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Improving Students' Mathematics Problem Solving Ability Through Jigsaw Method Based on Cooperative Learning Model in Pythagoras Theorema

Leo Luxman¹, Mohammad Rif'at², Dede Suratman³

Universitas Tanjungpura^{1,2,3}

leomtk90@gmail.com¹

mohammad.rifat@fkip.untan.ac.id²

dede.suratman@fkip.untan.ac.id³

Abstract

The study investigates the increase in students mathematical problem-solving abilities after being treated with the Jigsaw cooperative model on the Pythagorean theorem. The method used in this research was an experimental method with pre-experimental designs and the research design was One Group Pretest Posttest Design. The population was all students of VIII grade SMPN 1 Toba who were spread into four classes. Then the sample were students of VIII B class who were taken using the cluster random sampling technique. Data collection techniques used measurement techniques and data collection tools used problem-solving ability tests in descriptions. After the data was tested on the sample, then the data analysis was then carried out to test the hypothesis. But first, doing the prerequisite test was the data normality test. The normality test of this data used Chi-Square (χ^2). Obtained data normality test results χ^2 count = 2.75 and χ^2 table = 7.81. Because χ^2 count < χ^2 table, then the data was normally distributed. The next test was to do a one-group t-test with a significance level (α) = 0.05. The results obtained tcount = 2, 541 and t table = 1.961. Because tcount > ttable, it can be concluded that there was an increase in students mathematical abilities after being given a Jigsaw cooperative learning model.

Keywords: Cooperative Learning Model, Jigsaw, Problem Solving

INTRODUCTION

Education is a means of preparing reliable human resources (HR) in the future who must be critical, logical, and innovative in dealing with and solving every problem at hand. It is in line with Rusman's (2013) view, which stated that education is preparing for the future and creating a future. One of the goals of learning mathematics, according to Widjajanti (2013), is that students can solve math problems or problems. Through learning, in which the teaching and learning process begins by exposing students to a problem and linking it to other knowledge, it will lead to students' mathematical problem-solving abilities. Hamzah (2014) stated that problem-solving is a solution to bridge the gap of "what is known and what is questioned." Learning problem-solving leads to the formation of student creativity.

The importance of problem-solving abilities for a student and other abilities, namely reasoning

and proof, communication, connection, and mathematical representation, is evident from the determination of standards for these abilities in the National Council of Teachers of Mathematics (NCTM). In achieving the research objectives, there is a need for mutually tolerant cooperation with one another to study mathematics. One of the many models of learning mathematics is cooperative. This learning model is a form of learning where students learn and work collaboratively in small groups with a heterogeneous group structure. This learning model is widely recommended by mathematics education experts (Rusman, 2013). Furthermore, Antuni (2014) stated that cooperative learning provides opportunities for positive interdependence between students in achieving learning goals.

This cooperative learning model consisted of several types. One of them is the Jigsaw cooperative model. The learning model no longer focuses on a teacher as a teacher in the classroom but more as a facilitator during learning. Smarter students teach other students in their respective groups. This type of Jigsaw cooperative learning has several advantages. These advantages encourage students to be more active in class, creative in thinking, and responsible for the learning process.

Several studies used the Jigsaw cooperative learning model have shown significant results. The research conducted by Handayani (2018) where the results obtained that after applying the Jigsaw cooperative learning model, student learning achievement was getting better. Then Rokhis (2019) reported the results of his research that the average value of student learning achievement increased after applying this type of Jigsaw cooperative learning model. Furthermore, Rohim (2019) reported his research results, which showed that student learning outcomes had increased quite high. It was shown in the posttest value data, which had an increase of 81.82% compared to pretest scores and more than 75% of students who passed the minimum completeness criteria.

According to Yamin and Ashari (2012), the advantages of the Jigsaw type of cooperative learning are as follows 1) teach students to believe in the teacher and believe in their own ability to think, seek information and other sources, and learn from other students, 2) encourage students to express their ideas verbally and compare ideas with friends. It is especially meaningful when in the problem-solving process, 3) helping students learn to respect students who are smart and students who are weak in accepting these differences, 4) is an effective strategy for students to achieve academic and social outcomes including increasing achievement, self-confidence, and relationships. Positive interpersonal skills between one student and another, improve time management skills and positive attitudes towards school, 5) provide many opportunities for students to compare their answers and the accuracy of these answers, 6) encourage weak students to continue to act to help smart students identify gaps in achieving learning outcomes, 7) The interaction that occurs in the Jigsaw cooperative is to help motivate students and encourage their thinking, 8) Can develop leadership talents and teach discussion skills, 9) Make it easier for students to carry out social interactions 10) Appreciate other people's ideas that they feel better, and 11) Improve creative thinking skills.

Based on the results of interviews with mathematics teachers at SMPN 1 Toba, general information is obtained that the learning process of mathematics in the classroom has gone well according to the curriculum that has been implemented in schools namely K13. Furthermore, the facts found were that students were still confused about solving the Pythagorean theorem. Student learning outcomes on this subject were still low. It can be seen from the results of daily tests given by teachers who were still below the minimum completeness criteria. The minimum completeness criteria for VIII grade mathematics in this school was 70.

From the interview results, it was also obtained information that students tended to be less enthusiastic in doing the assigned assignments. They put less effort into solving it. Even though the ability to solve mathematical problems in students was demanded to be higher because students are required to have the ability to understand the problems faced, solve the problems and answer them according to the problems given.

It is necessary to find a solution to achieve satisfactory learning outcomes and optimize students' mathematical problem-solving abilities. The solution offered in this study was to improve students' mathematical problem-solving abilities through the Jigsaw cooperative learning model in

the Pythagorean theorem material in VIII grade of SMPN 1 Toba, Sanggau Regency.

METHOD

According to Sugiyono (2017), "The experimental method is a research method used to find the effect of treatment on others under controlled conditions." The method used in this research is the experimental method. The form of research used in this study was pre-experimental design. The design was said to be Pre-Experimental Designs because it was not a real experiment. After all, there were still external variables that influenced the dependent variable's formation (Sugiyono, 2017). The design in this study was One Group Pretest Posttest Design. A group of subjects was subjected to treatment for a certain period, then measurements were taken. Measurements were made before and after being given treatment and the effect of treatment was measured from the difference between before (O1) and after being given treatment (O2). According to Sugiyono (2017), the One Group Pretest Posttest Design research design was as follows.



Fig. 1 One Group Pretest Posttest Design

Information:

O₁ = before being given treatment

X = treatment

O₂ = before being treated

The population in this study were VIII grade students of SMPN 1 Toba Sanggau Regency in the 2019/2020 academic year consisted of VIII A, VIII B, VIII C, and VIII D classes. Sampling in this study was random and used the cluster random sampling technique. By first doing a homogeneity test of population variance using the Bartlett test. After the test was carried out, the sample will be selected by lot. Then, the group will be VIII B class.

The data collection technique used in this research was the measurement technique. The measurement referred to in this study was the provision of pretest and posttest to the research group in an essay test. In calculating the test results of students' mathematical problem-solving abilities using scoring, each item was answered. The data collection tool used in this study was a problem-solving ability test. The test was carried out before and after being given the Jigsaw cooperative learning type in the research class.

The things were needed to be considered in preparing the students' mathematical problem-solving ability test questions before the test was given to the research group were as follows:

1. Create a grid of questions
2. Writing Question Points
3. Analysis of test instruments

The higher the correlation index obtained, the higher the validity of the test. In determining the item's validity, the product-moment correlation was used by correlating the scores obtained by students on the items with the total scores obtained.

Table 1. The Results of Test Validity

Item Number	r count	r table	Criteria	Information
1	0,85	0,334	Very High	Valid
2	0,44		Medium	Valid
3	0,77		High	Valid
4	0,79		High	Valid
5	0,74		High	Valid
6	0,49		Medium	Valid

The discrimination power of a items was distinguishing between students who mastering the material and students who not mastering the material.

Table 2. Discrimination Power

Items	DP Score	Criteria
Item 1	0,29	Fair
Item 2	0,16	Poor
Item 3	0,24	Fair
Item 4	0,26	Fair
Item 5	0,26	Fair
Item 6	0,16	Poor

The difficulty level of the question states the chance to answer a question correctly at a certain ability level, usually expressed by an index. The greater the index of the difficulty level of the question, the easier it is.

Table 3. Difficulty Level

Items	Difficulty Index	Criteria
Item 1	0,66	Medium
Item 2	0,15	Difficult
Item 3	0,47	Medium
Item 4	0,47	Easy
Item 5	0,43	Medium
Item 6	0,14	Difficult

Instrument reliability is the degree of accuracy or persistence, or consistency of measuring instruments used to measure. When used to measure multiple times, a reliable instrument produces the same data (Zuldafrial, 2012). A test can have a high level of confidence if the test gives consistent results (Arikunto, 2012). The reliability of test items using the Cronbach alpha was 0.94 with very high criteria. Based on the above calculations, the test instrument made is suitable for use in this study.

After the data was tested on the sample, then the data analysis was carried out to test the hypothesis. However first the first step was the data normality test. The normality test of this data used Chi-Square. Obtained data normality test results $t_{count} = 2.75$ and $t_{table} = 7.81$. Because of $t_{count} < t_{table}$, then the data is normally distributed. Because the data is normally distributed, the next test is to do a one-group test with a significance level (α) = 0.05 with the following hypothesis: H_0 : There is no improvement in students' mathematical problem-solving abilities after being given the Jigsaw cooperative learning model in the Pythagorean theorem material in VIII grade of SMPN 1 Toba, Sanggau Regency.

H_a : There is an increase in students' mathematical problem-solving abilities after being given the Jigsaw cooperative learning model in the Pythagorean theorem in VIII grade of SMPN 1 Toba, Sanggau Regency.

Based on the calculation, the results obtained $t_{count} = 2,541$, and $t_{table} = 1.961$. Because $t_{count} > t_{table}$, then H_0 is rejected. It can be concluded that there is an increase in students' mathematical problem-solving abilities after being given the Jigsaw cooperative learning model in the Pythagorean theorem in class VIII SMPN 1 Toba, Sanggau Regency.

RESULTS AND DISCUSSIONS

The data obtained in this study were pretest data and posttest data. Data from the pretest results of mathematical problem-solving abilities were analyzed using descriptive statistics with descriptive inferences. Based on the pretest data calculation, it can be seen that the highest score of students was 75.13 and the lowest score was 37.50, with the average score of all students of VIII B SMPN 1 Toba, namely 52.64. There were eight students (28.57%) who completed out of 28 students, and 20 other students (71.43%) had not yet reached the minimum completeness criteria. It can be concluded that the mathematical problem-solving ability of class VIII B students of SMPN 1 Toba before being taught by the Jigsaw cooperative learning model was still very low from the minimum completeness criteria, namely 70.

Posttest data analysis was the same as the pretest result data analysis, using descriptive statistics. Based on the post-test data calculation, it can be seen that the highest score of the students was 80.15 and the lowest score was 51.50, with the average score of all students in VIII A grade at SMPN 1 Toba, namely 71.35. Based on the research results data analysis, as stated, there were 22 students or 78.57% of the 28 who passed minimum completeness criteria individually. Meanwhile, six students, or 24.43%, had not yet achieved minimum completeness criteria. It showed that more than half of the students passed minimum completeness criteria.

After processing the pretest and posttest data, the next step was to test these data to see if there was an increase in problem-solving abilities or not. Before seeing the improvement of students' mathematical problem-solving abilities, the thing that needs to be done was to test the normality of the post-test data using Chi-Square with a significance level $\alpha = 5\%$. After the calculation was complete, you get $\chi^2_{count} = 2.75$ and $\chi^2_{table} = 7.81$. With the test criteria, if $\chi^2_{count} < \chi^2_{table}$, then the data was normally distributed. Based on the comparison of these numbers, it can be concluded that the posttest data was normally distributed.

After the posttest data was normally distributed, what needs to be done to determine whether there is an increase in problem-solving abilities after being taught with the Jigsaw cooperative model is to do a one-group t-test. Based on calculations using one group t-test with a significance level of $\alpha = 5\%$, the results obtained $t_{count} = 2.541$ and $t_{table} = 1.961$ so that $t_{count} > t_{table}$. It can be concluded that in this study, there is an increase in students' mathematical problem-solving abilities after being given the Jigsaw cooperative learning model in the Pythagorean theorem material in VIII grade at SMPN 1 Toba, Sanggau Regency.

CONCLUSIONS

Based on data analysis and discussion, it can be concluded as follows:

1. Students' mathematical problem-solving ability before being taught the Jigsaw cooperative learning model in the Pythagorean theorem material in VIII grade at SMPN 1 Toba, Sanggau Regency has not yet achieved minimum completeness criteria with details of 8 students (28.57%) achieving minimum completeness criteria of 28 students and 20 other students (71.43%) have not reached the minimum completeness criteria.

2. Students' mathematical problem-solving abilities after being taught the Jigsaw cooperative learning model in the Pythagorean theorem material in VIII grade at SMPN 1 Toba, Sanggau Regency achieved minimum completeness criteria with details of 22 students or 78.57% of 28 who passed the minimum completeness criteria individually. Meanwhile, six students, or 24.43%, have not reached the minimum completeness criteria.
3. It can be concluded that in this study, there was an increase in students' mathematical problem-solving abilities after being given the Jigsaw cooperative learning model in the Pythagorean theorem material in VIII grade at SMPN 1 Toba, Sanggau Regency.

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