Tradition can be taught to students. The role of math and science teachers is urgently needed to transform the culture-based learning of mathematics and science. In this way, ethnoscience can be used as a fun learning medium for conveying mathematics and science concepts with a background in local wisdom.

Table 1. List of parts of the Spread Apem Ya Qowiyyu Tradition

Ethnomatscience	Domain	Implementation

 Form of manufacturing mold apem and shape of apem	Mathematics (Circle Concept)	The apem and apem making tools themselves have a circular shape. a two-dimensional shape formed from a set of points with a constant or regular distance from a fixed point in a plane. The characteristics of a circle are that it has 1 side, has no angles and has the same radius[10].
	Mathematics (Trapezoid and Triangle Concept)	On the roof there is a flat concept, namely trapezoids and triangles. A trapezoid is a quadrilateral that has exactly one pair of parallel opposite sides. Meanwhile, a triangle is a flat shape bounded by three sides[11].
 Oro-Oro Tarwiyah	Mathematics (Square Concept)	In the oro-oro tarwiyah there is a flat shape formed on the side of the building, namely a flat square shape. A square is a flat shape limited by 4 sides of the same length. A square is a flat shape that has the same parallel sides and 4 right angles[12].
 Oro-oro tarwiyah	Mathematics (The Quadrilateral Prism Concept)	On the roof of the oro-oro tarwiyah has a rectangular prism shape. A rectangular prism is defined as a prism with a rectangular base and lid.
	Mathematics (Cube Concept)	The core building in the Oro-oro tarwiyah has a cube-like shape. build a flat-sided space where all sides are square and all edges are the same length[13].

 Apem mountain	Mathematics (The Concept of Quadrilaterals)	One form of the Apem mountain is shaped like a rectangular pyramid. A quadrilateral pyramid is a geometric figure bounded by Quadrilaterals and four triangles whose bases coincide with the sides of the quadrilateral
 Bedug	Mathematics (Concept of Tubes)	The drum musical instrument, which is a relic from ancestors in Jatinom, Klaten, is shaped like a tube. The tube is a shape of three-dimensional space and has a lid and base, the shape itself is a circle that has the same size as the enveloped rectangle[14].
 Mount Apem		
 Dancer's headband	Mathematics (Concept of Reflection)	In this mask, there is a transfer of objects by using a mirror, which is a flat mirror so that it produces the same image. So that the mask is included in the concept of reflection, which is a type of transformation that moves each point in a plane or geometric shape by using the properties of objects and images on a flat mirror[15]
 Apem mountain	Mathematics (Concept of Dilation)	In the apem mountains, it can be seen that there are apem mountains that are large to the smallest. This is what causes the apem mountains to be included

		in the concept of dilation. Dilation is the reduction or enlargement of an object to a certain scale. In dilation, the location and size of an object change, in contrast to transformations in reflection, rotation, and translation, which only change the position of the object.
 The source of the surak	Mathematics (Concept of Rectangle and Circle)	A rectangle is a flat shape where the length of the long side is longer than the length of the wide side, which is the opposite side. the same length.
	Mathematics (Concept of Parallel Lines)	On the fence the source of the surak is installed parallel, so that it can be said to be included in the concept of parallel lines. Parallel lines are two lines that do not intersect but have the same slope so they are parallel to one another.
 Making Apem	Biology (Concept Zat Food and function for Man)	One of the components for making apem is flour. The flour used is wheat flour and rice flour. Flour contains carbohydrates that the body needs. Carbohydrates are a nutrient that functions asmain source of energy for the body
 Making Apem	Biology (Concept Zat Food and function for Man)	The components for making apem are sugar and grated coconut. Sugar is a carbohydrate that occurs naturally in many foods. The body mostly

		uses carbohydrates as a source of energy. Some glucose is also very important for the brain, central nervous system, and red blood cells to function properly. Meanwhile, grated coconut in 100 grams of dry grated coconut has a calorie content of 660 kcal. Of these calories consist of 83% fat, 13% carbohydrates and 4% protein. It contains 64.53 grams of fat, 23.65 grams of carbohydrates and 6.88 grams of protein.
 Tape yeast	Biology (Biotechnology Concept)	One of the ingredients in making Kua Apem ya qowiyu is using tape as the developer material. Tape is a food product that uses biotechnology in its manufacturing process. Tape is a food ingredient fermented from cassava or sticky rice. Biotechnology is the use of living things to help work or produce a product that is beneficial to humans. Making tapai involves cassava tubers as a substrate and tapai yeast (Saccharomyces cerevisiae) which is smeared on tubers that have been peeled.
	Biology (Protein Concept)	One of the ingredients for making Apem cake is eggs. In this case the egg is one of the proteins needed by the human body. The protein found in

Ingredients for Making Apem (Eggs)		animal foods such as eggs is said to be perfect protein. Eggs are divided into yellow and white parts which have different protein values. The protein content in free-range chicken egg whites has the lowest level of 863.3 mg/mL and in free-range chicken egg yolks has the highest protein content of 1,229.5 mg/mL, and the protein content in free-range chicken egg whites is 945.07 mg/mL, chicken egg yolks race 930.9 mg/mL[16]
 Apem cake	Chemistry (Concept of Material Content)	The relationship between apem kesesi and chemicals lies in the ingredients used to make apem and the manufacturing process. Rice flour contains water, protein, fat, carbohydrates, calcium, phosphorus, sodium, potassium, vitamin B3, vitamin B1, and vitamin B2. Palm sugar contains water, carbohydrates, calcium, iron, phosphorus, sodium, potassium and zinc[17]
 Apem cake	Chemistry (Reaction Rate)	The process of melting palm sugar by cutting it into small pieces then dissolving it using hot water and developing the dough using yeast when making apem kesesi is one

		example of the application of the reaction rate factor.
 Oro-oro tarwiyah	Physics (Parabolic Motion Concept)	When throwing apem from oro-oro tarwiyah, the throwing produces a trajectory that forms a parabola. Parabolic motion is a combination of uniform rectilinear motion (GLB) in the horizontal (horizontal) direction and uniform rectilinear motion (GLBB) in the vertical direction.
 Oro-oro tarwiyah	Physics (The Concept of Gravitational Force)	When throwing apem cake from above oro-oro tarwiyah to the community, a force arises, namely the force of gravity. Gravity is an attractive force that occurs between objects in the universe. The Earth we live in also has a gravitational force, which is commonly called the Earth's gravitational force or Earth's gravitational force.
 Mount Apem	Physics (Concept of Force)	The strength of carrying the Gunungan Apem is inseparable from the theory of lifting heavy loads. This theory can be studied in the style chapter. Force is something that causes a change in velocity and a change in the shape of an object.

 Hadroh Mahbaba	Physics (Momentum Concept)	When the tambourine is hit, there will be a collision between the tambourine player's hand and the tambourine shell. When hitting the tambourine, the hand will have two conditions, namely bouncing or sticking to the tambourine skin as well as the tambourine. When the hand hits the tambourine and bounces, the concept that occurs is partially elastic momentum. Meanwhile, when the hand hits the tambourine and then the hand sticks to the tambourine, a collision occurs or the momentum is not elastic at all[18]
 Hadroh Mahbaba	Physics (Concept of Sound Intensity)	On the tambourine/hadroh musical instrument, because it is circular in shape, the tambourine has spokes. In terms of the sound intensity equation, the relationship between intensity and radius is inversely proportional, meaning that the larger the radius of the tambourine, the smaller the sound produced.

The table above shows that there are a lot of ethnomatscience concepts in the Sebar Apem Ya Qowiyyu tradition, so they can be used and developed for culture-based learning media for mathematics and science in schools, both in the form of textbooks and other learning media. Thus learning mathematics and science becomes more meaningful, enjoyable, and able to increase students' motivation in learning mathematics and natural sciences and can instill local wisdom values in students (Shanti et al., 2018). Students become more proud and able to interpret the nation's cultural values with the knowledge they have.

4. CONCLUSION

Based on the discussion that has been described above, it can be concluded that the concept of ethnomatscience contained in the Sebar Apem Ya Qowiyyu tradition can be used as a learning tool for mathematics and science in schools, both in the form of learning media and textbooks. In this way, learning mathematics and science becomes more innovative, meaningful and can also increase motivation in learning. Apart from that, it can teach and introduce local wisdom values to students. Students become more understanding, familiar with and proud of the nation's cultural values with the addition of the knowledge they have learned.

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