International Journal of Research in Mathematics Education
Vol. 1 No. 2, December 2023, 100-15
Universitas Islam Negeri Prof. K.H. Saifuddin Zuhri Purwokerto
e-ISSN: 3025-7638, p-ISSN: 3025-1842, https://doi.org/10.24090/ijrme.v1i2.8676

Implementation of Discovery Learning Assisted by Pythagorean Puzzle to Improve Mathematical Problem-Solving Ability

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Received June 16, 2023 *Accepted November 21, 2023* *Published November 27, 2023*

Abstract: Mathematical problem-solving ability is one of the problems of mathematics learning. Researchers applied the discovery method assisted by learning media which was one of the alternatives to improve mathematical problem-solving ability, namely the discovery learning model assisted by the Pythagorean Puzzle. This study aimed to determine the effectiveness of discovery learning assisted by the Pythagorean Puzzle in improving the mathematical problem-solving ability of the eighth-grade students of MTs Muhammadiyah 01 Purbalingga. This research was a quasi-experiment research with a quantitative approach. The population in this study were students of the eighth grade at MTs Muhammadiyah 01 Purbalingga which consisted of 163 students. The samples of this study were the students of VIII C which consisted of 22 students in the Experimental Class and the students of VIII D which consisted of 22 students in the Control class. Data collection in this study used instruments in the form of observations and tests of mathematical problem-solving skills. Based on the analysis obtained, discovery learning assisted by Pythagorean Puzzle was implemented very well. The results of data analysis using the T-test, and post-test comparison test obtained sig (2-tailed) of 0.000 < 0.05, which showed that there was a difference in the average experimental class and control class. So, it can be concluded that the implementation of discovery learning assisted by the Pythagorean Puzzle was effective in improving the mathematical problem-solving skills of eighth-grade students of MTs Muhammadiyah 01 Purbalingga.
Keywords: Discovery Learning; Mathematical; Problem-Solving; Puzzle; Pythagorean.

A. Introduction

Education is an effort to provide guidance or help in developing the physical and spiritual potential given by adults to students to achieve the goal that students are able to carry out their life tasks independently (Hidayat, MA dan Abdillah, 2019). Meanwhile, according to the Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System, education is a basic and planned effort to create an atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation, and state. So, we can mean that education is a learning process that has the aim of improving personal quality.

Mathematics is the study of abstract concepts such as numbers, formulas, and structures, and uses logic and deduction methods to solve problems. Mathematics is used to explain and understand natural and human phenomena, as well as solve problems in other fields of science, such as physics, economics, and technology (Sadewo et al., 2022). Mathematics is a discipline

that may be uniquely based solely on texts and concepts, which do not describe or refer to the world of experience except indirectly (Siagian, 2016).

Mathematics is not a static discipline consisting of a large set of concepts and skills that must be mastered in sequence but is a dynamic discipline consisting of a collection of interrelated signs and symbols, rules for the use of these representations, and problem situations that have led to the discovery of these signs and symbols, and strategies for investigating and solving problems that can be represented by these signs and symbols (Romberg, 2003). In addition, the availability and use of new technologies change, in fundamental ways, the problem situations, methods of representation, and strategies used.

Mathematics learning is one of the small and most important parts of the mathematics education process. Mathematics learning in Indonesia itself has been applied to start from the kindergarten level (TK) to the college level. At the Junior High School (SMP) level, there are several components that are actively involved including educators, students, the environment, facilities and infrastructure, and other components. Problems in learning mathematics, especially in Indonesia, are caused by several factors. These factors come from students and teachers. One of the teacher factors that can cause problems in learning mathematics is that teachers lack mastery of learning models, learning approaches, and even learning media that are appropriate for use in different materials and classes.

Based on the results of preliminary observations conducted at MTs Muhammadiyah 01 Purbalingga, it is known from the results of the first daily test of arithmetic and geometric sequence material in the form of essay questions, several classes still have difficulty solving the problem. The VIII grade mathematics teacher said that the mathematical problem-solving ability of VIII grade students of MTs Muhammadiyah 01 Purbalingga was still relatively low, even throughout the material not only arithmetic and geometric series material. Various ways have been implemented by teachers to improve students' abilities. However, teachers have not found a model that is suitable and attractive to students. And the limitations of learning media are also an obstacle for teachers in delivering math material. Many learning models are already popular. One of the learning methods that is often used in education is called discovery learning (In'am & Hajar, 2017).

The discovery learning model is a learning that is based on the discovery of real problems or real situations that are concrete so that they are easier to visualize and connect (Svinicki, 1998). In addition, the discovery learning model means a learning model that uses an approach that refers to the view that learning is a student-centered physical and mental activity (Artanti & Lestari, 2017). The model has advantages including students being active in learning because this learning model requires students to be active in the learning process. Students find it easier to understand concepts by finding them themselves than getting concepts from books. In this learning model, teacher activity greatly influences student activity (Resnani, 2019). Therefore, many researchers use the model in learning.

The previous research conducted by Padrul and Amirul said that the discovery learning model can improve students' mathematical problem-solving skills on cube and beam material (Jana & Fahmawati, 2020). Furthermore, in research conducted by Ani, et al, using a learning model and coupled with Microsoft Excel media can improve statistical problem solving skills (Sasmita et al., 2019). Not only implementing the learning model, but this research will also

use Pythagorean puzzle learning media where the media aims to facilitate students in understanding Pythagorean material.

The media has also been applied in previous studies. Research conducted by Devi, et al stated that Pythagorean puzzle media can improve the ability to understand mathematical concepts. Then, in other studies also stated that the Pythagorean puzzle media was effective, practical and valid in building students' understanding (Rifai & Prihatnani, 2020). From the research that has been described, the model and learning media can be applied to this research. One way to measure the success of these learning methods and media is by giving pretest and posttest questions where the answers to the two questions will be analyzed and concluded through testing the success hypothesis.

B. Methods

1. Literature Review

Regarding the discovery learning model, we conducted a research review with other studies related to the research being carried out. First, Siti Wulandari and her friends conducted a study in 2019 entitled "The Effectiveness of Problem Based Learning and Discovery Learning Models Assisted by Tangrams on Mathematical Problem Solving Ability of Junior High School Students" this study aims to determine the effect of learning models on problem solving skills with tangram assistance (Wulandari et al., 2019). The equation of this research with the author's research is about the effect of the application of the discovery learning model on problem-solving skills. While the difference between this research and the author's research is in the population and sample. Siti Wulandari's research was applied to seventh-grade junior high school students. While the researchers used a sample of VIII grade junior high school students. In addition, it is also different in the material applied.

Second, a journal by Padrul Jana and his friends in 2020 entitled "Discovery Learning Model to Improve Problem Solving Ability". The equation of this research with the author's research is to determine the effect of the discovery learning model on students' problem solving skills (Jana & Fahmawati, 2020). The difference between this research and the author's research is in the material applied. In addition, the study only used a learning model while the author's research was assisted by learning media, namely the pythagorean puzzle.

Third, a journal by Mas'ud Rifai and Erlina Prihatnani entitled "Development of Puzzle Media for Proving the Pythagorean Theorem" researchers discuss the development of puzzle learning media to instill the concept of the Pythagorean theorem to students. Students get flexibility in using the learning media. In addition, it makes it easier for teachers to make their own media by determining the pieces of the puzzle in the way of use that has been provided (Rifai & Prihatnani, 2020). The difference between this research and the author's research is applying puzzles in class VIII. While the difference between this research and the author's research is to improve mathematical problem-solving skills.

Fourth, a journal by Ester Simare-mare and her friends entitled "The Effectiveness of Using the Discovery Learning Model on Students' Mathematical Problem Solving Ability at SMP Negeri 5 Padangsidimpuan" (Simare-Mare et al., 2020). The study has similarities in the dependent variable, namely mathematical solution ability. In addition, the independent variable is the Discovery Learning learning model. In the author's research, the author added

Pythagorean Puzzle media to the independent variable so that this made the author's research different from the research of Ester and her friends.

2. Experimental Design

This research is a quantitative method with an experimental design. This research is used to determine the effect of independent variables (treatment) on the dependent variable (outcome) under controlled conditions. Based on the type of experimental design, this research uses the Nonequivalent Control Group Design which is applied to the Pretest-Posttest Control Group Design. The table can be seen in Figure 3.1. In this design, there are two classes selected from pretest results with the same problem-solving ability. Then, it is divided into a control class and an experimental class to find out whether the post-test results are different between the two classes.

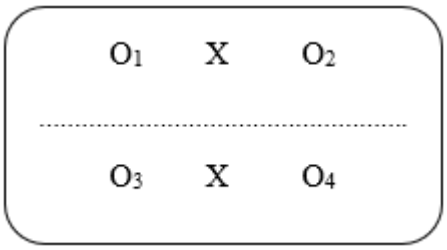

Figure 1. Format of Nonequivalent Control Group Design

The treatment given is marked with the symbol X, the pre-test is identified with the symbols O1 and O2, while the post-test is identified with the symbols O3 and O4. In addition, to complete this research, we conducted several stages as shown in the following Figure 2.

Figure 2. Research Method

In Figure 2 we can see several stages that are carried out, the first is data selection where the stage aims to collect data and select which data will be used. Then the next stage is data collection techniques where the stage has the aim of how to collect the data to be studied. The last step is data analysis techniques which is the stage for analyzing data in reaching a hypothesis. These stages will be explained in detail in the next chapter.

3. Data Selection

a. Population

Population is the whole object that will / wants to be studied (Sinaga, 2014). This population is often referred to as the universe. The following is a table of data on the number of students in each class.

Table 1. Total Number of Students

Class	Total Number of Students
VIII A	32
VIII B	32
VIII C	22

VIII D	22
VIII E	28
VIII F	27

Members of the data population are living and inanimate objects, and humans, where the properties that exist in them can be measured or observed. The population in this study were all students in class VIII MTs Muhammadiyah 01 Purbalingga.

b. Sampling

The sample is part of the number and characteristics of the population (Mokoagow et al., 2018). The sampling technique that will be used in the research is called the sampling technique. Sampling techniques are grouped into two types, namely: probability sampling and non-probability sampling, simple random, proportionate stratified random, disproportionate stratified random, and area random including probability sampling. While non-probability sampling includes systematic sampling, quota sampling, incidental sampling, purposive sampling, saturated sampling, and snowball sampling.

The sampling technique used in this research is purposive sampling technique (sample purpose). This technique is a sample with certain considerations (Sugiyono, 2009). The reason for using purposive sampling technique because Pythagoras material is included in class VIII material. Thus, the samples of this study were students of class VIII C and VIII D based on the recommendation of the mathematics teacher of class VIII MTs Muhammadiyah 01 Purbalingga.

The sampling technique used in this research is purposive sampling technique (sample purpose). This technique is a sample with certain considerations (Sugiyono, 2009). The reason for using purposive sampling technique because Pythagoras material is included in class VIII material. Thus, the samples of this study were students of class VIII C and VIII D based on the recommendation of the mathematics teacher of class VIII MTs Muhammadiyah 01 Purbalingga.

4. Data Collection Techniques

In this study we used the observation method. Observation is an activity of strengthening attention to objects using all senses (Hasanah, 2016). In this study, the researcher became the object of observation by teachers and friends. Researchers compile observation guidelines that contain a list of types of activities that may arise and will be observed. In the observation process, the observer only marks the column where the event appears. This observation was carried out in only a few meetings. All events that appear are checked; events that appear more than once in one observation cycle are only checked once. Thus, a picture of the events that appear in the teaching situation will be obtained.

This observation uses an observation sheet that contains statements in accordance with the lesson plan. The observation sheet in this study was used to determine the process of implementing discovery learning assisted by Pythagorean Puzzle in mathematics learning. Each stage is given a score according to the score guidelines given. Tests are a way of collecting data that presents a number of questions or instructions to research subjects where student responses can be categorized into correct responses or incorrect responses (Mashuri, 2016).

Tests are questions given to students to obtain answers from students in oral form (oral test), writing (writing test), or action form (action test). In this study, pre-test and post-test will be conducted. Pre-test will be done before treatment to students. Pre-test is done with the aim that researchers can find out the initial ability before treatment. While the post-test is done after the treatment carried out by researchers to students.

5. Data Analysis Techniques

After all the data is collected, then the data is analyzed to provide a hypothesis whether the model under study has met the expected hypothesis or not. There are two stages that are done, namely the prerequisite test analysis and hypothesis testing. The analysis prerequisite test includes a normality test and homogeneity test, while the hypothesis test includes T-test.

a. The Analysis Prerequisite

The data analysis prerequisite test aims to determine whether the data can continue hypothesis testing or not.

1. Normality Test

Normality testing is carried out to determine whether a data distribution is normal. This is important to know because it is related to the accuracy in choosing the statistical test to be used. Parametric statistical tests require data to be normally distributed. If the data is not normally distributed, it is recommended to test nonparametric statistics. Data normality testing can be done with Liliefors, Kolmogorov-Smirnov, and Chi-Square tests. In this study, we will use the Kolmogorov-Smirnov technique and SPSS 25. The test criteria for this technique are that the data is normally distributed if the Sig. ≥ 0.05 with a significance level of 5%. If the score Sig. < 0.05 then the data is not normally distributed (Nuryadi,. Astuti, T.D., Utami, E.S., & Budiantara, 2007).

2. Homogeneity Test

The homogeneity test was conducted to test the similarity of variants of each data group. Homogeneity test requirements are needed for inferential analysis on the comparison test. For testing the uniformity of variance of two normally distributed populations. The decision-making criteria for homogeneity testing through SPSS using the 5% significance level reference are as follows (Mariana & Zubaidah, 2015): If the sig. ≥ 0.05 then the two groups of data are declared homogeneous and if the sig. < 0.05 then the two groups of data are declared inhomogeneous.

b. Hypothesis Test

This study will use a t-test with independent samples. It is said to be independent because the data of two groups of one does not depend on the data of the second group. The test is checked based on the hypothesis (Rahmawati & Illiyin, 2021):

$$H_0 : \mu_1 = \mu_2$$
$$H_1 : \mu_1 \neq \mu_2$$

The statistics used are:

$$t_{result} = \frac{\bar{X}_D}{\sqrt{\frac{\sum d^2}{N(N-1)}}} \quad \ldots (1)$$

with

$\bar{X}_D$: The average of the subtraction of the first data and the second data

d : $D - \bar{X}_D$

N : The amount of data

The decision-making criteria are H0 rejected if $t_{result} < t_{table}$ and H0 accepted if otherwise, namely $t_{result} \geq t_{table}$. This research was assisted using SPSS 25.

C. Results and Discussion

1. Experimental Design

In this study, the experimental class, namely class VIII C, was treated with the discovery learning model assisted by the Pythagorean Puzzle with 22 students, and the control class, namely class VIII D, was not treated with the Discovery Learning model assisted by the Pythagorean Puzzle with 22 students. The implementation of the discovery learning model assisted by the Pythagorean Puzzle was measured by observation. In this study, there were two observers during the learning process. The observation was carried out for 4 consecutive meetings. The observation aimed to measure how well the researchers implemented the discovery learning model assisted by Pythagorean puzzle. The following Table 4.1 results of observation scores:

Table 2. Observation Score Result

Meeting	Observer 1	Observer 2	Average
1	4.09	4.36	4.23
2	4.18	4.63	4.40
3	4.18	4.36	4.27
4	4.18	4.27	4.23
Average	4.16	4.40	4.28

The data score of the observation of the implementation of discovery learning with the help of the Pythagorean puzzle there were 11 learning processes that must be carried out by researchers with the ideal score given a maximum of 5 and a minimum of 1. The average score obtained by researchers during 4 meetings with two observers was 4.28. It can be seen in Table 2 that the process of implementing discovery learning with the help of Pythagorean puzzles has been carried out very well.

2. Data Collection and Analysis

Data on students' initial mathematical solving abilities were obtained from pre-test data consisting of 2 problem-solving items which were then applied to class VIII C (as the experimental class) and class VIII D (as the control class). To find out the initial ability of students, the control class pre-test answer score in Table 3 to 4.

Table 3. Control Class Pre-test Answer Score

No	Student Name	Result
1	A. N. S.	20.00
2	A. R. N. A.	34.29
3	A. D. Y.	31.43
4	D. T.	25.71

5	F. A.	31.43
6	G. D. P.	28.57
7	H. S. N.	8.57
8	J. D. N.	20.00
9	K. A. D.	8.57
10	K. H. B.	17.14
11	M. G. F.	22.86

Table 4. Control Class Pre-test Answer Score (Continue)

No	Student Name	Result
12	M. H.	11.43
13	M. I. Z.	20.00
14	N. Z. N.	22.86
15	N. S. N.	14.29
16	N. D. A.	22.86
17	P. F.	8.57
18	P. D. P.	34.29
19	P. W. A.	28.57
20	R. S.	34.29
21	R	14.29
22	R. P. O.	14.29
	Average	

In addition, we can also see the pre-test results of the experimental class in Table 5. Between the control class and the experimental class have the same data, which is 22 data.

Table 5. Experimental Class Pre-test Answer Score

No	Student Name	Result
1	A	8.57
2	A. D. O.	14.29
3	B. S. S.	20.00
4	B	8.57
5	D. A. P.	28.57
6	F. S.	28.57
7	G. L. A.	17.14
8	I. R.	28.57
9	I. S. B.	34.29
10	J. P.	20.00
11	K. C.	8.57
12	K. A. N.	17.14
13	L. F.	20.00
14	N. N. D. A.	22.86
15	N. M.	22.86
16	R. H.	22.86
17	R	25.71
18	S. D.	34.29
19	S. S. J.	31.43
20	S. P.	11.43
21	Y. A. A.	14.29
22	Y. A. S.	34.29
	Average	

After knowing the initial ability of the control class and experimental class, then the implementation of discovery learning assisted by the Pythagorean puzzle was carried out. To measure how effective discovery learning aided by the Pythagorean puzzle is in improving students' mathematical solution skills, a post-test of 5 learning meetings was carried out. The following is a table of post-test scores of control class in Table 6.

Table 6. Control Class Post-test Answer Score

No	Student Name	Result
1	A.N.S.	25.79
2	A.R.N.A.	33.33
3	A.D.Y.	33.33
4	D.T.	28.57
5	F.A.	41.67
6	G.D.	33.33
7	H.S.N.	25.00
10	K.A.D.	16.67
11	M.G.F.	8.33
12	M.H.	16.67
13	M.I.Z.	58.33
14	N.Z.	41.67
15	N.S.N.	41.67
16	N.D.	33.33
17	P.F.	16.67
18	P.D.P.	58.33
19	P.W.A.	33.33
20	R.S.	33.33
21	R.	16.67
22	R.P.	25.00
	Average	

In addition, we can also see the post-test results of the experimental class in Table 7. Between the control class and the experimental class have the same data, which is 22 data.

Table 7. Experimental Class Post-test Answer Score

No	Student Name	Result
1	A	73.53
2	A. D. O.	85.29
3	B. S. S.	70.59
4	B	79.41
5	D. A. P.	67.65
6	F. S.	52.94
7	G. L. A.	82.35
8	I. R.	67.65
9	I. S. B.	52.94
10	J. P.	52.94
11	K. C.	52.94
12	K. A. N.	55.88
13	L. F.	76.47
14	N. N. D. A.	58.82
15	N. M.	64.71
16	R. H.	52.94

17	R	85.29
18	S. D.	52.94
19	S. S. J.	85.29
20	S. P.	52.94
21	Y. A. A.	67.65
22	Y. A. S.	61.76
	Average	

We can see from Table 3 to Table 7 that there are differences from each test given. The pre-test and post-test data will be tested for comparison as follows.

a. Pre-test Comparison Test

1. Normality Test

The normality test aims to determine whether the data taken from the population is normal or not. In this study using the Kolmogorov-Smirnov test assisted by SPSS 25 with the following output:

Table 8. Normality Test Results of Pre-test Data

One-Sample Kolmogorov-Smirnov Test		
		Pre-test Score
N = 44		
Normal Parameters	Mean	21.5593
	Std. Dev.	8.50445
Most Extreme Differences	Absolute	.113
	Positive	.099
	Negative	-.113
Test Statistic		-.113
Asymp. Sig. (2-tailed)		.189

In Table 8 there is information on the results of the calculation of the normality test on the pre-test scores. In this study, we used Asymp. Sig. 2-tailed to determine whether the data is normal or not. Based on the table of normality test results, the Sig value. 0.189. Because the significance value ≥ 0.05, it can be concluded that the data is normally distributed.

2. Homogeneity Test

The homogeneity test is used to ensure that the pre-test score data of the experimental class and control class are homogeneous. In this study, the Levene Test with the help of SPSS 25. The results of the homogeneity test output are as follows:

Table 9. Homogeneity Test Results of Pre-test Data

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
Pre-test Score	Based on Mean	.973	1	42	.850
	Based on Median	.845	1	42	.850
	Based on Median and with adjusted df	.845	1	42.000	.850
	Based on trimmed mean	.987	1	42	.850

Based on the Table 9, the significance value is 0.850. Because the significance value of 0.850 ≥ 0.05, it can be concluded that the data is homogeneous.

3. T Test

In the T test we have two hypotheses

H0 : μ1= μ2

H1 : μ1≠μ2

with μ1 expressed the mathematical problem-solving ability of the experimental class and μ2 stated the mathematical problem-solving ability of the control class. The t-test output results are as follows:

Table 10. T Test Results of Pre-test Data

Independent Samples Test									
Mean of Pre-test Data = 20.71		t-test for Equality of Means							
		Mean Difference	Std. Error Difference	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pre-test Score	Equal variances assumsed	.00045	2.59453	1.834455	-5.23553	5.23644	.000	42	1.000

Based on the Table 10, the significance value is 1.000. Because the significance value ≥ 0.05, then H0 is accepted which means that the initial ability of the experimental class is the same as the mathematical problem-solving ability of the control class.

b. Post-Test Comparison Test

1. Normality Test

The normality test aims to determine whether the data taken from the population is normal or not. In this study using the Kolmogorov-Smirnov test assisted by SPSS 25 with the following output:

Table 8. Normality Test Results of Post-test Data

One-Sample Kolmogorov-Smirnov Test		
		Post-test Score
N = 44		
Normal Parameters	Mean	48.1950
	Std. Dev.	22.69531
Most Extreme Differences	Absolute	.128
	Positive	.104
	Negative	-.128
Test Statistic		-.128
Asymp. Sig. (2-tailed)		.067

From the Table 12, the results of the calculation of the normality test on the post-test scores. In this study, we used Asymp. Sig. 2-tailed to determine whether the data is normal or not. Based on the table of normality test results, the Sig value. 0.067. Because the significance value ≥ 0.05, it can be concluded that the data is normally distributed.

2. Homogeneity Test

The homogeneity test is used to ensure that the post-test score data of the experimental class and control class are homogeneous. In this study, the Levene test with the help of SPSS 25. The results of the homogeneity test output are as follows:

Table 12. Homogeneity Test Results of Post-test Data

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
Post-test Score	Based on Mean	3.577	1	42	.065
	Based on Median	2.120	1	42	.153
	Based on Median and with adjusted df	2.120	1	38.798	.153
	Based on trimmed mean	3.552	1	42	.066

Based on the Table 12, the significance value is 0.065. Because the significance value of 0.065 ≥ 0.05, it can be concluded that the data is homogeneous.

3. T Test

In the T test we have two hypotheses

H0 : μ1=μ2

H1 : μ1≠μ2

with μ1 expressed the mathematical problem-solving ability of the experimental class and μ2 stated the mathematical problem-solving ability of the control class. The t-test output results are as follows:

Table 13. T Test Results of Post-test Data

Independent Samples Test									
Mean of Post-test Data = 20.71		t-test for Equality of Means							
		Mean Difference	Std. Error Difference	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Post-test Score	Equal variances assumsed	-35.69364	4.19594	2.946805	-44.16138	-27.22589	-8.507	42	.000

Based on Table 13, the significance value is 0.000. Because the significance value < 0.05, then H0 is rejected, H1 is accepted, which means that the mathematical problem-solving ability of the experimental class is different from the mathematical problem-solving ability of the control class after different treatments are applied. It can be said that there is an increase in students' problem-solving ability in the experimental class.

3. Discussion

This sub-section will explain the results of the research that has been carried out by researchers. This series of studies began in December, starting with preliminary observations then testing the validity of research instruments. Researchers took two classes as samples for research, namely class VIII C as an experimental class with 22 students and class VIII D as a control class with 22 students. Then the two classes were given pretest questions to ensure that the two classes had the same mathematical problem-solving skills.

The control class applied conventional learning without the help of learning media to support learning activities. The experimental class implemented discovery learning with the help of the Pythagorean puzzle. The following is a picture of this research activity.

Figure 3. Research Activity

In Figure 3, we can see that students are very enthusiastic in math learning. This research was conducted for 4 meetings in each class group, with learning material namely the Pythagorean theorem. The implementation of discovery learning aided by the Pythagorean puzzle starts from January 7, 2023, to January 21, 2023, in accordance with the attached schedule and lesson plan.

During the process of implementing discovery learning with the help of Pythagorean puzzles, there were two observers as observers and assessors. This aims as evidence that researchers have carried out learning steps in accordance with the learning model used. The results of each observer's assessment can be seen in Table 2 based on this table, shows that the average score of the assessment by the first observer for 4 meetings was 4.16. While the average score of the assessment by the second observer for 4 meetings was 4.40. So, the average score of the implementation of discovery learning assisted by the Pythagorean puzzle is 4.28.

After the process of implementing discovery learning aided by the Pythagorean puzzle was carried out, the researcher gave posttest questions to the control class and experimental class. The results of the pretest and posttest were then tested for comparison through the prerequisite analysis test, namely the normality test and homogeneity test. Then continue to test the hypothesis using the t-test.

In the pre-test comparison test, the normality test results showed that the Sig. 0.189. Because the significance value ≥ 0.05, it can be concluded that the data is normally distributed. After knowing that the data is normally distributed, then homogeneity is tested. It is known that the significance value is 0.850. Because the significance value ≥ 0.05, it can be concluded

that the data is homogeneous. Then continue to test the hypothesis using the t test. Based on the t test results table, the significance value is 1.000. Because the significance value ≥ 0.05, then H0 is accepted which means that the mathematical problem-solving ability of the experimental class is the same as the mathematical problem-solving ability of the control class before different treatments are given to the control class and the experimental class.

In the posttest comparison test, the normality test results show the Sig value. 0.067. Because the significance value ≥ 0.05, it can be concluded that the data is normally distributed. After knowing that the data is normally distributed, then homogeneity is tested. It is known that the significance value is 0.065. Because the significance value ≥ 0.05, it can be concluded that the data is homogeneous. Then continue to test the hypothesis using the t test. Based on the t test results table, the significance value is 0.000. Because the significance value < 0.05, then H0 is rejected. So H1 is accepted, which means that the mathematical problem-solving ability of the experimental class is different from the mathematical problem-solving ability of the control class after different treatments are applied in the two classes. This can also be seen from the average value of the experimental class which is 66.04 while the control class is 30.35.

There is a difference in the mathematical problem-solving ability of the experimental class and the control class after different treatments. The average mathematical problem-solving ability of the experimental class is higher than the mathematical problem-solving ability of the control class. So, we can know that there is an increase in mathematical problem-solving ability in the experimental class.

In this study, the implementation of discovery learning aided by the Pythagorean puzzle was effective in improving the mathematical problem-solving skills of class VIII students of MTs Muhammadiyah 01 Purbalingga. This is supported by the research of Ester Simare-mare, et al with the title "The Effectiveness of Using the Discovery Learning Model on Students' Mathematical Problem Solving Ability at SMP Negeri 5 Padangsidimpuan" (Simare-Mare et al., 2020). The results showed that the average pre-test score was 63.33 in the sufficient category and the average posttest score was 83.67 in the very good category. So that the use of the discovery learning model is significantly effective on the mathematical problem-solving ability of class VIII students of SMP Negeri 5 Padangsimpuan.

In another study conducted by Padrul and Amirul explained that the learning model must be adjusted to the situation and conditions in the classroom and consider the material to be taught, such as the discovery learning model has a positive impact on students' skills in solving mathematical problems (Jana & Fahmawati, 2020). In addition, Siti Wulandari and friends also said in a study entitled "The Effectiveness of Problem-Based Learning and Discovery Learning Models Aided by Tanggram on Mathematics Problem Solving Skills of Junior High School Students" that Discovery Learning is effective on problem-solving skills due to the active students seeking new knowledge, easier understanding of the material provided, the ability of students to socialize between group members so as to improve the ability to solve the problems given (Gusmania & Marlita, 2016).

This statement is also supported by Borthick and Jones who say that Discovery Learning is also closely related to problem solving (or learning how to solve problems under a more metacognitive perspective) (Borthick & Jones, 2000). The results of another study by Mas'ud Rifai and Erlina Prihatnani showed that the Pythagorean puzzle was used to instill a concept understanding of the Pythagorean theorem. Pythagorean puzzles are effectively used to

construct students in learning Pythagoras (Rifai & Prihatnani, 2020). Understanding students' mathematical concepts greatly affects students' problem-solving ability. Research conducted by Damianus Siki, Kristofous D. Djong and Yohanes O. Jagom said that subjects with high and medium problem solving abilities had no difficulty in understanding mathematical concepts (Jagom et al., 2021). This statement is also supported by Indah Suciati, Rio Fabrika Pasandaran and Hajerina who said that the higher the students' mathematical concept understanding ability, the better the students' mathematical problem solving ability (Suciati et al., 2021).

D. Conclusion

Discovery learning with the help of pythagorean puzzles in mathematics learning was implemented, especially the Pythagorean theorem material in class VIII MTs Muhammadiyah 01 Purbalingga very well. This is evidenced by the results of observations by two observers for 4 meetings with an average score of 4.28 which means they have done very well. The implementation of discovery learning assisted by pythagorean puzzle effectively improves the mathematical problem-solving ability of students in class VIII MTs Muhammadiyah 01 Purbalingga. This can be seen from the results of the post-test comparison test which obtained a sig (2-tailled) of 0.000 <0.05, which means that there is a difference in the average of the experimental and control classes.

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