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ETHNOMATHEMATICS OF THE DISTRIBUTION OF APEM YA QOWIYYU GUNUNGAN IN KLATEN ON GEOMETRY MATERIAL

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Abstract. This study aims to describe the mathematical activities in the adat sebaran apem ya qowiyyu and analyze the results of the application of adat sebaran apem ya qowiyyu in mathematics learning. This research method is qualitative. The results showed that the mathematical activities that exist in the custom of sebaran apem ya qowiyyu are as follows: designing activities, namely the community implements it in making the frame, measuring activities, the community implements it by measuring the webbing when creating the gunungan frame, while calculating activities are seen when determining the mass and area of the gunungan mold or frame. Based on the results of the application, it shows that out of 20 students completed with a percentage of 85% completeness in the very good category. The results of the error analysis showed that some students found errors in calculating, reading, interpreting, and transforming. So it can be interpreted that ethnomathematics-based learning in the customary distribution of apem gunungan ya qowiyyu is said to be good.

Kata Kunci : *Ethnomathematics, Gunungan Apem, Math Learning*

1. Introduction

Culture and education are things that correlate closely with life (Mariani, 2021). Education is a process of cultural inheritance from age to age (Suhendro & Subroto, 2023). According to Marsono (2019), education is the process of cultivating a sense of humanity, becoming an adult human being, and becoming a whole human being so that they can perform their vital functions fully and optimize culture. Education and culture have interlinked correlations because culture can be protected and developed by passing over from generation to generation (Susim et al., 2019). Educational integration with culture is an attempt to make people aware that they must continue to learn to face the agitation of changing and increasingly difficult life (Wahyu Setyawan, 2019). Furthermore, education focuses on the answer to the problem of cultural inventions whose authority by the public interests is based on the norms and schemes in force (Sunarso, 2020). Therefore, education and culture are a unity in shaping human beings into good individuals in the face of the challenges of life based on the existing system of values.

Education speculatively and pragmatically is not independent of culture (Iryani, 2019). Education is a mechanism of socialization, that is, the socialization of quantity, behavior, competence, knowledge (Alwi et al., 2021). Education must be based and based on cultural values, in the broad sense. Culture is intense and changing with the time and needs of each society, through a culture of the level of intelligence with the delicacy of thinking that civilization will develop (Suhendro & Subroto, 2023). Thus, the level of civilization and intellect as an essential component in the continuity of

science (Normah et al., 2022). The continuity of science is exclusively mathematical as the root of various sciences. Mathematics is one of the fields of science that studies reason, logic, magnitude, and interrelated schemes (Rahman, 2019).

Mathematics is the oldest field in comparison with other fields, has existed from time immemorial and continues to be a general knowledge that must be studied by all (Sulaiman, 2021). Math becomes an important factor in solving problems in life (Permatasari et al., 2023). This, in line with the mathematical learning guidelines of Permendikbud No. 12 of 2024 this curriculum emphasises the need to learn mathematics by using paradigms in problem solving, interpreting concepts, and using reasoning in problem solving. In addition, the curriculum also emphasises the implementation of the benefits of mathematics in everyday life. (Permana et al., 2020). Mathematics as a supportive component in various sectors including economics, work, and analysis of things, even though human activity is inherent in the diverse culture that exists in society (Bagus et al., 2023). Ethnomatematics is mathematical learning that is closely related to cultural elements (Zahra Nasiruddin & Silalong, 2021). Through the integration of cultural traditions with mathematics students will be easier to capture mathematical concepts (Wahdah et al., 2021). Ya Qowiyyu is one of the cultures that can be used as an object in the study of mathematical learning (Suhendro & Subroto, 2023). Gunungan is one of the traditions in the Klaten district that presents a curved side space in the shape of a knot that has never been used in the background of mathematical learning (Nursyahidah dkk., 2020).

According to Alders & Soemantri (1980), geometry is the study of space, composition, shape, angle, size, properties, and interrelationships. But for students of mathematics, geometry in particular is seen as a difficult lesson. Referring to the results of the Trends in International Mathematics and Science Study (TIMSS) on the concept of geometry obtained results in 2007 pupils gained an average score of 395 (39.5), in 2011 gained a average of 377 (37.7%), and in 2015 gained 394 (39.4%) (Amaliyah dkk., 2022). Based on the results of the TIMSS showed that the students' ability to learn on geometric material belonged to low. Another study carried out by Nurmanitia (2023) in his research entitled “Ethnomatematics on Batik Motif and Its Implementation in Mathematical Learning of Matter Geometry in Klaten” obtained the result that material geometry achieved an average of 57 below the standard of minimum accuracy criteria. (KKM). Therefore, the problem is the responsibility of educators to deal with it.

According to Ajmain dkk's research, entitled "Implementation of Ethnomathematical Approaches in Mathematical Learning", achievements in implementing mathematical learning accompanied by ethnomatematical strategies can grow the dynamic attachment of learners in learning agility. It is based on the observations of students obtaining a presentation of 81.46% in cycle I and 93.46% at cycle II. Further, it is matched with the indicator of student activity of 85%. Thus, it can be concluded that the response of students given treatment through an ethnomatematical approach to both results positive in the category well. (Ajmain et al., 2020).

Based on the description above, learning requires involvement with its environment so, in learning mathematics, requires something that includes the environment in learning. Culture becomes one of the alternative means for students to understand learning. Therefore, ethnomathematics-based mathematical learning becomes a solution in the application of an independent curriculum that requires teachers to create teaching materials by using their creativity for quality learning. (Nelawati, 2018). The researchers will explore and observe the mathematical concepts and activities that will be applied to the learning of mathematics. Thus, the researchers

took the title "Ethnomatematics of the Distribution of the Apem Ya Qowiyyu Gunning in the Clay on the Building Material of the Curved Side Space of the Nucleus".

2. Method

This research was conducted using qualitative methods. Qualitative research is an investigative procedure that aims to identify human or social phenomena by producing broad and complex reflections, presenting detailed views from the source, and implementing them in a natural context. (Fitriani et al., 2019). The researchers used descriptive analysis techniques to collect field data. The purpose of this research is to provide a quick and accurate description of the traditional way of spreading apem in Ya Qowiyyu, Jatinom Klaten sub-district which is used in ethnomathematics-based mathematics learning. The subjects in this study were 20 students. Data sources in this study came from observation, test results, documentation, and interviews, as well as literature study. The purpose of qualitative research is to obtain capture related to actuality through inductive thinking procedures. (Adlini et al., 2022). The researcher focuses on events or situations in the context under study.

3. Result and Discussion

One of the traditions that exists in the Klaten district has an ethnomathematical element is the spread gun of Ya Qowiyyu. The unique and distinctive array of arms derived from the arms that are elevated up form geometry. The procedure of sketching the frame of the spread of the gun apem Ya Qowiyyu is applied to the building material of the curved side space (knuckles) that is, in the nets of a knuckle. Here's a sketch of the Ya Qowiyyu dispersion gun that shows the existence of ethnomatematics can be seen in Figure 1.

Figure 1. Sketch a gun spread apem Ya Qowiyyu.

In the custom of sebar apem Ya Qowiyyu, the frame builder takes measurements of the size of the woven bamboo. Measurement activities are carried out by the sebar apem designer in determining the composition benchmark for making sebar apem cannons that can be applied in building materials for curved, conical spaces. To determine the unit used in naming the area of woven bamboo in metres and the volume or weight of the sebar apem gunungan in litres. In addition to compiling the design of woven bamboo, the designer also calculates the area of the bamboo blanket that will be made into a gunungan frame. In this calculation activity, it is also used to estimate the mass of the Ya Qowiyyu apem scattering gunungan and the total allocation that will be made on the Ya Qowiyyu apem scattering gunungan. The material is built on the curved side space (cone) because the gunungan sebar sebar apem Ya Qowiyyu has sides, shapes, and elements that resemble the radius of a cone. Gunungan is the height,

diameter, and blanket that we can measure its area and volume analytically.

The work of measuring the area of bamboo can be applied to the building materials of curved side spaces because curves have structures, properties, and factors that resemble curves. Curves can have diameters, heights, and envelopes that we can measure the width and volume of with measurements. The conical nets on the mountain of Ya Qowiyyu apem distribution can be seen in Figure 2.

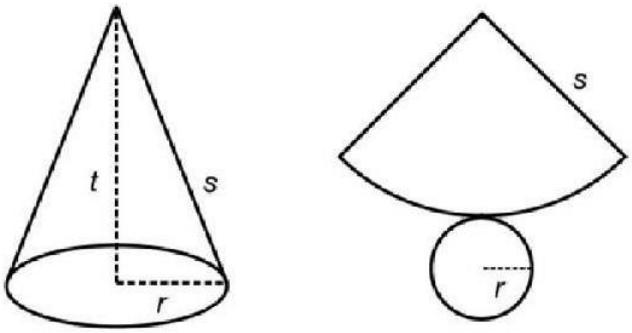

Figure 2. Networks of cannon spreading apem Ya Qowiyyu.

In the area of the circle L is the base of the gun, Juring ABC is the blanket of a gun. The point A is the peak point *r* is the fingers t is the height of the arm. A circle with fingers r is equal to the length of the bow BC. The line is on the line AB and BC :
$AB = AC = r, s^2 = r^2 + s^2$

So, can be calculated the volume and the surface area:

$$Volume = \frac{1}{3}\,\pi\, r^2\, t$$

$$The\ surface\ area = \pi r\,(r + s)$$

Based on the explanation above, it can be seen that there are several activities related to mathematics, namely designing buildings contained in the activities of sketching gunungan, measuring and calculating. The connection between ethnomathematics activities and mathematics learning can be seen in Table 1.

Table 1. Ethnomathematics Activities And Mathematics Learning

Activities	Ethnomathematics	Learning Mathematics
Design a build	In the process of making the framework of the armor that was subsequently stamped to form a node, using the correct bamboo embossing in the armour sketch, because the shape of the arms sketch resembles building a curved side space in the form of a nude. .	Estimate that the materials used like bamboo can be accurate and correct in making the gun. The buckle used in the apem-shaped spread builds a curved side space whose result ultimately resembles a knot.
Measuring.	The ingredients used require a suitable mixture in order to be supplied in a single bowl. Root heavy flour to	Determine bamboo plants according to the size in meters and the volume of bamboo or the weight of

	make apem and the amount of apem needed for a spoon.	the spacing gun in liters that will be used later.
Counting.	The creation of an apem spread gun with a diameter of 1.5 meters and a height of 2 meters, and the mass of the apem Spread gun is 1 quintal.	Determining the area by calculating the size of the bamboo plant as a blanket and the volume of apem the gun can be calculated by mass of flour trees materials and so on used.

This research is in line with the research applied by Hidayati (2020) entitled Ethnomatsains Identification on Gunungan Tradition in Yogyakarta Kraton. This research has the purpose of knowing ethnomatsains on the components of the custom Gunungan in Kraton Yogyakarta which can be used as a means of learning mathematics or sais/IPA. This research is a descriptive examination with an ethnomathsains approach. Based on the library results obtained some concepts of mathematics or science/IPA that exist in the parts of the custom Gunungan in Kraton Yogyakarta presented in the form of a matrix. The parts in the custom of Gunungan at Kratón Yogyakarta show the existence of correlation with the mathematical and scientific concepts/IPA among other forms of the natural gunungan Kakung namely knuckles, food forms forming gunungan, kinds of plants forming the gunungan that have a variety of elements of science /IPA.

Apem Ya Qowiyyu Spread Gunning Tradition in Mathematical Learning

The tradition of the spread gunning in Jatinom, Klaten district is able to be used as a method of learning mathematics based on ethnomatematics, i.e. by applying an integrated learning approach that links local customs with material building space side curvature of the nodules in mathematical learning. The data collection techniques obtained from this research are ethnomatematical-based tests. The subjects in this study were high school pupils with a total of 20 pupils. A presentation of the ethnomathematics-based test results can be seen in Table 2.

Table 2. Percentage Of Test Results For Ethnomathematics-Based Questions

Criteria	Precentage	Frequency	Interval
Very Good	81% - 100%	12	82,30
Good	61% - 80%	8	10,00
Good Enough	41% - 60%	2	7,70
Less	21% - 40%	0	0
Very Less	0% - 20%	0	0
Amount		22	100

The minimum accuracy criteria (KKM) used in analyzing data is 73 corresponding to the mathematics subjects in one of the high schools. The average grade score is 82.30. Presentation of the student's accurateness is based on the criterion of the minimum accuratecy in any of the upper secondary schools in Klaten is 75% then in the category very good with a score of 85%. Thus, mathematical learning integrated with ethnomatematics is able to enhance the interaction of students actively in categories very good.

Regarding the results of ethnomathematical-based tests can be seen in Figure 3 - 11.

Figure 3. Question

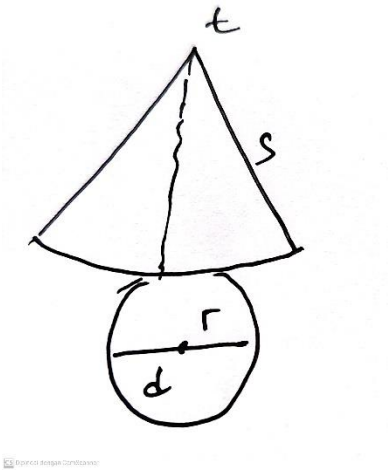

Figure 3. Student answers

The reaction of the students implies that they do not only understand the mathematical concepts, but the students are also asked to enjoy the exclusive tradition of Klaten district which is the spread of apem Ya Qowiyyu.

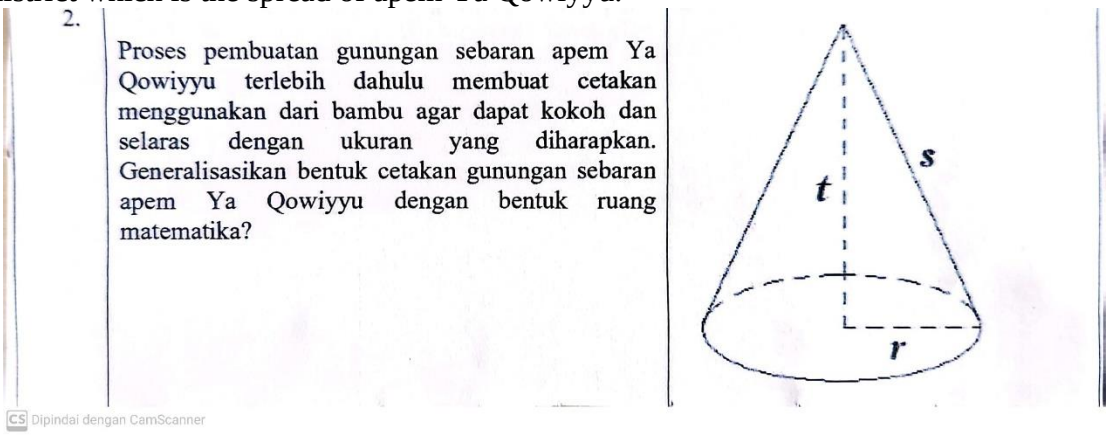

Figure 4. Questions and Answers of Students

Making a very beautiful and sturdy, apem-spread gunpowder stamp requires distinctive skills. The procedure begins with working on a sketch of the shovel, which is called a "building space" in mathematics, and then using bamboo or shrimp plants to make the prints.

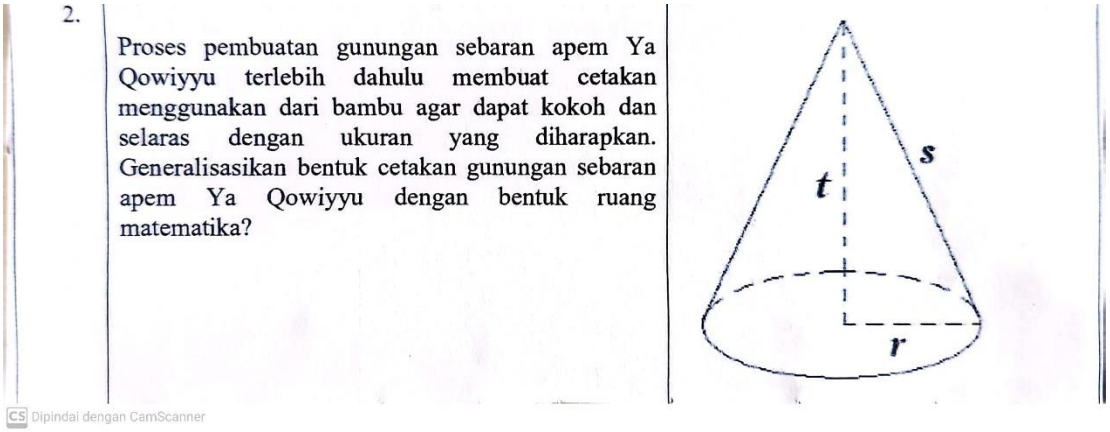

Figure 5. Questions and Answers Graduate Participants

Making apem spread molding, which is very beautiful and robust, requires distinctive skills. The procedure begins with working on a sketch of the shovel, which is called a "building space" in mathematics, and then using bamboo or shrimp plants to make the prints.

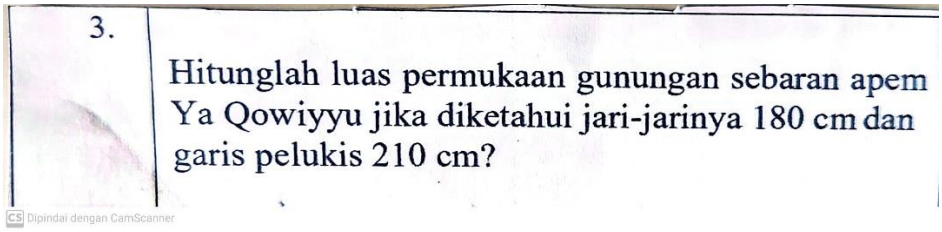

Figure 6. Question

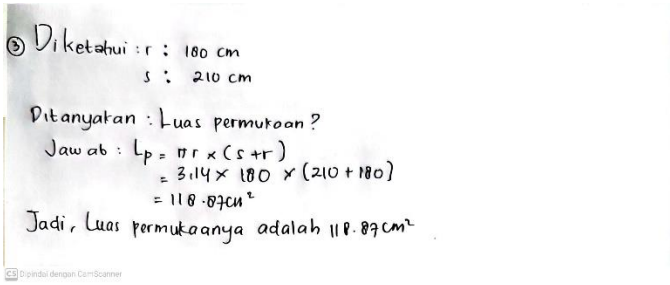

Figure 7. Student answers

As demonstrated by the students, the students have mastered ethnomathematics-based questions, including determining what they already know, what is asked, and the formula to solve questions, namely determining the area of the surface of the displacement of apem Ya Qowiyyu.

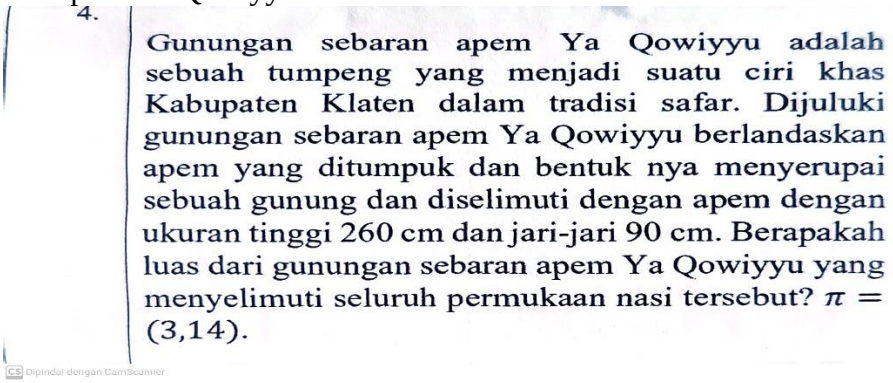

Figure 8. Question

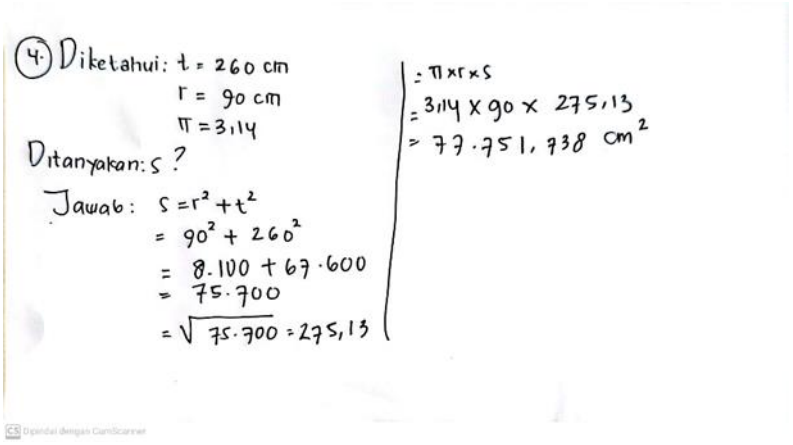

Figure 9. Student answers

The material used to make the apem spread is bamboo, nail, and paint. The area of bamboo spread should be determined by measuring the area of a blanket or a nozzle without a base.

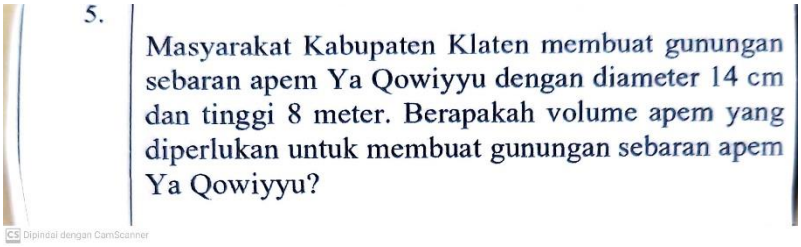

Figure 10. Question

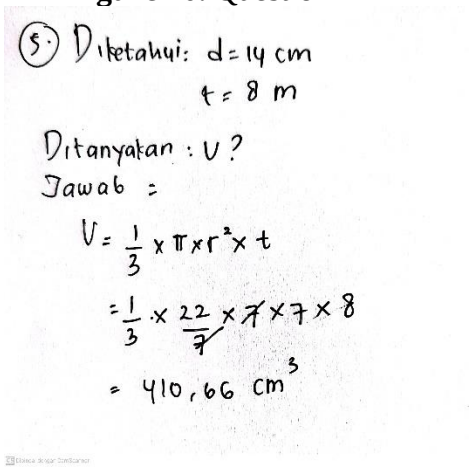

Figure 11. Student answers

Based on the answers the students showed that the students already mastered ethnomathematics-based questions, i.e. proving what they knew, what was asked, and the formula to solve the issue, that is, calculating the volume of gunpowder spread apem Ya Qowiyyu.

Based on the data obtained that there are a total of 22 high school pupils who earned a score above the KKM or higher with a presentation of the proficiency of one of the high school in the klaten is 75% in the category very good with a score of 82.30%. The results of the percentage error for each item can be seen in Table 3.

Table 3. Percentage Error For Each Item

Error Type	Error (%)
Reading Error	6,120%
Interpretation Error	22,14%
Transforming Error	45,78%

Error Type	Error (%)
Counting Error	77,31%
Reading Error	6,120%

The result of the student error presentation shows that the majority of students still experience difficulties in calculating more specifically in the context of reading, interpretation, and transformation. Based on the results of interviews with a number of pupils, most pupils do not understand the existence of the tradition of apem Ya Qowiyyu spread in Klaten district, but based on the work of the issue showed that the pupils can understand and solve the issue well. Basing their opinion on ethnomathematics-based tests is more in demand than the usual question, because students acquire cultural-related knowledge in their neighborhood.

This research is in line with the research carried out by Wardani dkk entitled "Etnomatematics Study on the Culture of Merti Villages in Giring Village, Paliyang Prefecture, Kidul Mountain". Further results of this research show that there is mathematical science in the custom merti is flat building. As for the similarity with the research that the researchers are going to study is the same as the study of ethnomatematics related to the dam. The second difference is that this research more accurately weighs ethnomathematics in flat building matter. Meanwhile, the researchers analyzed ethnomatematics on the build-up of spaces, the nodules

4. Conclusion

The results of the research are: 1) the mathematical activities contained in the culture of the spread of apem Ya Qowiyyu, namely, the activities of designing the building of a society implementing it in the preparation of the framework of the arm, the measurement activities of the society using it to form a framework, the activity of calculating is to determine the weight and the breadth of the Arm, the results of application of the cultural propagation of a community based on the test based on ethnomatematics yield good gains. Analysis of student errors is often found mostly in calculation errors and then a small part in reading, interpretation, and transformation. Ethnomathematics-based learning can increase the interest of students in interpreting mathematical concepts in the field of constructing curved side spaces, i.e. nodules.The researchers encouraged further researchers to develop detailed questions to avoid the possibility of data being lost. (Sintawati et al., 2019).

5. Acknowledgement

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