Application of Problem Posing in Mathematics Learning Material for Building Flat Side Spaces

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Abstract

This research aims to determine the differences in the average learning outcomes of students taught using the Problem Posing learning model on flat-sided geometric material at Woloan Christian Middle School. This research used the experimental method on class VIII students at Woloan Christian Middle School. The samples in the study were class VIII-A as an experimental class with a total of 31 students and class VIII-B as a control class with a total of 31 students, a total of 62 students at Woloan Christian Middle School, even semester of the 2023/2024 academic year. The instrument used in this research consisted of a learning outcomes test in the form of a written test in the form of an essay with flat-sided geometric material. The technique for collecting observation and test data is in the form of evaluation questions. The test is carried out twice. Namely, the pretest is carried out at the beginning of the research to determine students' achievement scores before treatment, and the posttest is carried out on both control and experimental groups after treatment. Based on hypothesis testing using SPSS test statistics, where from the calculation results of the Tcount value of 1.822 with Ttable 1.671 (1.822 > 1.671), it can be said that there is a significant difference in the average learning outcomes of the experimental group using Problem posing and the control group using the learning model. Direct Instruction, which means that there is an influence of the application of the Problem posing learning model on the average learning outcomes of class VIII students at Woloan Christian Middle School

Keywords: Problem Posing, Mathematics Learning Results, Building Flat Side Spaces

INTRODUCTION

One of the objectives of mathematics subjects contained in the Content Standards for Middle School Mathematics Subjects in Minister of National Education Regulation Number 22 of 2006 is for students to be able to solve mathematical problems which includes the ability to understand problems, design mathematical models, complete models and interpret the
solutions obtained (Rachmayani, 2014; Akbar et al., 2018). Students need to master this problem-solving ability to encourage them to become good problem solvers, who are able to face problems in everyday life (Sari & Noer, 2017; Hotimah, 2020).

The flat-sided spatial shapes taught are material that has been introduced to students since elementary school, but in reality students still experience difficulties in determining the volume and surface area of these shapes (Dwi et al., 2016; Sari, 2017). Apart from that, the flat-sided building material is also one of the materials contained in the National Middle School Examination (Indraningtias & Wijaya, 2017; Sari, 2017). The difficulty in students' learning mathematics on the subject of flat-sided geometric shapes is that students do not understand correctly how to determine the surface area of a cube, cuboid, prism, pyramid (Hasibuan, 2018). Students also sometimes experience difficulty in solving questions related to the volume of a pyramid (Nursyamsiah et al., 2020; Amalia et al., 2020). Some students also have difficulty distinguishing space diagonals and diagonal planes in cubes and blocks (Mutia, 2017; Maryanih et al., 2018).

It is still found that many students have difficulty in solving problems related to the elements of flat-sided geometric figures, as well as concluding that a cube is a cuboid with the same edge length. This problem also occurred at Woloan Christian Middle School. Students' mastery of mathematics material is relatively low. One of the mathematics materials that students have low mastery of is the material on Building a Flat-Side Room. Based on the results of interviews with mathematics teachers, looking at the daily test learning results in 2022/2023, students' learning results have not yet reached the KKM standard determined by Woloan Christian Middle School for this material, which is 75, while the average learning results achieved by students is 65.

The cause of low student learning outcomes in mathematics learning is influenced by learning activities that do not allow students to build their own concepts and be active in the learning process (Mulyati, 2016; Manafe et al., 2022), namely the lack of students' skills in asking questions and opportunities for students to express ideas in their own language. (Febriyanto et al., 2018; Darmayanti & Setiawati, 2022). Most students still find it difficult to ask questions during the learning process (Andiasari, 2015; Pratiwi et al., 2019; Subakti & Prasetya, 2022).

In overcoming the problems above, an interesting learning model is needed. One way is to use the Problem Posing model, namely a learning model that emphasizes how knowledge can be understood by someone who studies it (Rahmad, 2012; Suprianingsih & Wulandari, 2020). The Problem Posing Model is learning that requires students to compose their own questions or break down a problem into simpler questions so that it refers to solving the problem (Septian & Rahayu, 2021; Rizky & Sritresna, 2021). In short, in learning Problem Posing students are expected to be able to create problems and solve them (Faidah et al., 2022). Based on the background above, the researcher is interested in conducting research with the title "Application of Problem Posing in mathematics learning material on Building Flat Side Spaces".
**METHOD**

Based on the problems discussed in this research, researchers use this type of experimental research. Experimental research is research that looks for causal relationships between the independent variable and the dependent variable, where the independent variable is controlled and controlled to be able to determine the influence it has on the dependent variable. Experimental research aims to describe what will happen if certain variables are controlled in a certain way.

This research will be conducted at Woloan Christian Middle School, Tomohon City, Class VIII. Research time in the even semester of the 2023/2024 academic year. The population in this study were all students in class VIII of Woloan Christian Middle School, which consisted of two classes. The sample in the research was class VIII A which consisted of 31 students. The type of research design used is experimental research in the Posttest-only control group design category which can be described as follows:

<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment Class</td>
<td>X</td>
<td>O1</td>
</tr>
<tr>
<td>Control Class</td>
<td>Y</td>
<td>O2</td>
</tr>
</tbody>
</table>

Where:
- \( X \) = Treatment (problem posing model)
- \( Y \) = Treatment (Direct instruction)
- \( O_1 \) = Learning outcomes after treatment

The research design consists of two stages: the preparation stage and the implementation stage.

1. Preparatory stage
   Prepare learning tools (RPP) and research instruments to be used.
2. Implementation stage
   At this stage, learning is carried out using the Problem Posing learning model. Learning steps are in accordance with the Learning Implementation Plan (RPP).

The variables in this research consist of the treatment variable and the response variable. The treatment variable is the Problem Posing learning model, which is the treatment in the experimental class, and the direct learning model is the treatment in the control class. The response variable is the results of learning about flat-sided building material for students in the treatment class, namely the experimental class, by carrying out a final test after the learning is carried out. The research instrument used was a learning outcomes test in the form of an essay. The instrument has been tested for content validity, and consultation with the supervisor is needed to determine whether the test created is suitable for use in research.

The data collection techniques in this research are;

a. Test method.
The test method collects data that evaluates the process's results. The test questions used in this research were essay questions with flat-sided geometric shapes.

b. Interview Method

The interview method is a data collection technique based on a one-way verbal question-and-answer process, meaning that the questions are asked by the interviewer and the answers are given by the interviewee.

c. Documentation Method

This method can be interpreted as a way of collecting data by utilizing data in the form of book notes (documents). As explained by Sanapiah Faesal, following the documentary method, the source of information is written or recorded materials. In this method, data collection officers transfer the relevant written materials on sheets that have been prepared for them as appropriate.

Hypothesis testing

Hypothesis testing will use the t-test with the formula:

\[
t = \frac{\bar{x}_1 - \bar{x}_2}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}
\]

sample variations:

\[
S^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}
\]

Information:

- \(\bar{x}_1\) = Average experimental class learning outcomes
- \(\bar{x}_2\) = Average learning outcomes of the control class
- \(S^2\) = Combined variance
- \(s_1^2\) = Variance of the experimental class
- \(s_2^2\) = Variance of the control class
- \(n_1\) = number of experimental classes
- \(n_2\) = number of control classes.

(Lolombulan, 2017)

The statistical hypothesis to be tested is:

\[H_0: \mu_1 = \mu_2\]
\[H_1: \mu_1 > \mu_2\]

Hypothesis criteria, if:

\(t_{\text{count}} < t_{\text{table}}\) then \(H_1\) is accepted and \(H_0\) is rejected with \(\alpha = 5\%\)

Before testing the hypothesis with the t-test, a normality test and a variance homogeneity test will first be carried out.

Normality test
The normality test that will be used is the normality test with the Liliefors test. The formula that will be used is as follows:

\[ L = \text{Max}\{F(z_i) - s(z_i)\} \]

Information:

\[ z_i = \frac{x_i - x}{s} \]

Significance level \( \alpha = 0.05 \)

The test hypothesis is as follows:

\( H_0 \): data spreads normally

\( H_1 \): data spreads abnormally.

Testing rules:

Reject \( H_0 \) if \( L_{\text{count}} > L_{\text{table}} \)

Accept \( H_0 \) if \( L_{\text{count}} \leq L_{\text{table}} \)

Homogeneity Test

The statistic used to test equality of variances is the F-test with the formula

\[ F_{\text{count}} = \frac{s_1^2}{s_2^2} \]

Information

\( s_1^2 \) = Smallest sample variance

\( s_2^2 \) = Largest sample variance

(Lolombulan, 2017)

RESULT AND DISCUSSION

This research was carried out in the even semester of the 2023/2024 academic year at Woloan Christian Middle School located at Jl. Raya Tomohon – Woloan Ward 2, West Tomohon District, Tomohon City, North Sulawesi. This research was conducted in class VIII A, which consisted of 31 students as the experimental group, and in the control group, class VIII B, which consisted of 31 students. The learning outcome data in this research are scores from two variables obtained from the results of completing tests in the form of essay questions given during the posttest to two groups of students, namely the control class and the experimental class, along with the scores from the students’ posttest results.

Table 2. Posttest results data for Class VIII students

<table>
<thead>
<tr>
<th>Information</th>
<th>Student learning outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Samples</td>
<td>Experimental Class</td>
</tr>
<tr>
<td></td>
<td>31</td>
</tr>
</tbody>
</table>
The table above shows that the experimental class posttest data is in the interval 70 to 100 while the control class posttest data is in the interval 60 to 95. The average of the experimental class posttest data is 80.97, while the control class is 74.19. Posttest data in the experimental class was more varied than posttest data in the control class. The variance value shows this in the two classes, where the data variance in the experimental class is 55.70, while in the control class, it is 55.16.

Data Normality Test Results Posttest Values for Experimental Class and Control Class

Table 3. Normality Test Results of Posttest Score Data for Experiment Class and Control Class

<table>
<thead>
<tr>
<th>Posttest Learning Results</th>
<th>Liliefors test</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>L_count</td>
<td>L_table (n)</td>
</tr>
<tr>
<td>Experiment Class</td>
<td>31</td>
<td>0.1967</td>
<td>0.886</td>
</tr>
<tr>
<td>Control Class</td>
<td>31</td>
<td>0.2310</td>
<td>0.886</td>
</tr>
</tbody>
</table>

From the results of the table above:
- For the experimental class \( L_{count} < L_{table} = 0.1967 < 0.887 \). Thus, it can be concluded that the data is normally distributed.
- For the control class \( L_{count} < L_{table} = 0.2310 < 0.886 \). Data is normally distributed.

Homogeneity Test

Statistical hypothesis

\( H_0 : \sigma_1^2 = \sigma_2^2 \), both variants are the same.

\( H_1 : \sigma_1^2 \neq \sigma_2^2 \), the two variants are not the same.

Significance level: \( \alpha = 0.05 \)

Test Statistics:

\[
F = \frac{\text{Largest sample variance}}{\text{Smallest sample variance}} = \frac{s_1^2}{s_2^2}, \text{ if } S_1^2 > S_2^2
\]

\( F_{table} = F_{0.05}(dF_1, dF_2) \)

\( F_{count} = \frac{s_1^2}{s_2^2} \)

Conclusion: \( H_0 \) is rejected if \( F_{count} \geq F_{table} \)

Calculation:

\( dF_1 = n_1 - 1 = 30 \)
\( dF_2 = n_2 - 1 = 30 \)
\( \alpha = 0.05 \)
\[ F_{\text{count}} = \frac{55.70}{55.16} = 1.00978 \]

**Decision**

Because the value of \( F_{\text{count}} = 1.00978 < F_{\text{table}} = 1.84 \), \( H_0 \) is accepted. So, the variance of the posttest data for the experimental class and control class is homogeneous.

**Hypothesis testing**

The statistical test used is the two-average t-test with the condition that both classes are normally distributed and homogeneous.

The steps for hypothesis testing are as follows:

1. \( H_0: \mu_1 = \mu_2 \)
2. \( H_1: \mu_1 > \mu_2 \)
3. Significant level: \( \alpha = 0.05 \)
4. Test Statistics: \( t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \)
5. \( T_{\text{table}} = t_{\alpha,0.05} = (dF = n_1 + n_2 - 2) = 1.671 \)
6. Conclusion \( H_0 \) is rejected if \( T_{\text{count}} > T_{\text{table}} \)

Based on the results of hypothesis testing, \( T_{\text{count}} = 1.822 \) and \( T_{\text{table}} = 1.671 \). Because \( T_{\text{count}} > T_{\text{table}} \), then reject \( H_0 \). Therefore, the learning outcomes of students who are taught using the problem-posing model have higher learning outcomes than the learning outcomes of students who use the direct instruction learning model. Thus, the problem-posing learning model influences the problem-posing learning model influences students' mathematics learning outcomes.

Based on the results of statistical testing, there is a significant difference in the learning outcomes of the experimental group class VIII A and the control class VIII B at Woloan Christian Middle School, using a Posttest-only control group research design. And collected using data collection techniques in the form of a posttest) which is carried out for the average value of student learning outcomes. The test questions are in the form of essays. After testing normality, homogeneity, and hypothesis testing.

In the normality test, it was found that the experimental class posttest value obtained a \( L_{\text{count}} \) value of 0.1967, which was smaller than \( L_{\text{table}} 0.8666 \). The control class posttest value obtained a \( L_{\text{count}} \) value of 0.2310, which was smaller than \( L_{\text{table}} 0.866 \), meaning that the data for the posttest
experimental class and control class were said to be normal so that Research requirements can be carried out by carrying out a homogeneity test. In the research data homogeneity test, the $f_{\text{count}}$ was 1.00978, which is smaller than $f_{\text{table}}$ 1.84, meaning that the variance of the posttest data for both classes is homogeneous.

The results of testing the hypothesis of this research were obtained using the t-test by comparing the values of $T_{\text{count}}$ and $T_{\text{table}}$. After testing, it was received that the $T_{\text{count}}$ value was 1.822 and $T_{\text{table}}$ 1.671, meaning that the results of learning mathematics on flat-sided geometric shapes for students taught using the Problem Posing model were higher than students taught using the Problem Posing model. Direct Instruction model. This can also be seen from the comparison of the average score of the control class learning results using Direct Instruction, which got an average score of 74.19, which is lower than the average score of the experimental class, which used the Problem Posing learning model, whose average score reached 80.97.

The learning activities carried out by the two classes were very different. In the control class, the students participated in learning by listening to the teacher directly, in contrast to the experimental class, which carried out learning independently and in groups, discussing how to solve a problem in a fun atmosphere.

CONCLUSION

Based on the results of the research and discussion that have been described in the results and discussion, it can be concluded that the average learning outcomes of students taught using the problem-posing learning model on flat-sided geometric material is 80.97 higher than the average KKM (Criteria Minimum Completeness). In this way, learning Problem Posing on flat-sided geometric material in class VIII increases learning outcomes, as seen from the average value of the final test results (post-test).

REFERENCE


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