Problem Based Learning Models on Critical Thinking Ability in Science Lessons of Grade V Elementary School

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\textbf{ABSTRACT}


1. INTRODUCTION

Education is an important thing in human life. Education is a means for humans to develop abilities through the learning process. Education continues to experience renewal and improvement in the learning process. Improving the quality of learning can be achieved by teachers making learning innovations and making students the center of learning so that students are able to understand the meaning of the material being studied. This is consistent with 21st century learning. 21st century learning is a transition of learning from teacher centered to student centered (Astuti, 2021; Nurul Fitri, 2021). In 21st century learning, students are required to be able to master the four learning skills (4C), namely: critical thinking and problem solving, creativity creativity and innovation, communication, collaboration (Husein et al., 2019;
Critical thinking and problem solving is one of the abilities that students must train and develop. Critical thinking skills are very important to be trained and developed. Critical thinking skills are a person's high-level thinking skills in solving a problem logically and consistently to draw a conclusion (Perdana et al., 2020; Pramana et al., 2020; Sihotang, 2019). Problem-based learning is a learning model that involves students to actively solve a real problem which is used as a learning resource (Husein et al., 2019; Winarni et al., 2022). Problem-based learning steps require students to be active and think critically so that problems can be solved properly. Problem-based learning requires students to be active in solving problems with their own knowledge and experience. Teachers who apply the problem-based learning model to learning only act as facilitators and focus on student learning. Therefore, the problem-based learning model can help students train and develop critical thinking skills in solving problems (Amris & Desyandri, 2021; Syamsudin, 2020). In solving and solving problems properly, it is necessary to have encouragement so that the problems experienced can be resolved. Teachers can provide encouragement by using an interesting learning design. The learning design used is to apply a problem-based learning model, so that students' critical thinking skills are trained and problems experienced by students can be resolved.

Some previous research findings state that the problem-based learning model has an effect on critical thinking skills (Rahmatia, 2020; Risnawati et al., 2022). Applying the problem-based learning model is the right way to develop critical thinking skills. The problem-based learning model can be used in science lessons on heat material (Al-Fikry et al., 2018; Seibert, 2020). Many studies are related to the application of the problem-based learning model, but this research needs to be done because not all schools implement learning to train critical thinking skills in science lessons. So by doing this research at least schools implement learning by training students' critical thinking skills in science lessons. The purpose of this study was to analyze the effect of the problem-based learning model on critical thinking skills in science lessons for grade V elementary school students in Gugus VI Mengwi District in the 2022/2023 academic year.

2. METHOD

The type of research used was quasi-experimental with a research design of nonequivalent control group design. The research design consisted of 2 groups, namely the experimental group and the control group. The design is show in Figure 1.

<table>
<thead>
<tr>
<th>O1</th>
<th>X</th>
<th>O2</th>
</tr>
</thead>
<tbody>
<tr>
<td>O3</td>
<td>-</td>
<td>O4</td>
</tr>
</tbody>
</table>

**Figure 1. Nonequivalent Control Group Design**

The population in this study were fifth grade elementary school students in Gugus VI Mengwi District in the 2022/2023 academic year. The sample selection in this study used a cluster random sampling technique, namely a random draw of classes regardless of the competence of the population and it was obtained that fifth grade students at SD No. 1 Kapal as an experimental group and fifth grade students at SD No. 3 Kapal as the control group. The number of students for the experimental group was 32 students and the number of students for the control group was 29 students. The experimental group was given treatment by applying the problem-based learning model to the learning process and the control group was given treatment without applying the problem-based learning model to the learning process.

Data collection techniques used test techniques and research instruments using essay test questions equipped with an assessment rubric. The data analysis technique used is descriptive statistical
techniques to determine the average value of each group and t-test inferential statistical techniques to
determine the effect of the problem-based learning model. The requirement to conduct a t-test is that the
instruments of the experimental group and control group are normally distributed and homogeneous.
Before the instrument is used, the research instrument was first tested for validity and reliability. The
validity test uses the product moment correlation formula and the reliability test uses the alpha cronbach
formula. Validity and reliability testing using Microsoft Excel 2013.

Testing the validity of the items as many as 10 questions. The results of the calculation of the
validity test of the questions with rcount > rtable = 0.361 were declared valid and rcount < rtable = 0.361
were declared invalid. Of the 10 questions, there are 8 items were valid and 2 items were invalid. Invalid
questions were not used in the study and were not tested for reliability, while valid questions were tested
for reliability. The results of the reliability test on 8 questions with Cronbach’s alpha calculation results
were 0.805. The results of the item reliability test with the help of Microsoft Excel showed that the
Cronbach’s alpha value was between 0.70-0.90. The research instrument was declared valid and reliable,
so the normality test was carried out in both study groups. The normality test results are presented in Table
1.

Table 1. Data Normality Test of Critical Thinking Ability of Experiment Group and Control Group Students

<table>
<thead>
<tr>
<th>Data Group</th>
<th>X^2 count</th>
<th>X^2 table</th>
<th>df</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eksperiment</td>
<td>3.927</td>
<td>11.07</td>
<td>5</td>
<td>Normal Distribution</td>
</tr>
<tr>
<td>Control</td>
<td>3.608</td>
<td>11.07</td>
<td>5</td>
<td>Normal Distribution</td>
</tr>
</tbody>
</table>

The results of the data normality test for the critical thinking skills of students in the experimental
group and the control group showed a normal distribution because of the results of X^2count < X^2table at a
significance level of 5% df = 5. After the data is normally distributed, the next step is to test the homogeneity
of the two study groups using Fisher’s test. The homogeneity test results are presented in Table
2.

Table 2. Homogeneity Test of Critical Thinking Ability of Students in the Experiment Group and the Control Group

<table>
<thead>
<tr>
<th>Sample</th>
<th>S^2</th>
<th>df</th>
<th>Fcount</th>
<th>Ftable</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eksperiment</td>
<td>61.31</td>
<td>32</td>
<td>1.51</td>
<td>4.00</td>
<td>Homogen</td>
</tr>
<tr>
<td>Control</td>
<td>40.45</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Base on Table 2 show the results of the homogeneity test in the experimental group and the control
group obtained Fcount = 1.51. While Ftable = 4.00 at a significance level of 5% with db in numerator = 1
and db in denominator = 59. This shows that Fcount = 1.51 < Ftable = 4.00, then the variance of the critical
thinking ability of students in the experimental group and the control group is homogeneous.

3. RESULT AND DISCUSSION

Result

This type of research is a quasi-experimental with a non-equivalent control group research design.
The implementation of the lesson uses theme 6 Heat and its Transfer, sub-theme 2 Heat Transfer Around
Us. The learning implementation of experimental group by applying the problem-based learning model and
the control group with conventional learning. The learning process in the experimental group applies the
problem-based learning model through forming study groups consisting of 4-5 students, observing
problems that arise during the learning process, dividing tasks to solve problems, collecting data, analyzing
data, making discussion reports, and presenting report results. The learning process in the control group
with conventional learning through the steps of listening to material explanation of the material, recording
the material, asking questions, doing assignments. The learning process in the control group was carried
out according to the method used by the teacher at school. After giving the treatment 6 times to the
experimental group and the control group, they were given a critical thinking ability test in the form of an
essay test with a total of 8 questions. The average results of the critical thinking ability test scores of the
two groups are presented in detail in Table 3.

Base on Table 3 the results of the critical thinking ability test scores in the experimental group and
the control group can be explained that the maximum score in the experimental group is 93.7, while the
maximum score in the control group is 81.2. The minimum score for the experimental group is 59.3, while
the minimum score for the control group is 53.1. Both groups have a mode value that is greater than the
median and the median is greater than the mean (Mo>Me>M), thus forming a negative squint curve in the
sense that most of the values tend to be high. Even though they both form negative squint curves, there are differences in the results of calculating the average value of critical thinking skills. The average result of the experimental group's critical thinking ability was 75.8, while the control group's critical thinking ability was 65.5.

Table 3. Average Critical Thinking Ability Test Scores for Students in the Experiment Group and the Control Group

<table>
<thead>
<tr>
<th>Data Group</th>
<th>Maximum Score</th>
<th>Minimum Score</th>
<th>Average</th>
<th>Median</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eksperiment</td>
<td>93.7</td>
<td>59.3</td>
<td>75.8</td>
<td>76.5</td>
<td>78.4</td>
</tr>
<tr>
<td>Control</td>
<td>81.2</td>
<td>53.1</td>
<td>65.5</td>
<td>66.0</td>
<td>69.9</td>
</tr>
</tbody>
</table>

Furthermore, the data analysis technique uses the t-test technique which aims to determine the effect of the problem-based learning model on students' critical thinking skills in the experimental group and control group. The two research groups were normally distributed and came from populations with homogeneous variance, so a t-test analysis was performed using the pooled variance formula. The results of the t-test analysis are presented in detail in Table 4.

Table 4. Calculation Results of the t-test of Students' Critical Thinking Skills in the Experimental Group and the Control Group

<table>
<thead>
<tr>
<th>Data Group</th>
<th>n</th>
<th>Average</th>
<th>S²</th>
<th>df</th>
<th>tcount</th>
<th>ttable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eksperiment</td>
<td>32</td>
<td>75.8</td>
<td>61.31</td>
<td>59</td>
<td>5.65</td>
<td>2.001</td>
</tr>
<tr>
<td>Control</td>
<td>29</td>
<td>65.5</td>
<td>40.45</td>
<td>59</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4, obtained tcount = 5.65 and ttable = 2.001 at a significance level of 5% with degrees of freedom = 59. This means tcount = 5.65 > ttable = 2.001, so that H₀ rejected and Hₐ accepted, which means that there is a significant effect of the application of the problem-based learning model on critical thinking skills in science lessons for fifth grade students at SD Group VI, Mengwi District.

Discussion

This research is a quasi-experimental with a research design of nonequivalent control group design. The implementation of the lesson uses theme 6 Heat and its Transfer, sub-theme 2 Heat Transfer Around Us. The research results show several findings. First, the application of the problem-based learning model in the experimental group makes students' critical thinking skills higher than the control group with conventional learning. The application of the problem-based learning model is carried out in the learning process, because learning focuses on students in solving problems so that students can understand the material being studied (Wati & Widiansyah, 2020; Zuryanty et al., 2019). Students are able to discover, develop, and take responsibility for their new knowledge in the learning process and students become more active and learning becomes more fun. Problem based learning is a learning model that can be varied by the teacher and clarify the flow which will make students more active (Fatma & Budhi, 2019; Syamsudin, 2020). Problem based learning is a learning model that begins with finding problems and requires students to think critically in solving problems by providing opportunities for students to experience problems in the real world directly (Ariyani & Kristin, 2021; Ting et al., 2021). Problem-based learning helps students develop critical thinking skills in solving a problem. Therefore, the problem-based learning model is effectively applied in the learning process in the classroom.

Second, the problem based learning model encourages students to think critically in science lessons. The problem-based learning model requires students to be active in solving their own problems with the knowledge that these students have. Learning focuses on students and teachers only as facilitators who encourage students to think critically. Thinking skills arises when students identify problems, determine problems so that they can provide strategies for solving these problems (Devirita et al., 2021; Laar et al., 2017). Problem-based learning encourages students' critical thinking skills which consist of several indicators, namely analyzing the opinions obtained, being able to ask questions, being able to answer questions, being able to solve problems in their own way and being able to make conclusions from these problems. In curriculum 2013, science lessons in elementary schools are still integrated and integrated with other lessons in the form of themes. Science lessons aim to spur the development of critical thinking skills through discussion, experimentation, and simulation activities (Kwon et al., 2021; Nurhamidah, 2022; Puring C, 2021). In science lessons that apply the Problem-Based Learning model, students find problems when conducting heat transfer experiments from conductors and insulator objects, then students prepare to discuss in groups to solve problems, then present the results of their discussions,
students compare their group's answers with other groups, and students follow up in solving problems. This activity can encourage critical thinking indicators consisting of analyzing opinions, being able to ask questions, being able to answer questions, being able to solve problems and being able to make conclusions (Andarwulan et al., 2021; Hwang et al., 2022).

Based on the findings, it showed that there was a significant influence on critical thinking skills in science lessons of students who are taught using the problem-based learning model with students who are not taught using the problem-based learning model in class V in SD Gugus VI, Mengwi District. This can be seen from the average critical thinking ability of students in the experimental group which is higher than that of students in the control group. This finding is reinforced by the findings of previous research which states that there is an influence of the problem-based model on the critical thinking skills of fifth grade students in elementary schools (Rahmatia, 2020; Risnawati et al., 2022). The application of the problem based learning model is the right way to train and develop critical thinking skills. The problem based learning learning model influences student learning outcomes in elementary schools (Nofziarni et al., 2019; Selbert, 2020). The implication of this research is that teachers are expected to be able to innovate by applying problem-based learning models so that learning in class becomes more active and effective and teachers can apply problem-based learning models to train students’ critical thinking skills. However, the application of the problem-based learning model has the disadvantage that the learning takes a long time in each learning step.

4. CONCLUSION

The results of the study showed that there was a difference in the average value of critical thinking skills in science lessons for the group of students who were taught using the problem-based learning model and the group of students who were not taught using the problem-based learning model. The average critical thinking ability in science lessons for the experimental group was higher than that for the control group. Thus, there is a significant influence of the problem-based learning model on critical thinking skills in science lessons of grade V elementary school students in SD Gugus VI Mengwi District. Thanks to this research, it is hoped that other studies can find out the situation and conditions in the learning process in the classroom. Thus, the shortcomings contained in this study can be refined in further research.

5. REFERENCES


