Integrated Science Education Journal
Vol. 4, No. 2, May 2023, pp. 84~89
ISSN: 2716-3725, DOI: 10.37251/isej.v4i2.390

A Study Comparison the Application of Discovery Learning and Problem Based Learning Models on the Critical Thinking Ability

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Article Info

Article history:

Received May 20, 2023
Revised May 31, 2023
Accepted Jun 8, 2023
OnlineFirst Jun 8, 2023

Keywords:

Critical Thinking
Discovery learning
Physics Learning
Problem-Based Learning

ABSTRACT

Purpose of the study: The purpose of this study is how are the differences in students' critical thinking skills in physics subjects using discovery and problem-based learning models at Madrasah Aliyah Laboratory in Jambi City.

Methodology: The research design used by researchers is a quantitative research type of quasi-experimental design using a pretest-posttest control group design, with a total sample of 56 students using a total sampling technique. The instrument in this study used a test with a Cronbach alpha of 0.919. The data analysis used includes descriptive and inferential statistics.

Main Findings: Based on the data analysis and discussion above, it can be concluded that students' critical thinking skills in physics subjects in static electricity material are in a good category. This indicates that the application of discovery learning models and problem-based learning can improve the thinking skills of critical students. This is reinforced by testing the hypothesis through an independent sample t-test that there is a significant difference between the use of the two models in improving students' critical thinking skills, especially in physics lessons on static electricity.

Novelty/Originality of this study: This research has a novelty, especially in cognitive, namely critical thinking skills, which can be improved with a scientific approach, especially using discovery learning models and problem-based learning.

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1. INTRODUCTION

One branch of science that develops through scientific study and research is one of them is physics. Physics is the most basic branch of science, because it deals with the behavior and structure of objects [1]. Early discoveries of sophisticated and contemporary (contemporary) products are one of the concrete manifestations of the development of the study of physics studies. Physics learning as a subject within the scope of science material aims as a means to train thinking skills in order to foster attitude abilities [2]. Thus, physics is one of the most fundamental branches of science, because it deals with the behavior and structure of objects, thus requiring the ability to think to be able to develop sophisticated and modern products which are the result of applying physics. Physics is one of the fields of applied science, which aims to be a means of creating a person's scientific attitude in keeping abreast of technological developments, so as to produce a product of sophisticated technology to meet human needs. Physics learning is one of the subjects that must be taught in senior high schools, because by learning physics students can gain an understanding of various facts about the ability to recognize and solve

problems and have a scientific attitude [3]. So, it can be concluded from this theory, that with products resulting from the development of physics, it can help meet human needs.

Physics is one of the branches of science so that physics is a subject that can develop inductive and deductive analytical thinking skills in solving problems related to natural events around them, both qualitatively and quantitatively, using mathematics, and can develop knowledge, skills and attitudes confident [4]-[6]. Thus, through the physics learning process it is hoped that students will be able to cultivate a scientific attitude, and have the ability to think analytically in solving problems, so that they can increase the knowledge, skills and attitudes of students. Physics is usually known as a subject that students "fear" and do not like, often starting with the student's learning experience [7]. In addition, the study of physics is very boring, because teachers are still in the classical learning model, which is dominated by one-sided and teacher-oriented learning activities [8]. This resulted in weak critical and creative abilities possessed by graduates of the national exam education which were always monopolized by science products, and ignoring the science process resulted in low students' ability to explore their abilities in scientific performance [9]. Thus, learning physics is still considered scary learning because the selection of models and teacher approaches is inappropriate and not in accordance with the scientific process so that students make physics the most boring subject, so that some students are not interested in participating in the learning process.

Critical thinking is meaningful and reflective thinking that aims to decide what to believe or what to do. Critical thinking is the activity of analyzing an idea in a more specific direction, choosing to identify, study, and develop it in a more perfect direction [10]-[13]. Critical thinking is an organized process that involves mental work such as problem solving, decision making, predictive analysis and scientific research. This way of thinking develops ideas that are holistic, logical, reliable, concise and convincing [14]. Critical thinking skills can be demonstrated by teaching students how to make analytical thinking in decision making by using critical thinking practices. The learning model can at least include a number of processes, namely material skills, internalization, and transfer of material in various situations [15]. An appropriate and meaningful learning model for students, namely a model based on problem solving skills that requires students to think critically [16].

In the 21st century, education is becoming increasingly important to ensure students have learning and innovation skills, skills in using information technology and media, and can work and survive by using life skills. The three concepts are 21st Century Skills, scientific approach and authentic assessment. Furthermore, the three concepts are adapted to develop education towards Creative Indonesia in 2045. The learning process in the 2013 curriculum for all levels is carried out through a learner-centered learning approach that has the following criteria for a scientific approach, (1) Learning materials are based on facts or phenomena that can be explained with certain logic or reasoning, not limited to approximation, fantasy, legend, or fairy tales. (2) The teacher's explanations, student responses and teacher-student educational interactions are free from immediate prejudice, subjective thinking, or reasoning that deviates from the flow of logical thinking. (3) Encouraging and inspiring students to think critically, analytically, and appropriately in identifying, understanding, solving problems, and applying learning materials. (4) Encouraging and inspiring students to be able to think hypothetically in seeing differences, similarities, and links to one another from learning materials. (5) Encourage and inspire students to be able to understand, apply, and develop rational and objective patterns of thinking in responding to learning materials. (6) Based on accountable concepts, theories, and empirical facts. (7) Learning objectives are formulated in a simple and clear manner, but the presentation system is interesting [17].

Agustriana, Ningrum, & Somantri, stated that the Discovery Learning learning model could increase the effectiveness and student learning outcomes in Ecosystem material [18]. Other studies have also found significant differences between groups of students with critical thinking skills taught by the Discovery Learning model, namely differences in students' critical thinking abilities after learning between the test group using the Discovery Learning model and the control group. using standard models. It can be said that the Discovery Learning learning model statistically influences students' critical thinking skills [19]. Therefore, based on these results, the discovery learning model influences students' critical thinking. Meanwhile, the problem-based learning model is closely related to critical thinking [20]. Problem-based teaching or problem-based learning is a teaching model with an environment as a basis for acquiring knowledge and understanding and solving ideas and problems in real life. [21]. The study results show that the Problem-Based Learning Model can develop important thinking skills in students in GLBB learning [22]. It is from this gap between research that researchers conduct experimental research so that they can impact the world of education, namely by applying discovery learning models and problem-based learning in physics learning to improve students' critical thinking skills, especially in physics subjects at Aliyah madrasah. This is because optimizing students' critical thinking skills on a topic, using language, logical thinking structures, verifying scientific truth, and experimenting in various ways will benefit students to become self-taught learners. The purpose of this study is how are the differences in students' critical thinking skills in physics subjects using discovery and problem-based learning models.

2. RESEARCH METHOD

The research design used by researchers is a quantitative research type of quasi-experimental design using a pretest-posttest control group design. It is done to investigate causal hypotheses about causation that can be manipulated by comparing one or more experimental groups that are treated with one comparison group that is not treated [23]. This research design is applied because it is in accordance with the research objectives, where the aim is to find out whether there is a difference between students' critical thinking skills using the discovery learning model and the problem-based learning model. This study uses descriptive statistics in the form of mean, min and max and uses inferential statistics. The inferential statistic used is the independent sample t-test.

Tabel 1. Pretest-Posttest Non-Equivalent Control Group Design

Group	Pretest	Treatment	Posttest
Experimental	O_1	Learning using the discovery model	O_1
Control	O_2	Learning using the Problem-Based Learning	O_2

The subjects in this study were students at the Madrasah Aliyah Laboratory of Jambi City in grade 12, using the total sampling technique, where the number of samples in this study totaled 56 students who would be divided into two groups.

The instrument in this study used questions adapted by researchers from Karim & Normaya's research, [24], 10 valid statements were obtained, with a Cronbach alpha value of 0.919. The following is a categorization of students' critical thinking skills in physics from Srianty & Samad [25] (table 2).

Table 2. Categories for Students' Critical Thinking Skills

Interval	Category
80.1 – 100.0	Very Good
60.1 – 80.0	Good
40.1 – 60.0	Enough
20.1 – 40.0	Not Good
0.0 – 20.0	Very Not Good

After learning was carried out in each class according to the treatment previously mentioned, the researcher then gave valid questions to the subjects who were the focus of this study. After they filled out the questions, the researcher corrected and analyzed them using SPSS 21. In this study, the data analysis used by researchers was in the form of descriptive statistics and inferential statistics, where the descriptive statistics included mean, min, max and category while for inferential statistics used independent sample t-test.

3. RESULTS AND DISCUSSION

After the Post-test was carried out, namely students' critical thinking skills after treatment in each group. The treatment in question is the application of the Discovery Learning learning model to the experimental group 1 and the application of the Problem Based Learning learning model to the control group 2.

Table 3. Results of Critical Thinking Skills in Learning Physics Static Electricity Material

Score	Discovery Learning		Problem-Based Learning	
	Critical Thinking Skills		Critical Thinking Skills	
	Pree-test	*Post-test*	*Pree-test*	*Post-test*
Max	79	88	63	84
Min	47	58	40	50
Mean	60.53	76,75	52.92	66.82

Table 3 shows that the mean pretest and posttest critical thinking skills of the experimental class were greater than those of the control class, both classes showing differences in critical thinking skills. These results show that the critical thinking skills of the two classes have differences. It can be seen that the experimental class which uses the Discover Learning learning model of students tends to be more active in the physics learning process than the control class which uses problem-based learning. The students tend to be passive. This shows that the critical thinking skills of the experimental class are superior to the control class. This is also reinforced by the results of the independent sample t-test, where the results are in table 4 below.

Table 4. Independent Sample T-Test for Critical Thinking Skills

	T	df	Mean	Std.Deviation	*95% confidence interval*	
					Lower	*Upper*
Critical thinking	4.615	54	9.929	2.151	5.615	14.242
skills	4.615	53.979	9.929	2.151	5.615	14.242

From table 4 it can be seen that the value is obtained (t count) with the value of t table. The t-table value can be found in table t with a significance value of 0.05 (2-sided test) with degrees of freedom (df) 54. In this study, the results for t table are 1.67356. While for the value of t count can be seen in table 4. (column t) which is 4.615. The hypothesis testing criteria is that there is a rejection value of H0 [26]. So, it can be concluded that there is a significant difference between students' critical thinking abilities between the control class which is taught using PBL and the experimental class which uses discovery learning. It can be seen from table 4 that the average value of student interest is 9,929, which means it can improve students' critical thinking skills in dynamic electricity physics subject.

In this study, researchers assumed that there were factors that caused differences in mathematical problem-solving abilities between students who received the PBL learning model and students who received the DL learning model. One of the factors causing the difference in mathematical problem-solving abilities between students who received the PBL learning model and students who received the DL learning model was the characteristic of the different steps of the two learning models. The PBL learning model places more emphasis on students seeking information and solutions to solve their own problems so that they are used to working on mathematical critical thinking questions [27]-[29]. Meanwhile, the DL learning model places more emphasis on guided discovery so that students have a basis for solving mathematical critical thinking questions [30], [31]. Another thing that causes differences in mathematical critical thinking skills is because the learning stages of the two models are different.

In research, students have followed and carried out the stages/phases in the discovery learning model and the problem-based learning model well. In the theory that the author describes, the discovery learning model according to Hosnan, is a model for developing active ways of learning by finding yourself, investigating yourself, then the results obtained will be loyal and long lasting in memory [32]. Discovery learning is a student-centered learning approach, teachers provide opportunities and freedom for students to find, explore and construct their own knowledge, so students can better understand and easily understand the material. learning. By learning to discover on their own, students will be better able to understand and remember the concepts and knowledge they learn on their own, so that student learning outcomes can improve. Meanwhile, Affandi et al; Saryadi and Sulisworo suggests that problem-based learning is a learning model in which students work on authentic problems with the intention of compiling their own knowledge, developing inquiry and higher-order thinking skills, developing independence and self-confidence [33], [34]. Problem-based learning is a learning model in which students are initially faced with a problem, then followed by a student-centered information-seeking process.

It is from this that it is up to date in this study, by identifying the use of learning models, especially in discovery and problem-based learning models, able to strengthen students' critical thinking skills, especially in physics lessons in static electricity material. The advantages of the discovery learning model and the problem-based learning model in learning are that in this model it makes student learning activities more interesting because students are asked to look for problems in learning and solve them themselves [35], [36]. In this learning is also able to train students to think critically. It is hoped that the discovery learning model and problem based learning model can be applied by teachers into science learning which is more innovative and varied so that it has meaning for students, besides that the science learning process becomes more interesting and fun and in the end can foster enthusiasm and interest in student learning, especially in science subjects, if students' interest in learning has grown from within, this can make it easier for students to accept the lessons conveyed by the teacher.

4. CONCLUSION

Based on the data analysis and discussion above, it can be concluded that, students' critical thinking skills in physics subjects in static electricity material are in a good category, this indicates that the application of discovery learning models and problem-based learning is able to improve thinking skills critical students. This is reinforced by testing the hypothesis through an independent sample t-test, that there is a significant difference between the use of the two models in improving students' critical thinking skills, especially in physics lessons on static electricity. This can be a reference for teachers, schools and stakeholders to decide on an idea to improve student aspects, especially in the cognitive aspect.

ACKNOWLEDGEMENTS

Based on the results of the research that has been done, the researchers provide suggestions as follows: 1) In learning physics, it is recommended that educators use the discovery learning model with problem based learning. This learning model can improve thinking processes that relate knowledge and experiences of students through a series of questions. 2) To find out the critical thinking skills of class XII students of Madrasah Aliyah Jambi City Laboratory. 3) For future researchers, it is expected to develop this research so that students can more easily understand the material being taught so that their learning outcomes will also increase.

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