

# The Difference between Problem Based Learning Model and Discovery Learning Model on Students' Critical Thinking Ability

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## ABSTRAK

Keberhasilan guru dalam menyelenggarakan proses pembelajaran dipengaruhi oleh beberapa faktor, salah satunya adalah ketepatan dalam pemilihan model pembelajaran. Penelitian ini bertujuan untuk menganalisis perbedaan antara model PBL dan model discovery learning dalam meningkatkan kemampuan berpikir kritis siswa. Sampel penelitian ini adalah 27 orang siswa. Penelitian ini merupakan penelitian eksperimen dengan menggunakan non-equivalent control group design. Instrumen yang digunakan untuk mengukur kemampuan berpikir kritis adalah angket. Uji prasyarat menggunakan uji normalitas dan uji homogenitas. Analisis data menggunakan uji-t (uji-t untuk sampel independen). Hasil penelitian menunjukkan bahwa terdapat perbedaan yang signifikan kemampuan berpikir kritis siswa yang menggunakan model PBL dan model discovery learning pada siswa kelas IV. Selisih skor rata-rata kemampuan berpikir kritis pada model PBL mendapat skor rata-rata 68,44, dan model discovery learning memperoleh skor rata-rata 57,09. Oleh karena itu, model PBL dapat dimaknai lebih unggul dari model discovery learning dalam hal kemampuan berpikir kritis. Hal ini didukung oleh hasil uji-t yang memiliki nilai sig (dua sisi) sebesar  $0,000 < 0,05$ ,  $H_0$  ditolak dan  $H_a$  diterima. Artinya kemampuan berpikir kritis model PBL secara signifikan lebih efektif daripada model discovery learning.

## ABSTRACT

The success of teachers in carrying out the learning process is influenced by several factors, one of which is the accuracy in the selection of learning models. This study aims to analyze the differences between the PBL model and the discovery learning model in improving students' critical thinking skills. The sample of this research is 27 students. This research is an experimental study using a non-equivalent control group design. The instrument used to measure critical thinking skills is a questionnaire. Prerequisite test using normality test and homogeneity test. Data analysis used t-test (t-test for independent samples). The results showed that there were significant differences in students' critical thinking skills using the PBL model and the discovery learning model in fourth grade students. The difference in the average score of critical thinking skills in the PBL model gets an average score of 68.44, and the discovery learning model gets an average score of 57.09. Therefore, the PBL model can be interpreted as superior to the discovery learning model in terms of critical thinking skills. This is supported by the results of the t-test which has a sig (two-sided) value of  $0.000 < 0.05$ ,  $H_0$  is rejected and  $H_a$  is accepted. This means that the critical thinking ability of the PBL model is significantly more effective than the discovery learning model.

## 1. INTRODUCTION

The 2013 curriculum demands not only the grouping of several subjects but also efforts to develop students' personalities (Fitriani et al, 2020; Kurniaman & Noviana, 2019). The learning objectives in the 2013 curriculum are to achieve higher-order thinking skills (HOTS), including critical thinking (Nguyễn & Nguyễn, 2017; Utomo et al, 2019). Critical thinking is an organized process that allows students to evaluate the evidence, assumptions, logic, and language that underlie what other people say (Febrina & Airlanda, 2020). Critical thinking is a very complex process of thinking skills (Ariani, 2020; Laelasari & Adisendjaja,

2018). Therefore, for students to be able and able to think critically, they need to be trained in their thinking skills. Critical thinking applies when students can test student experiences, evaluate their skills and ideas, and consider discussions (Kadek Perdinna Tri Astiwi et al, 2020; Devi & Bayu, 2020). Critical thinking is the ability to think at a higher level when solving a problem rationally (Rahmawati & Trimulyono, 2021; Yonanda et al, 2019). Critical thinking skills can also train students to think more rationally in determining and choosing the best option (Kadek Perdiana Tri Astiwi et al, 2020; Jannah & Atmojo, 2022; Leniati & Indarini, 2021). Student success can be influenced by several factors, one of which is the teacher. The teacher's role in carrying out the learning process has a very large influence on student success. A teacher not only needs to have the knowledge and skills to carry out the process of teaching and learning activities in the classroom but must have creativity. One of the forms of creativity is selecting appropriate learning models.

But in reality, students tend to be passive and do not want to ask questions, but when the teacher gives questions to students, they only answer the question with the answers listed in the book (Effendi et al, 2021; Hussin et al, 2018). Students only memorize answers and cannot find the relationship between the studied material and everyday life (Cahyo et al, 2018a; Nurhayati et al, 2015). The learning process is still teacher-centered, conventional, and monotonous resulting in students' thinking skills not being fully developed (Kadek Perdiana Tri Astiwi et al, 2020; Fakhriyah, 2014). Teachers often give assignments at home without being given feedback on the assignments (Mitra & Purnawarman, 2019; Nguyễn & Nguyễn, 2017). It causes students to feel bored in receiving class lessons. In addition, the lack of use of varied methods or models in the learning activities used by teachers (Setiyowati, 2019; Yerimadesi et al, 2019). In implementing learning activities, students are not encouraged to develop critical thinking skills, and student learning outcomes are low under the Minimum Completeness Criteria. If these problems are not immediately addressed, they will impact student development and influence student learning outcomes.

The solution that can be done to overcome these problems is by applying a learning model. Learning models are generally very closely related to learning media. Learning media can communicate news and information about learning materials to carry out the learning process (Hanida et al, 2019; Harianti, 2018; Pentury et al, 2019). The PBL model and the discovery learning model increase the improvement of critical thinking skills. The PBL model emphasizes problem-solving activities in learning (Hussin et al, 2018; Servant-Miklos, 2019). The PBL model allows students to learn through problem-solving activities and improve their thinking skills (Haryanti et al, 2020; Sudana et al, 2019). A learning model guides students to actively relate new information to existing knowledge through learning activities (Haryanti et al, 2020; Perusso & Baaken, 2020). PBL is a learning process in which students face a problem, followed by a student-centered information search process (Primayanti et al, 2019; Rahmadani, 2019). The teacher's method is to instill concepts by communicating well with students by opening up students' thinking insights. The way of developing students' thinking can be done by studying various things and being able to relate them to the problems of everyday life. One method that can be used in developing critical thinking skills is problem-based learning.

Concepts in PBL learning will be achieved if the learning process is centered on tasks or problems that are authentic, relevant, and presented (Effendi et al, 2021; Perdana et al, 2020; Rahmat et al, 2020). By making the problem the focus of learning and encouraging students to find the information needed to solve the problem then, students will identify the problem and then develop an understanding of the various concepts that underlie the problem and other relevant knowledge principles. The focus of the discussion is usually a (written) issue that includes various phenomena that require explanation (Amris & Desyandri, 2021; Irwanti & Zetriuslita, 2021). PBL aims for students to acquire and form their knowledge in an efficient and integrated manner. The advantage of PBL is that students are encouraged to explore the knowledge they already have and develop it into new knowledge (Al-Fikry et al, 2018; Amris & Desyandri, 2021; Djonomiarjo, 2020). This learning model influences students to seek answers to what they want to know. The role of students in this strategy is to look for their lessons so that they can focus on their ideas and contribute actively and become more supportive in this activity to solve certain problems (Amris & Desyandri, 2021; Hendriana et al, 2018). The active learning model that can overcome these problems is the discovery learning model—applying learning models that are directly related to students' real lives so that students can easily understand the material presented (Bayharti et al, 2019; Parno, 2015). One of the learning models that can improve student learning outcomes is the use of discovery learning models.

The discovery learning model is a learning model that encourages students to think critically about its application so that it can enable students to more actively identify their understanding of the problems discussed in learning activities, and this is encouraged to do (Candra et al, 2017; Safitri & Mediatati, 2021). Learning activities that encourage students to experience new things can be very helpful in improving their learning outcomes. It provides a better understanding through the discovery learning model because it solves the problems students face, and students are directly involved in solving them (Candra et al, 2017;

Siswanti, 2019). The application of the discovery learning model has six stages, namely stimulation. Activities in this phase consist of explaining the learning objectives that must be achieved by the teacher and carrying out problem-solving activities. Explanation of the problem, the activities carried out at this stage are the teacher providing opportunities for students to identify problems related to the material. Data collection the activity in this phase is to collect as much information as possible. Data collection can be done by reading sources, observing, interviewing, or conducting experiments. At this stage, the teacher will instruct students to process data from the information received. Verification: At this stage, the teacher will instruct students to consider the results of the data obtained carefully. In generalization, the activity in the final stage is to conclude the research process.

Previous findings stated that the PBL model could improve students' critical thinking skills (Fauzan et al, 2017; Kartikasari et al, 2021). The PBL model influences students' critical thinking skills and improves student learning outcomes (Farisi et al, 2017; Rahmat et al, 2020). The PBL model can improve learning outcomes (Abdurrozak & Jayadinata, 2016; Hussin et al, 2018). There are differences in learning outcomes through discovery and problem-based learning models (Gani et al, 2021). Applying discovery learning models in science learning can improve elementary school students critical thinking skills and learning outcomes (Safitri & Mediatati, 2021). The guided discovery learning model for learning videos shows the differences in students' mathematical problem-solving abilities (Ulfa et al, 2017). No research study analyzes the differences in the application of the PBL model with the discovery learning model on the critical thinking skills of fourth graders. Both learning models can be applied by teachers and are very innovative learning models. This study aimed to determine the differences in applying the PBL and discovery learning models to the critical thinking skills of fourth-grade elementary school students in the Gugus Abiyoso.

## 2. METHOD

This type of research is a quasi-experimental (quasi-experimental) experimental class and control class which is pre-tested and post-tested. The research design used experimental research using the Nonequivalent Control Group Design. This study's sampling method is a random class sampling by providing opportunities for each class. The samples of this study were fourth-grade SDN 3 Kaliwungu and SDN 1 Rogomulyo. The data acquisition method used in this study was a questionnaire sheet. Questionnaires are used to determine the level of critical thinking of students. The data analysis method is a statistical test using quantitative descriptive analysis method hypothesis testing minimum score, maximum score, mean, standard deviation, and t-test. The analyzed sample did not show a correlation, so the t-test for this study used an independent t-test. Prerequisite tests, including tests of normality and tests of uniformity of variance, were performed before running the hypothesis test. So the hypothesis tested in this study is  $H_0$ . There is no difference between using PBL and discovery learning models on students' critical thinking skills in fourth-grade elementary school thematic subjects.  $H_a$ : There is a difference between the use of the PBL model and the discovery learning model on students' critical thinking skills in the thematic subjects of fourth-grade elementary school.

## 3. RESULT AND DISCUSSION

### Result

The research data was taken from the learning process according to the steps of the PBL and discovery learning models. The sample of this study was fourth-grade elementary school students in the Abyoso Cluster in Semarang Regency, providing a sample of up to 27 fourth-grade elementary school students. The sample consisted of SDN 1 Rogomulyo (16 students) and SDN 3 Kaliwungu (11 students). Sample selection is made randomly. Each sample was divided into two experimental groups: the class that applied the PBL model and the class that applied the discovery learning model. The results of this study were obtained from the pre-test and post-test data of students' critical thinking skills. Table 1 shows a comparison of the results of measuring critical thinking skills.

**Table 1.** Results of the Critical Thinking Ability Questionnaire

Critical Thinking Ability Measurement	PBL Model	Discovery Learning Model
Average Score	68,44	57,09
Maximum Score	76	64
Minimum Score	56	51
Standard Deviation	5,278	4,346

The data on the acquisition of critical thinking skills in each sample class that applies the PBL model and the PBL model are in [table 1](#). the critical thinking skills of the 16 students applying the PBL model achieved an average score of 68.44, a maximum of 76 and a minimum of 56, standard deviation 5,278 while the critical thinking skills of the 11 students applying the discovery learning model got an average score of 57.09. The maximum is 64, and the minimum standard deviation of 51 is 4,346. Therefore, to get the results of balanced population data from the two samples, it is necessary to carry out statistical tests. The results of the data normality test were carried out on 27 students using the Kolmogorov-Smirnov student's critical thinking ability in the thematic learning class that applied the PBL model, and the class that applied the discovery learning model was 0.200. Based on the hypothesis formulation,  $H_0$  is a sample that comes from a normally distributed population, and  $H_a$  is a sample that does not come from a normally distributed population. Furthermore, it was decided that  $H_0$  would be accepted if the significance was 0.05. Then it was decided if the significance  $<0.05$   $H_0$  was rejected. Because the data significance value is  $0.200 > 0.05$ ,  $H_0$  is accepted. Furthermore, based on the normality test criteria of Kolmogorov Smirnov, it can be concluded that the distribution of data in the class that applies the PBL model and the class that applies the discovery learning model is derived from a normally distributed population.

The results of the homogeneity test of the two groups were homogeneous or heterogeneous. If the significance value is greater than 0.05, the data is said to be uniform. a Hypothesis  $H_0$  is distributed data per homogeneous group,  $H_a$  distributed data per group is not homogeneous. The significance of critical thinking skills for students from both groups was 0.761. Furthermore, the significance value  $> 0.05$  means that the decision is accepted by  $H_0$ , the class that applies the PBL model, and the class that applies the homogeneous discovery learning model. Based on the results of the description of the data, it turns out that the normality test of the data shows that the data is normally distributed, and the homogeneity test shows that the variance of the two homogeneous data increases. Therefore, hypothesis testing was carried out using the t-test, namely the independent sample t-test. The tested samples were unpaired, and the data used was in the form of interval or ratio scale data, so an independent t-test was carried out. If the data is normally distributed and homogeneous, an independent sample t-test is used, assuming the variances are the same. Suppose the results of the t-test of virtual data collection using a decision-based independent sample t-test is a significance  $> 0.05$ . In that case,  $H_0$  is accepted, and  $H_a$  is rejected, reflecting important students. Students' critical thinking ability during learning means that the PBL model is superior to the discovery learning model. On the other hand, if the seriousness value is  $< 0.05$ , then  $H_0$  is rejected, and  $H_a$  is accepted. It means that students who study with the PBL model have better critical thinking skills than the discovery learning model.

**Table 2.** t-test results

Statistic	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Berpikir Kritis	0.109	0.744	5.880	25	0.000	11.347	1.930	7.372	15.321
Equal variances assumed									
Equal variances not assumed			6.101	24.066	0.000	11.347	1.860	7.509	15.184

Based on [Table 2](#), the results of the t-test using the independent sample test above, it is known that the tcount is 5.880 with a significance in the Sig. (2-tailed) column of 0.000, the result is  $0.000 < 0.05$ , so as the basis for decision making in the t-test, the significance value is smaller than the Alpha value, then  $H_0$  is rejected, and  $H_a$  is accepted. Based on the results of the data analysis, it is known that the t-table is 1.70814. To find out the t-table with the help of MS.Excel, write `{=TINV (probability:deg_freedom)}` probability with a significant level of 5% (0.05), while deg\_freedom is a df based on the results of the t-test which is equal to 25. The calculation results of the hypothesis test use t-test Independent Sample Test. The table shows the t coefficient score of 1.70814 with a significant value of 0.000 which means it is greater than 0.05 ( $0.000 < 0.05$ ). The t-test shows t count  $>$  t table that is  $5.880 > 1.70814$  and significant  $0.000 < 0.05$ . It shows a significant difference in applying the PBL and discovery learning models to the critical

thinking skills of fourth-grade elementary school students in the Gugus Abiyoso. It means that students critical thinking skills in learning to apply the PBL model are superior to learning to apply the discovery learning model.

### Discussion

The finding is that students' critical thinking skills about alternative energy in thematic learning using the PBL model are significantly superior to those of the discovery learning model. This result is supported by the difference in the mean of the two samples. The control group was 68.44, while the experimental group was 57.09. It proves that the PBL model has a different impact and is superior to the discovery learning model. The PBL model's effectiveness contributes more to students' critical thinking skills than those who apply the discovery learning model. In the learning process in the class that applies the PBL model as a whole, students are enthusiastic about participating in learning. Each student pays attention to the teacher's instructions in explaining the PBL learning model technique and following the learning stages. Students are interested in using PBL because they can search for the material being studied on their own and give opinions about what they know from the material (Asyari et al., 2016; Serevina et al., 2018; Triwahyuningtyas et al., 2020). Students actively ask if there is the material they do not understand from the teacher's explanation. Students can provide their conclusions from what has been learned then the teacher summarizes conclusions about the learning material being studied.

The effectiveness of the PBL model has an effect because its implementation follows the syntax/steps of the PBL model. The contents of the syntax include organizing students to problems. The teacher informs the learning objectives, explains the important logistical needs, and motivates students to be involved in problem-solving activities (Amris & Desyandri, 2021; Cahyo et al., 2018b). Organizing students for learning, teachers assist students in determining and organizing learning tasks related to the problem. Assisting independent investigations in groups, the teacher will encourage students to collect appropriate information in experiments and look for explanations and solutions. Developing and presenting work, the teacher assists students in planning and preparing appropriate works such as reports, video recordings, and models and helps them share their work. Analyzing and evaluating the problem-solving process, the teacher helps students reflect on the investigation and the processes they use.

The findings of this study were strengthened by previous studies, which stated that there were differences in student learning outcomes using Problem Based Learning (PBL) and Discovery-Inquiry learning models. Problem Based Learning (PBL) model is superior to the Discovery-Inquiry Model (Utami & Giarti, 2020). The ability to think critically with the problem-based learning model is improved than ordinary learning without treatment (Handayani & Koeswanti, 2021; Kartikasari et al., 2021). The discovery learning model is more effective than the problem-based learning model for mathematics learning outcomes (Septiyowati & Prasetyo, 2021). The problem-based learning model can improve students' critical thinking skills in the sub-subject of straight motion changing regularly (Ariani, 2020; Pratiwi & Setyaningtyas, 2020). These results indicate increased creativity and learning outcomes using the fifth-grade PBL learning model. Thus the results of this study indicate that the PBL model is superior to the discovery learning model on students' critical thinking skills in thematic subjects of the fourth-grade elementary school in the Gugus Abiyoso. This research implies that teachers are expected to be able to apply the PBL model in the learning process to improve creative thinking skills. In addition, the PBL model can also improve students' critical thinking skills. Developing various abilities, especially the ability to solve problems, can improve student learning outcomes. It is recommended to students that applying the PBL model in thematic learning is expected to encourage students to always participate in learning activities and improve their critical thinking skills.

### 4. CONCLUSION

The results showed that the PBL model was superior to the discovery learning model in terms of critical thinking skills on the fourth-grade elementary school theme. The PBL model is superior to the discovery learning model in fourth-grade elementary school's critical thinking skills. Based on the research results, the suggestion is that teachers apply it in learning because it can improve students' critical thinking skills and create a fun, active, and effective learning atmosphere.

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