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# The Effect of a Realistic Mathematics Education Approach with the Jigsaw Learning Model on Students' Creative Thinking Ability and Self-regulated Learning

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***Abstract***

This study aims to describe: (1) The effect of a Realistic Mathematics Education Approach with a Jigsaw Type Cooperative Learning Model on Students' Creative Thinking Abilities; (2) The effect of a Realistic Mathematics Education Approach with a Jigsaw Type Cooperative Learning Model on Students' Learning Independence; (3) The effect of a Realistic Mathematics Education Approach with a Jigsaw Type Cooperative Learning Model on Students' Creative Thinking Abilities and Self-regulated Learning. This research is a quasi- experimental study with a pretest and posttest design. The population in this study were all class VIII students of SMP Negeri 1 Kota Bima for the 2023/2024 academic year, consisting of 10 classes. Two classes were randomly selected as the research sample, namely class VIII- 2 as the experimental class I, which was treated with realistic mathematics education approach with a jigsaw type cooperative learning, and class VIII-3 as the experimental class II, which was given the realistic mathematics education approach. The instruments used to collect data were creative thinking ability tests and self-regulated learning questionnaires. The validity of the contents of the instrument was determined by asking for the assessment of two experts (expert judgment) who stated that the instrument was suitable for use after revision. The tests used were independent sample t-test and hottelling T2. The results of the study show: (1) Learning using realistic mathematics education approach with a jigsaw type cooperative learning model has a significant effect on students' creative thinking abilities; (2) Learning using a realistic mathematics education approach with a jigsaw type cooperative learning model has a significant effect on self-regulated learning; (3) Learning using a realistic mathematics education approach with a jigsaw type cooperative learning model has a significant effect on students' creative thinking abilities and self-regulated learning.

***Keywords:*** *Creative Thinking; Jigsaw Type Cooperative Learning; Realistic Mathematics Education; Student Self-Regulated Learning*

## *Introduction*

Mathematics education in the country is currently undergoing a paradigm shift. There is a strong awareness, particularly among policymakers, of reforming mathematics education. The goal is to make mathematics learning more meaningful for students and equip them with sufficient competencies for further studies and entering the workforce (Hadi, 2005). Students learning mathematics need arithmetic skills and the ability to think and reason mathematically to solve new problems and learn new ideas they will encounter in the future.

One aspect that needs to be maximized in this context is the ability to think creatively. Amarta (2013) states, 'Creative thinking is the ability to solve problems in an original and useful way.' Creative thinking is an essential skill that needs to be developed in students. Creative thinking involves generating new ideas, viewing problems from various perspectives, finding innovative solutions, and adapting to change.

Tabach Friedlander (2017) stated that students' mathematical creative thinking ability greatly determines their conceptual understanding during learning. The higher the students' creative thinking ability, the more likely they are to apply flexible and creative thinking when solving problems without being confined to the methods taught by the teacher. According to Wang (2011), the most critical aspects of creativity in mathematics are fluency, flexibility, originality, and elaboration.

However, according to the facts in the field, the current challenge is that the creative thinking ability of students in Indonesia still needs to improve and remains relatively low in its development. This is evident when students are given a mathematics test; they tend to have similar answers and often make the same mistakes. This is triggered by students' need for more creativity in expressing their ideas or answers to the given problems, resulting in a need for varied responses.

In the Indonesian education system, students' creative thinking ability still needs to improve. This is due to the learning approach, often dominated by conventional methods that focus on transferring knowledge and routine activities (Kurniasih & Berlin, 2017). Students are more frequently asked to memorize and repeat information rather than being encouraged to think creatively.

In addition to cognitive abilities such as creative thinking, it is also essential to instill affective abilities in students to maximize the role of mathematics education, such as student independence. Learning independence is an aspect that needs attention in the learning process, as it is crucial for improving students' academic performance (Nietfeld et al., 2023).

Students' learning independence is still relatively low. Students still need to be more dependent on teachers for acquiring knowledge (Nurfadilah & Hakim, 2019), with many viewing the teacher as the sole source of information. Students often hesitate when solving problems because they need more confidence in their abilities (Febriyanti & Imami, 2021). The researcher also conducted observations and found that the learning independence of middle school students still needs to improve. This is evident as students heavily rely on teachers, expecting them to be the primary source of information. Students still tend to cheat or copy their friends' answers and frequently fail to submit assignments on time, indicating that their learning independence needs to be optimized.

Topics involving solid geometry can present a complex challenge for students. In finding solutions, students must think creatively to identify the right approach, explore various strategies, and innovate when choosing effective methods. Through problems related to solid geometry, creative thinking skills can be honed. Understanding solid geometry concepts enables students to address the need to generalize problems related to solid geometry in everyday life. Creative thinking skills help students make broader generalizations, identify hidden patterns, and create innovative mathematical representations.

Various approaches and strategies can be applied to solving mathematical problems related to solid geometry. Creative thinking skills help students develop flexible thinking, allowing them to view problems from different perspectives, try different approaches, and adapt to changes that may occur during the problem-solving process.

Considering the importance of creative thinking skills and student learning independence, teachers must make innovative efforts to develop both. Teachers can help foster these skills through selected approaches and learning models. The approach to a chosen learning model is critical. According to Muslih (2009:40), there are two reasons why the approach in a learning process is crucial. First, the design of the program content, materials, strategies, learning resources, and assessment techniques/forms must align with the chosen approach. Second, the selected approach is a reference for determining the overall general stages of managing the learning process. Therefore, the approach is essential in a learning model as it contributes to achieving the learning objectives.

The realistic mathematics education approach exemplifies an effort to improve students' creative thinking skills and learning independence through a learning model approach. The Realistic Mathematics Education (RME) approach is a student-centered learning method. According to the RME approach, learning begins with real-world contexts for students, allowing them to meaningfully engage directly in the learning process. The teacher's role is limited to guiding and providing resources in the form of knowledge to students. In this approach, students are considered to have the potential to develop their knowledge (Wijaya, 2012).

In her research, Agustina (2016: 5) reveals that realistic mathematics education, as implemented in classroom action research, has positively impacted students' conceptual understanding and mathematical problem-solving abilities. Sulastri, Marwan, and Duskri (2017: 67) also concluded in their research that realistic mathematics education is effective in terms of mathematical representation skills. This includes presenting data or information from a problem in tabular form, solving problems involving mathematical expressions, and writing out the steps for solving mathematical problems in words.

This research combines a cooperative learning model that emphasizes the construction of student knowledge through social aspects among students in heterogeneous groups with the Realistic Mathematics Education (RME) approach. One of the popular cooperative learning models is the Jigsaw model. The Jigsaw model involves students in heterogeneous groups where each member is responsible for mastering one part of the material and sharing their knowledge with the other group members.

The Jigsaw learning approach introduces an innovative understanding of concepts and requires students to be active, which is expected to improve their learning outcomes. Students are encouraged to collaborate cooperatively, providing many opportunities to process information and enhance their creative thinking skills (Siahaan et al., 2021).

Other reasons for using the Jigsaw method as a learning strategy include the reduced competition among students within groups. Students collaborate to solve problems while addressing the different mindsets of each group member (Mansyur, 2017). Each student in the group is responsible for managing and teaching the assigned teaching materials to the other members.

The research conducted by Mulyani Anditia (2016) explains that applying the jigsaw- type cooperative learning strategy can address problems in the mathematics learning process, leading to improved student learning outcomes. Additionally, the Jigsaw type cooperative learning, when implemented in heterogeneous groups with varying backgrounds (race, religion, ability, gender, and economic status), is considered effective in enhancing student motivation and learning independence.

This research aims to identify learning strategies to enhance students' creative thinking abilities by combining the Realistic Mathematics Education approach with the Jigsaw-type cooperative learning model. Additionally, this study provides insights into the importance of considering differences in students' learning independence when designing effective learning strategies.

Based on the description above, this research aims to determine the impact of the Realistic Mathematics Education approach combined with the Jigsaw learning model on students' creative thinking abilities and learning independence. This article aims to address the following research questions:

1. Does the Realistic Mathematics Education approach combined with the Jigsaw cooperative learning model significantly impact students' creative thinking abilities and learning independence?

2. Does the Realistic Mathematics Education approach alone significantly impact students' creative thinking abilities and learning independence?

3. If both have a more effective impact, Rea lists the Mathematics Education approach combined with the Jigsaw cooperative learning model and the Realistic Mathematics Education approach alone in improving students' creative thinking abilities and learning independence.

## *Methods*

This type of research is classified as a quasi-experimental study with a Nonequivalent Pretest-Posttest Control Group Design. This design will compare two groups: Experiment Group I and Experiment Group II. Both groups, Experiment Group I and Experiment Group II, are given a pretest to measure the initial condition of the groups before treatment. The treatment involves a test of creative thinking abilities and a questionnaire to collect data on students' learning independence. After the treatment, students are given a posttest, including a creative thinking test and a learning independence questionnaire, to measure the condition of each group. The following is a description of the research design presented in Table 1.

Table 1: Research Design

| **Group** | ***Prestest*** | **Treatment** | ***Posttest*** |
|---|---|---|---|
| $K_1$ | $O_1$ | $X_1$ | $O_3$ |
| $K_2$ | $O_2$ | $X_2$ | $O_4$ |

The research was conducted at SMP Negeri 1 Kota Bima from January 29, 2024, to February 24, 2024. The population in this study consists of all students in grade VIII at SMP Negeri 1 Kota Bima for the academic year 2023/2024. The sample selected includes Class 8.2 as Experiment Group I (receiving the Realistic Mathematics Education approach combined with the Jigsaw cooperative learning model) and Class 8.3 as Experiment Group II (receiving only the Realistic Mathematics Education approach).

This study's instruments and data collection techniques include tests and non-tests. Tests are used to measure students' creative thinking abilities, while non-tests, such as questionnaires, are used to measure students' learning independence. The creative thinking ability test sheet is used to assess creative thinking ability on flat-sided spatial geometry material. The test used is an essay test. Tables 2 and 3 below are the instrument grids and rubrics for assessing students' creative thinking abilities.

Table 2: Instrument Grid for Creative Thinking Ability

| **No** | **Aspect** | **Indicator** | **Question Number** | **Maximum Score** |
|---|---|---|---|---|
| 1 | Fluency | Generate lots of problem-solving ideas | 1 | 4 |
| 2 | Originality | Delivering solutions in a new/unique way (different from other answers) | 2 and 5 | 4 |
| 3 | Flexibilty | View a problem instantly from multiple perspectives | 2 and 4 | 4 |
| 4 | Elaboration | Describe the steps to solve the problem in sequence | 3, 4, and 5 | 4 |

Table 3 below is the scoring guideline criteria for divergent thinking ability. Table 3: Scoring Rubric for Creative Thinking Ability Test

| No | Aspect | Criteria | Score |
|---|---|---|---|
| 1 | *Fluency* | Providing more than 3 relevant answers fluently to problem-solving, with correct outcomes | 4 |
| | | Providing more than 2 relevant answers fluently to problem-solving, with correct outcomes | 3 |
| | | Providing more than 1 relevant answers fluently to problem-solving, with correct outcomes | 2 |
| | | Providing only 1 relevant answer fluently to problem-solving, with a correct outcome | 1 |
| | | No answer | 0 |
| 2 | Flexibilty | Providing more than 1 idea/method with correct answers | 4 |
| | | Providing more than 1 idea/method, but with incorrect answers | 3 |
| | | Providing only 1 idea/method with a correct answer | 2 |
| | | Providing only 1 idea/method, but with an incorrect answer | 1 |
| | | No answer | 0 |
| 3 | Elaboration | Developing ideas and providing detailed answers with correct outcomes | 4 |
| | | Developing ideas and providing detailed answers, but with incorrect outcomes | 3 |
| | | Developing ideas and providing less detailed answers, but with correct outcomes | 2 |
| | | Developing ideas and providing less detailed answers, but with incorrect outcomes | 1 |
| | | No answer | 0 |
| 4 | Originality | Less than 40% of students provide answers using a different method from the others | 4 |
| | | There are 40% - 59% of students who provide answers using a method different from that of other students | 3 |
| | | There are 60% - 79% of students who provide answers using a method different from that of other students | 2 |
| | | There are 80% - 100% of students who provide answers using a method different from that of other students | 1 |
| | | No answer | 0 |

The self-regulated learning questionnaire is used to measure students' levels of self- regulated learning. Table 4 below describes the grid of the self-regulated learning questionnaire.

Table 4: Self-regulated Learning Questionnaire Grid

| Indicator | Sub-Indicator | Item Number | | Item Total |
|---|---|---|---|---|
| | | **(+)** | **(-)** | |
| Setting Learning Goals | Ability to set learning goals | 3, 4 | 8, 18 | 7 |
| | student involvement in setting learning goals | 1 | 15, 23 | |
| Planning learning strategies | selection of learning strategies | 2, 9 | 14 | 6 |
| | action planning | 21 | 11, 17 | |
| Monitoring learning progress | active monitoring | 6, 10, 12 | 20, 24 | 5 |
| Evaluating learning progress | awareness of progress | 13, 16 | 5, 22 | 6 |
| | reflection on learning outcomes | 7 | 19 | |

In this questionnaire, respondents are asked to rate each statement using a Likert scale with five response options: always (SL), often (SR), sometimes (KK), rarely (JR), and never (TP). Table 5 below outlines the scoring criteria for self-regulated learning.

Table 5: Self-regulated Learning Scoring Criteria

| Characteristic | Scoring Criteria | | | | |
|---|---|---|---|---|---|
| | **SL** | **SR** | **KK** | **JR** | **TP** |
| (+) | 5 | 4 | 3 | 2 | 1 |
| (-) | 1 | 2 | 3 | 4 | 5 |

Based on the test results, the creative thinking ability and self-confidence of students on the topic of flat-sided space were determined. The validity of the instruments was used by expert judgment using Aiken's validity. The reliability of the instruments was measured usingCronbach's Alpha.

In this study, several data analysis techniques are employed, including descriptive data analysis and inferential data analysis. The data analyzed are the posttest scores of students in Experiment Group I and Experiment Group II. After obtaining the data, analysis is conductedto test the hypotheses using the average scores of students in both groups. The statistical methods used are the t-test to test hypotheses 1 and 2 and Hotelling's trace test to test hypothesis

## *Result and Discussion*

This study was conducted in two classes: Experiment I and Experiment II. Thefollowing data was obtained in this series of research:

Table 6: Results of Pretest and Posttest of Creative Thinking Ability

| Description | Experimental Class I | | Experimental Class II | |
|---|---|---|---|---|
| | ***Pretest*** | ***Posttest*** | ***Pretest*** | ***Posttest*** |
| Average score | 3,59 | 23,31 | 6,06 | 22,41 |
| Average percentage score | 11,23 | 83,26 | 19,14 | 80,02 |
| Standard deviation | 9,25 | 8,14 | 13,68 | 7,95 |
| Theoretical maximum score | 100 | 100 | 100 | 100 |
| Theoretical minimum score | 0 | 0 | 0 | 0 |
| Maximum score | 28,13 | 96,43 | 56,25 | 96,43 |
| Minimum score | 0 | 67,86 | 0 | 60,71 |

Based on the descriptive analysis results in Table 6, it can be seen that both classes, Experiment I and Experiment II, experienced improvement. In the initial test, none of the students met the learning objective criteria of achieving a minimum score of 75. After the intervention in both classes, the average increase in creative thinking ability for Experiment I class was 72.03 points, while Experiment II class saw an increase of 60.88 points. The posttest results indicate that the creative thinking ability in Experiment I class was 3.24 points higher than in Experiment II.

Additionally, the percentage achievement for each item and indicator of creative thinking ability after the intervention can also be determined, presented in Table 7 and Table 8below.

Table 7: Average Achievement of Creative Thinking Ability Test per Item After Intervention

| Item Number | Max Score | Average per Question | |
|---|---|---|---|
| | | Eksperimental Class I | Eksperimental Class II |
| 1 | 4 | 3,59 | 3,53 |
| 2 | 4 | 3,91 | 3,75 |
| 3 | 8 | 7,03 | 6,81 |
| 4 | 4 | 3,59 | 3,38 |
| 5 | 8 | 5,22 | 4,97 |

Table 8: Percentage Achievement of Each Indicator of Creative Thinking Ability AfterIntervention

| Indicator | Total Maximum Score Per Indicatorfor Students | Total Score Per Indicator for Students | | Percentage of Total Students Per Indicator | |
|---|---|---|---|---|---|
| | | Eks I | Eks II | Eks I | Eks II |
| Fluency | 128 | 114 | 107 | 89,06 | 83,59 |
| Flexibility | 256 | 190 | 183 | 74,22 | 71,48 |
| Elaboration | 384 | 367 | 358 | 95,57 | 93,23 |
| Originality | 128 | 75 | 69 | 58,59 | 53,91 |

Based on Table 8, students' abilities in the indicators of fluency and elaboration were well understood by all students in both Experiment I and Experiment II classes. Among all the indicators, originality was the lowest for both classes. The fluency indicator in the Experiment I class was 5.47% higher than in Experiment II. The flexibility indicator in the Experiment I class was 2.74% higher than in Experiment II. The elaboration indicator in the Experiment I class was 2.34% higher than in Experiment II. The originality indicator in Experiment I class was 4.68% higher than in Experiment II. Thus, overall, the percentage of indicators in the Experiment I class was higher than in the Experiment II class.

Based on Table 7 and Table 8, the four indicators of creative thinking ability in Experiment I class were higher than in Experiment II. Thus, in general, the Experiment I class,which used the realistic mathematics education approach with the cooperative learning model of the Jigsaw type, had a more significant impact on creative thinking ability than the Experiment II class, which used the mathematics education approach.

Data from the prescale and postscale results of student learning independence in Experiment I class, which used the realistic mathematics education approach with the Jigsaw cooperative learning model, and Experiment II class, which used the realistic mathematics education approach, will be presented in Table 9 below.

Table 9 Prescale and Post scale Results of Learning Independence

| Description | Experimental Class I | | Experimental Class II | |
|---|---|---|---|---|
| | ***Pre*** | ***Post*** | ***Pre*** | ***Post*** |
| Average score | 65,09 | 87,59 | 66,63 | 85,03 |
| Average percentage score | 7,6 | 11,06 | 8,18 | 12,04 |
| Standard deviation | 120 | 120 | 120 | 120 |
| Theoretical maximum score | 24 | 24 | 24 | 24 |
| Theoretical minimum score | 82 | 106 | 82 | 103 |
| Maximum score | 52 | 70 | 51 | 66 |

Based on the descriptive analysis results in Table 9, it can be seen that both classes experienced improvement in both Experiment I and Experiment II. After the intervention in both classes, the average score of the learning independence questionnaire in Experiment I class increased by 22.5 points, while Experiment II class saw an increase of 18.4 points. The postscale results indicate that learning independence in Experiment I was 2.56 points higher than in Experiment II.

The percentage achievement of learning independence indicators after the intervention between Experiment I and Experiment II classes can also be presented in Table 10 below.

Table 10 Percentage of Each Item and Indicator of Learning Independence AfterIntervention Between Experiment I and Experiment II Classes

| Indicator | No | Score for Each Statement (Max Score. 160) | | Percentage Per Statement | | Percentage Per Indicator | |
|---|---|---|---|---|---|---|---|
| | | **I** | **II** | **I** | **II** | **I** | **II** |
| | 1 | 101 | 102 | 63,13 | 63,75 | 71,25 | 69,82 |
| Setting LearningGoals | 3 | 109 | 114 | 68,13 | 71,25 | | |
| | 4 | 118 | 116 | 73,75 | 72,5 | | |
| | 8 | 122 | 120 | 76,25 | 75 | | |
| | 15 | 122 | 117 | 76,25 | 73,13 | | |
| | 18 | 94 | 89 | 58,75 | 55,63 | | |
| | 23 | 132 | 124 | 82,5 | 77,5 | | |
| Planning learning strategies | 2 | 123 | 116 | 76,88 | 72,5 | 72,81 | 71,25 |
| | 9 | 121 | 107 | 75,63 | 66,88 | | |
| | 11 | 133 | 133 | 83,13 | 83,13 | | |
| | 14 | 105 | 105 | 65,63 | 65,63 | | |
| | 17 | 104 | 102 | 65 | 63,75 | | |
| | 21 | 113 | 121 | 70,63 | 75,63 | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Monitoring learning progress | 6 | 129 | 128 | 80,63 | 80 | 76,12 | 71,38 |
| | 10 | 119 | 116 | 74,38 | 72,5 | | |
| | 12 | 110 | 96 | 68,75 | 60 | | |
| | 20 | 134 | 113 | 83,75 | 70,63 | | |
| | 24 | 117 | 118 | 73,13 | 73,75 | | |
| Evaluating learning progress | 5 | 129 | 122 | 80,63 | 76,25 | 72,60 | 71,25 |
| | 7 | 108 | 102 | 67,5 | 63,75 | | |
| | 13 | 107 | 102 | 66,88 | 63,75 | | |
| | 16 | 118 | 116 | 73,75 | 72,5 | | |
| | 19 | 125 | 123 | 78,13 | 76,88 | | |
| | 22 | 110 | 119 | 68,75 | 74,38 | | |

For each indicator of learning independence, the Experiment I class was higher than theExperiment II class. Thus, Experiment I class, which used the realistic mathematics education approach with the Jigsaw cooperative learning model, was better than Experiment II, which used the realistic mathematics education approach regarding learning independence.

Before conducting hypothesis testing to assess the impact of the realistic mathematics education approach with the Jigsaw cooperative learning model on students' creative thinking ability and learning independence, it is necessary to perform normality and homogeneity testsfirst.

Normality testing demonstrates that the sample data comes from a normally distributedpopulation. The results show that each group is derived from normally distributed data.

The results of the homogeneity test before the intervention on the pretest data of creativethinking ability and prescale of learning independence, as well as the results of the homogeneity test after the intervention on the posttest data of creative thinking ability and postscale of learning independence in both classes, Experiment I and Experiment II, are presented in Table7 below.

Table 11 Results of Homogeneity Testing

| **Description** | **Lavene** | **Sig** | **Decision** |
|---|---|---|---|
| Before Treatment | 1,566 | 0,198 | Homogen |
| After Treatment | 0,773 | 0, 616 | Homogen |

Based on Table 7, the information obtained shows that the significance value before the intervention using Levene's Test was 0.198 > 0.05. This allows us to conclude that the covariance matrices of the two classes before the intervention are the same or homogeneous. The significance value after the intervention using Levene's Test was 0.616 > 0.05, indicatingthat the covariance matrices of the two classes after the intervention are also the same or homogeneous.

After performing the normality test and confirming that the data comes from a normallydistributed population and the homogeneity test showing that both classes are homogeneous, hypothesis testing can proceed. The test conducted is the t-test, which is used to assess the effect of independent variables on dependent variables partially. This test is used to examine Hypotheses 1 and 2. The calculation for testing the above hypotheses can be performed using the independent samples t-test, with the calculations carried out using SPSS version 25.

The first hypothesis test was conducted to determine the effect of learning using the realistic mathematics education approach with the Jigsaw cooperative learning model on creative thinking ability. The first hypothesis states, "The realistic mathematics education approach with the Jigsaw cooperative learning model has an effect on students' creative thinking ability."

The results of the creative thinking ability test using the independent samples t-test with the assistance of IBM SPSS 25 are shown in Table 8 below:

Table 12 Results of Independent Samples t-Test for Students' Creative Thinking Ability inExperiment I and Experiment II Classes

| Class/Group | Mean | T | Sig. (2-tailed) | Decision |
|---|---|---|---|---|
| PMR + JIGSAW | 83,259 | 1,609 | 0,000 | $H_0$ rejected |
| PMR | 80,02 | | | $H_0$ rejected |

Table 8 shows that the independent samples t-test results yielded a t-value of 1.609 > 0 $\frac{sig.(2-tailed)}{2}$ of 0.000. Since $\frac{sig.(2-tailed)}{2}$ < 0.05, the null hypothesis is rejected, indicating a significant difference in the average creative thinking ability between the two classes. Therefore, using the realistic mathematics education approach with the Jigsaw cooperative learning model affects students' creative thinking ability.

The second hypothesis states, "The realistic mathematics education approach with the Jigsaw cooperative learning model has a significant effect on students' learning independence." The purpose of testing the second hypothesis is to determine the impact of the realistic mathematics education approach with the Jigsaw cooperative learning model on students' learning independence. An independent samples t-test was performed on the students' learningindependence data.

The results of the learning independence test using the independent samples t-test with the assistance of IBM SPSS 25 are shown in Table 9 below:

Table 13 Results of Independent Samples t-Test for Students' Learning Independence inExperiment I and Experiment II Classes

| Class/Group | Mean | T | Sig. (2-tailed) | Decision |
|---|---|---|---|---|
| PMR + JIGSAW | 87,594 | .886 | 0,000 | $H_0$ rejected |
| PMR | 85,031 | | | $H_0$ rejected |

Table 9 shows that the independent samples t-test results yielded a t-value of 0.887 > 0 and $\frac{sig(2-tailed)}{2}$ of 0.00 0. Since $^{sig.(2-tailed)}$ < 0.05, the null hypothesis is rejected, indicating a significant difference in the average learning independence between the two classes. Therefore, learning using the realistic mathematics education approach with the Jigsaw cooperative learning model affects students' learning independence.

The third hypothesis tests whether there is an effect of the independent variable, the realistic mathematics education approach with the Jigsaw cooperative learning model, on the two dependent variables: students' creative thinking ability and learning independence. To examine the effect of the realistic mathematics education approach with the Jigsaw cooperative learning model on students' creative thinking ability and learning independence, the results canbe determined using Hotelling's $T^2$ test with the assistance of SPSS version 25 on the pre-and post-intervention data obtained from the study.

The results of testing the effect on the average scores of creative thinking ability and learning independence using IBM SPSS 25 are displayed in Table 10 below:

Table 14 Hottelings T2 posttest-ppstscale

| **Effect** | **Value** | **F** | **Sig** | **Decision** |
|---|---|---|---|---|
| *Hotteling's Trace* | 243.757 | $1706.297^b$ | 0,00 | $H_0$ rejected |

Based on Table 10, the significance value obtained is 0.000 < 0.05, which means the null hypothesis ($H_0$) is rejected. This indicates a significant difference between the group using the realistic mathematics education approach with the Jigsaw learning model and the group using the realistic mathematics education approach alone regarding students' creative thinking ability and learning independence. Thus, it can be concluded that the realistic mathematics education approach with the Jigsaw cooperative learning model significantly affects both creative thinking ability and learning independence.

## *Conclusions*

Based on the data analysis and discussion, the following conclusions can be drawn:

1. Using the realistic mathematics education approach with the Jigsaw cooperative learning model significantly affects the creative thinking ability of Grade VIII students at SMP Negeri 1 Kota Bima.
2. Using the realistic mathematics education approach with the Jigsaw cooperative learning model significantly affects the learning independence of Grade VIII students at SMP Negeri1 Kota Bima.
3. Using the realistic mathematics education approach with the Jigsaw cooperative learning model affects both the creative thinking ability and the learning independence of Grade VIII students at SMP Negeri 1 Kota Bima.

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